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How could CDR interact with the EU ETS?

BELLONA REPORT

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List of acronyms

BioCCS – Biomass use with Carbon Capture and Storage

BECCS – Bioenergy with Carbon Capture and Storage

CDR – Carbon Dioxide Removal

CCS – Carbon Capture and Storage

DACCS – Direct Air Carbon Capture and Storage

ERW – Enhanced Rock Weathering

ESR – Effort Sharing Regulation

EU – European Union

EUAs – EU ETS Allowances

EU ETS – EU Emission Trading System

ERW – Enhanced Rock Weathering

IPCC – Intergovernmental Panel on Climate Change

LCA – Lifecycle Assessment

LRF – Linear Reduction Factor

LULUCF – Land Use, Land Use Change, and Forestry

MRV – Monitoring, Reporting, and Verification

MSR – Market Stability Reserve

$MtCO_2e$ – Million tonnes of CO_2 equivalent

Mtpa – Million tonnes per annum

Executive Summary

As the European Union moves towards its legally binding 2050 climate neutrality target, Carbon Dioxide Removal (CDR) has a limited yet essential role to play in reaching these obligations. CDR will be needed, broadly sequentially, to accelerate net emission reductions by balancing residual emissions and to enable net-negative emissions. **Achieving climate neutrality will require robust systems and frameworks to ensure CDR contributes effectively and does not act as a substitute for necessary emissions cuts.** CDR should not lower the incentive for industries to reduce their emissions. Nevertheless, additional efforts need to be pursued to enable the development of CDR such that it can fulfil the role it is expected to play. Given the long lead times for developing reliable legal and physical infrastructure at the scales needed, due consideration of these issues is a must.

Meanwhile, the EU is preparing to review its carbon market, the EU Emissions Trading System (EU ETS), with several potential changes including the potential integration of CDR into the system, with an impact assessment and, if relevant, a legislative proposal from the European Commission expected by July 2026. In light of this review, **we recommend to the Commission to explore an indirect interaction of CDR with the EU ETS.** This pragmatic and effective approach would leverage the climate benefits of CDR without prematurely fully integrating removals into the ETS, because this would be deeply complex and could significantly undermine the functioning of the EU's primary decarbonisation framework. It might also overlook critical quantification issues when it comes to generating CDR units, which could overestimate the climate effect of integrating carbon removals into the EU ETS and lead to a climate target shortfall.

This document stresses the urgent need for strong Monitoring, Reporting and Verification (MRV) and accounting systems as a prerequisite to ensure the environmental integrity of the interaction between CDR and the EU ETS, or any other system that may use CDR to counterbalance emissions.

Any interaction of CDR with the EU ETS should follow a phased approach with new types of removal only allowed as they become adequately demonstrated with enough understanding for realistic and robust MRV.

Key guiding principles for successfully designing a role for CDR in the EU's climate policy architecture, that addresses current technical, accounting and policy challenges, include:

- accounting for the timing and equivalent climate impact of emission reductions versus removals,
- covering the full scope of emissions,
- ensuring additionality for removal activities that are included,
- excluding projects with negative environmental or social impacts,
- replacing the current zero-emissions-rating assumption for biomass,
- and addressing other accounting inconsistencies.

These improvements are necessary for CDR to reliably contribute to reaching net zero, irrespective of whether CDR is included in the EU ETS or not.

Incorporating CDR into the EU ETS would require certified removals to be interchangeable with EU Allowances (EUAs), meaning they must deliver the same climate impact. This requires that **removals are accurately measured, truly physically permanent and only credited when the removal has taken place.** If there is uncertainty about the quantity of physically permanent removals that will be achieved, a conservative estimate should be applied.

Other key challenges must be considered before any interaction between CDR and the EU ETS. These include ensuring physical permanence, addressing the risks of reversal and subsequent liability.

There will inevitably be a need for new institutions and arrangements for nature-based removals. **Some types of removal, including forestry and soil carbon, are intrinsically temporary, so will never be suitable for inclusion in or a direct interaction with the EU ETS that governs permanent emissions**, even if other types of removals are included. There will therefore be a corresponding need for targets for removals that are separate from the EU ETS, including separate targets for impermanent Land Use, Land Use Change, and Forestry (LULUCF) removals within the post-2030 climate architecture.

To reduce the risks that removals will deter emissions reduction, quantity limits should be introduced for any removal units integrated into the EU ETS. There also should be no CDR in the EU ETS while there is a surplus of EUAs.

This report outlines key recommendations for an interaction approach:

General recommendations for effective CDR policy

1. Emissions reductions must remain the core priority

- The EU ETS should continue to focus on driving direct emissions reductions, with CDR playing only a limited role to address hard-to-abate residual emissions.
- Prioritising emissions reductions is essential because they directly prevent greenhouse gases from entering the atmosphere, while CDR introduces risks such as supply uncertainty, potential reversals, and weakened incentives for decarbonisation.
- Even as CDR options develop, the ETS must maintain strong pressure to continuously minimise residual emissions.

2. Set separate targets for emission reductions and carbon removals

- Establish clear, separate targets for emissions reductions and for carbon removals outside the EU ETS and ESR, to prevent removals from diluting the ambition of existing targets.
- This approach enables the EU to support CDR technology deployment while ensuring removals serve a defined role within broader climate objectives.

3. Reassess the carbon neutrality assumption for biogenic emissions

- Allowing biomass-based removals to generate CDR units for the ETS is likely to exacerbate the imbalance of incentives and further deplete the land sink.
- Urgently revise the zero-rating of biogenic emissions, ensuring that biomass use is accurately accounted for in relation to ecosystem carbon balances.
- Until robust safeguards and accounting are in place, biomass-based removals should not interact with the ETS.

4. Establish new frameworks and institutions for CDR

- Create new regulatory frameworks and institutions, such as buffer stock requirements, intermediaries, or a CDR Bank, to support CDR deployment whether inside or outside the ETS.

Specific recommendations for an interaction of CDR with the ETS

1. Limit the quantity and type of CDR allowed to interact with the ETS

- Introduce strict quantitative limits on CDR eligible to interact with the ETS, possibly with different limits for different removal types.
- Exclude CDR from the ETS while a surplus of EUAs exists (e.g., only allow CDR after three consecutive years without transfers into the Market Stability Reserve).
- Allow only permanent CDR to interact with the ETS and keep land-use-based removals out, due to high measurement uncertainty and reversal risks, which threaten market stability.

2. Establish robust MRV and accounting frameworks

- Develop and implement rigorous Monitoring, Reporting, and Verification (MRV) and accounting systems before allowing any CDR to interact with the ETS.
- These rules should:
    - Account for the timing and climate equivalence mismatch of emissions vs. removals.
    - Cover the full scope of emissions for the generation of CDR units.
    - Ensure additionality and exclude projects with negative environmental or social impacts.
    - Replace the current zero-rating of biomass with accurate lifecycle carbon accounting.
- These frameworks are essential for any credible CDR support system, regardless of ETS inclusion.

3. Phase the interaction of removals with the ETS

- In a first phase, consider only removals from Direct Air Capture with Carbon Storage (DACCS), provided robust MRV and accounting are in place.
- DACCS offers permanent storage with low leakage risk but is likely to be available only in limited quantities and at high cost and may be an option for sectors like long-haul aviation.
- Other removal methods (e.g., Enhanced Rock Weathering) should not interact with the ETS until their effectiveness and risks are better understood and quantified.

4. Develop additional policy instruments for CDR beyond the ETS

- The ETS alone is insufficient to support the scale-up of CDR. Mobilise complementary tools such as Carbon Contracts for Difference (CCfDs), reverse auctions, and dedicated financing mechanisms.
- Clearly communicate the limited, targeted role of CDR within the ETS to manage expectations and focus on residual emissions.

5. Implement a strong liability regime for permanence and storage risks

- Establish a robust liability regime to address reversal risks across all CDR technologies, with permanent responsibility for storage.
- This is particularly important for BioCCS, given uncertainties in managing above-ground carbon stocks.

In light of the upcoming revision of the EU ETS, these recommendations aim to ensure that CDR supports, rather than undermines, the EU ETS's primary goal of emissions reduction, while laying the groundwork for robust, science-based integration of removals into broader EU climate policy.

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1. Introduction

1.1 The role of carbon removals in meeting net-zero obligations

The EU's legally binding commitment to reaching climate neutrality by 2050 means that any remaining greenhouse gas (GHG) emissions will need to be counterbalanced by equivalent volumes of carbon dioxide removal (CDR)[1]. Reducing emissions will be by far the main means of reducing net emissions to net zero. However, eliminating all emissions is likely to be technically or economically infeasible. Consequently, some level of CDR will likely be necessary. The Intergovernmental Panel on Climate Change (IPCC)[2] sets out three roles for CDR within climate policy, which can be understood sequentially:

1. **to accelerate the reduction of net emissions to the atmosphere,**
2. **to balance so-called 'residual' GHG emissions,**
3. **to remove more GHGs than are emitted such that global atmospheric concentrations decrease to less severely damaging levels.**

The scale of residual gross emissions is estimated at 411 $MtCO_2e$ on the European level. The most recent Impact Assessment[3], that goes beyond the EU ETS, states that these primarily come from agriculture. In balancing these, the EU significantly relies on CDR from land sinks (333 $MtCO_2e$) in addition to any engineered/industrial permanent carbon removals (58 $MtCO_2e$). Land-based CDR has already been put into climate legislation, as the Land Use, Land-Use Change and Forestry (LULUCF) Regulation stipulates an EU-wide goal of reaching – 310 $MtCO_2e$ in 2030, which is currently projected not be reached (EEA, 2024)[4]. On the other hand, industrial removals currently do not contribute towards EU climate targets, because of the absence of a dedicated target and legal framework for their use.

Additionally, the dependence on industrial CDR can be limited. Since the quantity of removals that is needed for net-zero in theory depends entirely on the rate at which emissions are reduced, the dependence on CDR for reaching climate-neutrality may not be large if there is sufficiently vigorous action to reduce emissions, and if CDR is effective and reliable. For example, if residual emissions under the EU ETS are reduced to 100 million tonnes of CO_2 equivalent ($MtCO_2e$), that would represent approximately a 95% reduction compared to the cap in the covered sectors in 2008 when Phase 2 of the EU ETS began, the dependence on

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[1] The terms Carbon Dioxide Removals (CDR) and carbon removals will be used interchangeable in this report.
[2] https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf
[3] https://eur-lex.europa.eu/resource.html?uri=cellar:6c154426-c5a6-11ee-95d9-01aa75ed71a1.0001.02/DOC_1&format=PDF
[4] European Environmental Agency, 2024. EU emissions and removals of the LULUCF sector by main land use category. https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-land/eu-emissions-and-removals

CDR can be downsized. Nevertheless, 100 MtCO_2e of industrial CDR remains a significant market on which to drive investment decisions and a major upscaling challenge given current deployment rates.

Bellona strongly supports the establishment of three separate targets[5] which clarify the relative contributions of emission reductions, land-sink removals (LULUCF), and permanent CDR. These three targets would clarify how each contributes to the overall net climate target, while providing regulatory certainty that all three must progress simultaneously, ensuring that ambition is not weakened by mixing the approaches. At time of writing, while a 2040 target has been proposed by the European Commission, no such separation or clarity exists, including uncertainty over a potential downgrading of the LULUCF Regulation's consequent contribution.

The arguments in favour of integrating CDR into the EU ETS seemingly lie within its present design. Continuation of current policy parameters, in particular the EU ETS Linear Reduction Factor (LRF), beyond 2030 will lead to the cap reaching zero by around 2040. A potential integration would thus solve the issue of running out of EUAs and provide a solution on how to deal with residual emissions in the covered sectors. However, the prospect of EUAs running out is simply an assumption at present since the next phase of the EU ETS is yet to be agreed. There is no guarantee that the LRF should continue at its present level after 2030, even if the total amount of emission allowances remains the same. In fact, the LRF may take a different form which could lead to caps needing to reach zero a few years later, for example in 2045. The precise date by which CDR will need to be commercially established and interact with the EU ETS is therefore uncertain.

Furthermore, banking additional allowances in the short-term could extend the use of allowances beyond the date at which any cap might reach zero. This in turn would buy some additional time to establish robust treatment of CDR, substantiate a workable definition of "residual emissions", while providing some "breathing room" for particularly difficult to abate emissions and retaining the same level of ambition to reduce emissions.

Nevertheless, the 2050 net-zero target continues to provide a clear deadline. Whatever the trajectory of the cap, arrangements for CDR, including a legal framework, infrastructure, mature technology and viable business models, will need to be fully functional by the time net zero is reached. The fundamental challenges of combining deep emissions reductions with effective CDR remain, and they are likely to take many years to address even if action is prompt. Consequently, there is a continuing urgency to making progress in reducing emissions and setting up CDR.

In this report, we focus on the role of CDR in meeting obligations under EU ETS1, which will be the subject of a revision in 2026. Many of the same considerations apply to including CDR in either EU ETS1 or EU ETS2. However, differences in the design of systems (for example the point of obligation – the accountable party – being with fuel suppliers in EU ETS2), and in

[5] https://eu.bellona.org/2024/01/08/open-letter-on-separate-targets-in-2040-climate-framework-by-carbon-market-watch/

sectors covered, may lead to differences in the treatment of CDR. Consequently, the use of removals in EU ETS2 would require separate consideration.

1.2 The potential interactions of removals with the EU ETS

The likely need to combine some continuing emissions (although at a much lower level than at present) with CDR to achieve net zero and the need to finance CDR has led some to propose including CDR units – standardised measurement units of CO_2 removed from the atmosphere – in the EU ETS. However, there are many variants to manage the future of the EU ETS towards net-zero (sometimes referred to as the "endgame"[6]). These are most clearly laid out in International Carbon Action Partnership's "ETS, Reloaded" paper[7], which highlights five possible scenarios for the future trajectory of ETSs:

1. Net-positive ETS: net emissions are allowed to remain positive[8];
2. Net-zero ETS: emissions must be counterbalanced by equivalent volumes of CDR;
3. Net-negative ETS: emissions must be counterbalanced by higher volumes of CDR;
4. Absolute zero ETS: emissions are no longer permissible;
5. No ETS: the ETS ceases to exist.

The role of CDR in each outlined scenario varies both between each scenario but also within the specific application of each scenario. Ultimately, it is important to note that ETSs often only represent a portion of a jurisdiction's emissions and accompanying economy-wide net-zero target. Currently in the EU, roughly 40% of emissions are covered by the EU ETS, with the remaining 60% covered by the so-called "Effort Sharing Regulation" (ESR). Therefore, **while the role of removals in the ETS endgame remains a necessary conversation, the broader implications for CDR's role in EU policy must also be considered.**

Here, it is worth differentiating between the *interaction* of CDR with the EU ETS and the *integration* of CDR within the EU ETS.

The *interaction* of CDR with the EU ETS denotes the broader concept of using CDR to influence the pathway of the EU ETS, without necessarily requiring CDR to be directly integrated into the system. This would involve a broader range of policy interventions likely to be needed to manage the endgame of the ETS. For example, interaction could entail the creation of a separate and parallel system or obligation to procure CDR proportionally to an entity's emissions. But there are many other variants of designing the interaction. Ecologic's recent report outlines several policy designs which do not require the integration of CDR within the EU ETS[9].

On the other hand, ***integration* denotes a specific subset or type of interaction with the ETS, typically by allowing an emitter to meet its obligations under the EU ETS by surrendering either EUAs or certified removals** (or shift from surrendering EUAs towards certified removals), thereby treating EUAs and CDR units interchangeably. Effectively, the

[6] The endgame is a term that refers to the period of the EU ETS, where EUAs are running out.
[7] https://icapcarbonaction.com/system/files/document/ets-reloaded-paper_final.pdf
[8] Meaning that the ETS cap will not reach zero and emissions remain permissible.
[9] https://www.ecologic.eu/sites/default/files/publication/2025/60028-BMWK-EU-2040-Removals-Incentives.pdf

provision and use of CDR happen simultaneously within the ETS system. This could enable a net-zero ETS, even when there are residual emissions, and potentially lay the groundwork for a net-negative ETS. There are also more variants of an integration approach. For example, one tonne of certified removals may correspond to more than one tonne of expected removals, allowing a margin to take into account various risks and uncertainties associated with removals, or allowing the additional removals generated to be used for emissions outside the ETS.

1.3 The potential advantages and difficulties of including removals in the EU ETS

The inclusion of CDR in the EU ETS does present some potential advantages. Firstly, by integrating CDR into the EU ETS a **removals market could be enabled**, by creating a demand and sending a price signal, thus supporting growth of CDR. Secondly, a unified price signal covering both emissions and removals could lower total costs of reaching net zero by theoretically improving the efficiency of resource allocation between emissions reductions and removals leading to **cost efficiency**. Thirdly, stringent ETS process requirements could drive **more robust measurement, reporting, and verification (MRV)** and liability for removals to instil confidence in the market. Lastly, by **building on existing approaches**, the integration of removals could benefit from existing legislation. This might enable a smoother and more tractable path to implementation than building completely new mechanisms for financing CDR.

Despite these potential benefits, there are significant challenges related with including CDR in the EU ETS, which will be described in depth in section 2. The severity of each of these challenges varies with the type of removals. There are two main groups of issues that need to be addressed:

The first is centred around **MRV and liability methodologies** for removals, which are currently either in development, or not sufficiently accurate and robust to reliably quantify the net removals generated by an activity. **These issues need to be addressed whether or not removals are included in the EU ETS, because their resolution is essential to accurately and reliably defining and quantifying certified removals under any policy mechanism**. Nonetheless, any MRV system developed would need to be specifically tailored to the specificities of an ETS.

The second set of issues is around **uncertainties in long-term removals, including lack of permanence and risk of reversal**. Again, these apply in any case. However, there are additional concerns if removals are included in the EU ETS, because of the direct interchangeability that is required between emissions (which are always permanent in the case of CO_2) and removals (which may not be permanent). In addition, intrinsic uncertainties may create difficulties in incorporating certain types of removal in the EU ETS. For example, the net effect of applying biochar to soils may be extremely challenging to assess accurately even with high-quality MRV and interconnexion between different pools of carbon.

There has been minimal adoption of CDR in ETSs so far internationally. Only the New Zealand ETS, which allows removals from forestry, currently allows CDR in its ETS. The California Low

Carbon Fuel Standard also has related provisions. This reflects, at least in part, some of these challenges.

In July 2025, the UK Authorities have laid out their decision regarding the modalities for the integration of CDR into the UK ETS:

- the UK ETS gross cap is maintained to sustain reducing emissions;
- only permanent engineered removals (200+ years, i.e. DACCS and BECCS) that meet the requirements for the UK GGR Flex Standards from the British Standard Institute, with the addition of buffer pools for addressing reversals;
- nature-based removals are still being considered but further evidence is reviewed;
- the timeline for integration is slated for completion by the end of 2028, with operational roll-out by the end of 2029.

In assessing the issues, we have considered a range of methods for CDR, including the conversion of biomass into energy and or chemicals with Carbon Capture and Storage (BioCCS[10]), Direct Air Carbon Capture and Storage (DACCS), Enhanced Rock Weathering (ERW), biochar, afforestation and soil carbon sequestration. We have not considered ocean-based approaches as these are currently at too early a stage of development for any consideration of interaction with the EU ETS.

[10] The term BioCCS encompasses all applications that use biomasses to convert it into energy and or chemicals. Thus it is broader as Bioenergy with Carbon Capture and Storage (BECCS), that focuses on bioenergy facilities with CCS only.

2. The Need for Rigorous Monitoring, Reporting, Verification (MRV) and accounting or carbon accounting

Robust MRV and accurate accounting is central to any effective use of CDR. For all CDR methods, incentives based on the amount of tonnes generated should only be put in place once the MRV and quantification is reliable, and the risk of reversals and impacts on associated social and environmental co-benefits are well-understood and managed[11]. Without it, there is no way of ensuring that CDR is reliably generating the desired effect of counterbalancing the warming impact of residual emissions. **This would lead to overestimating the amount of CO_2 removed from the atmosphere and meeting climate goals only on paper, but not in reality.**

There are several principles to which robust and accurate MRV and accounting for removals must conform. These apply irrespective of whether removals are included in the EU ETS. Correspondingly, **putting in place appropriate MRV for removals is an essential prerequisite for using removals to meet net zero targets.**

2.1 Fulfilling quality criteria as precondition for an integration

Three quality criteria for removals have to be set as a precondition for a potential integration: **assured accountability, reliability of the MRV and permanence, and no significant environmental and societal harm**.

Firstly, **removals that only rely on "contractual permanence"[12] must not be integrated in the EU ETS**. A distinction must be made between removals where permanence is achieved via the fundamental physical and chemical characteristics of the removal method ("physical permanence"), and those where permanence is reliant on the perpetuity of legal and financial institutions ("contractual permanence")[13]. While physical permanence provides assurances that the carbon storage will persist largely independently of human systems, contractual permanence relies on the questionable assumption that human systems and incentive structures as they are will persist. Should contractual permanence fail, the absence of physical permanence implies a significant risk of reversal, thus undoing the initially accrued benefit of

[11] More on such considerations here: https://bellona.org/publication/addressing-differences-in-permanence-of-carbon-dioxide-removal

[12] These include nature-based removals, that are based on the continuation or non-continuation of a specific land- or forest-management practices, or removals from carbon stored in products or buildings, where the life-span of the embodied carbon rests on the modes of using products or buildings.

[13] https://carbongap.org/wp-content/uploads/2022/11/Carbon_Gap_White_Pater_Oct22_updateCRCF.pdf

removing CO_2 from the atmosphere. **Because of these fundamental discrepancies, removals which rely on contractual permanence may never be sufficiently robust to generate units which can be used in an ETS context.**

Secondly, the **criteria for CDR methods to be included** should be not solely dependent on the Technology Readiness Level (TRL) and economic feasibility, but **should be focused on the reliability of the MRV, permanence and overall climate impact**. The certification itself should only quantify the net amount of atmospheric CO_2 permanently removed.

Thirdly, **environmental and social co-benefits** are vitally important, and should be required to be qualitatively assessed aside the CDR value (e.g., ecosystem restoration, employment opportunities, improved soil fertility, improved air and water quality, health benefits...).

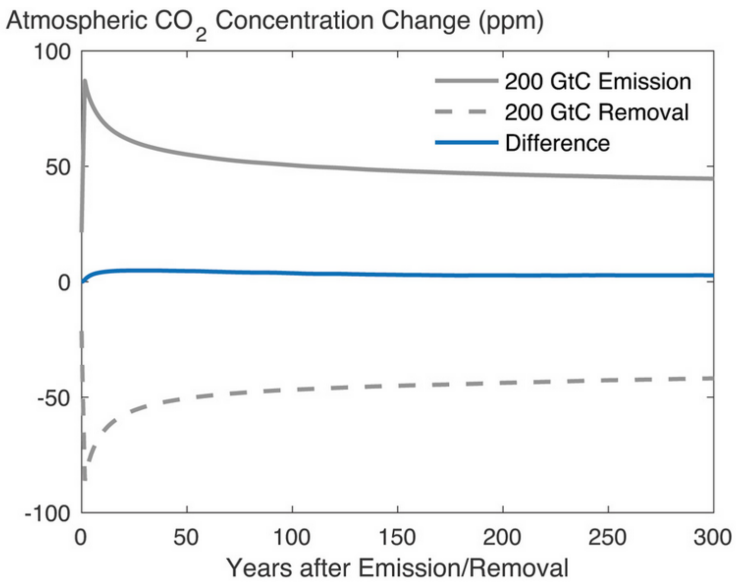
2.2 Accounting for the non-equivalent effects on the climate from emissions reduction and CDR

An equivalence between an emission and a carbon removal cannot be directly assumed. To properly account for a potential balancing-out three factors need to be considered: **the physical equivalence, the timing for the removal, and the carbon debt from nature-based removals**.

Fungibility between emissions and carbon removals cannot be assumed but has to be proven or managed via using discount factors. Carbon cycle modelling[14] suggests that **1t of CO_2e removed may not have an equal and opposite (balancing-out) effect on the climate as 1t of CO_2e emitted** (see Figure 1). Therefore, even with perfect MRV, it may be necessary to remove more than is emitted to achieve the desired climate outcome of neutralising the warming effect of emissions. Further research on this matter is necessary. For now, setting a conservative discount factor would be needed, until research better depicts the physical ration of an emission and a removal.

Removals should be used to counterbalance emissions only *after* the removal has demonstrably occurred. Emissions and removals may differ in their impact on the climate due to the timing of their occurrence. Emissions affect the climate immediately and continuously, whereas the timing of removals varies. In some cases, notably with DACCS, the removal is somewhat immediate as carbon is directly taken from the atmosphere and stored geologically. In the instance of BioCCS, the carbon accounting and timescale are less straightforward.

[14] https://www.nature.com/articles/s41558-021-01061-2



Change in atmospheric CO2 concentration following a CO2 emission (solid grey line) and removal (dashed grey line) of 200 GtC applied from a climate state at equilibrium with twice the pre-industrial atmospheric CO2 concentration. The rise in the atmospheric CO2 concentration following an emission is larger than the decline following a removal of the same magnitude (the blue line shows the difference). Credit: Kirsten Zickfeld.

Figure 1: *"Why CO2 removal is not equal and opposite to reducing emissions" by Prof. Kirsten Zickfeld, Carbon Brief 2021 Guest Post.*[15]

Often overlooked when assessing the carbon accounting of bioenergy and BioCCS is the carbon-debt or carbon-payback period of biomass. That must be gauged to determine its effect on the climate-biosphere relation. The associated emissions, the effect of direct and indirect land use change at the start of the project for supplying biomass to a BioCCS project represent a carbon debt. This debt needs to be paid back; the time needed depends on the land used, the type of plant grown (and if it regrows), the climate-specific location, supply chain and lastly the process conversion of the biomass (carbon efficiency). The point at which this carbon debt is paid back can vary from months to a few years (e.g. dedicated energy crops on marginal land), to more than a hundred years (e.g. wood from mature forests). The carbon efficiency measures how much of the CO_2 captured in the biomass is removed from the atmosphere. This parameter depends on the conversion route, i.e. if the biomass is burnt for heat / power (often referred to as BECCS) or if it is converted to another type of chemical or fuel (any biorefinery product, e.g. bioethanol, biogas, jet-fuel, biochar etc). BioCCS refers to Bio(mass) Conversion with Carbon Capture and Storage, which englobes BECCS, strictly Bioenergy (or power) with CCS. In the case of bioethanol with CCS, only the emissions of the fermentation process can be captured since the biofuel is burnt outside the BioCCS plant. Therefore, the biomass overall process emissions need to be extremely low for the BioCCS process to be net carbon negative.

In some cases, the production of renewable energy from biomass can have net-positive effects on the atmospheric concentrations of CO_2 and negative climate impact (see Figure 2).

[15] Carbon Brief (2021). Guest post: Why CO2 removal is not equal and opposite to reducing emissions. By Prof. Kirsten Zickfeld. https://www.carbonbrief.org/guest-post-why-co2-removal-is-not-equal-and-opposite-to-reducing-emissions/

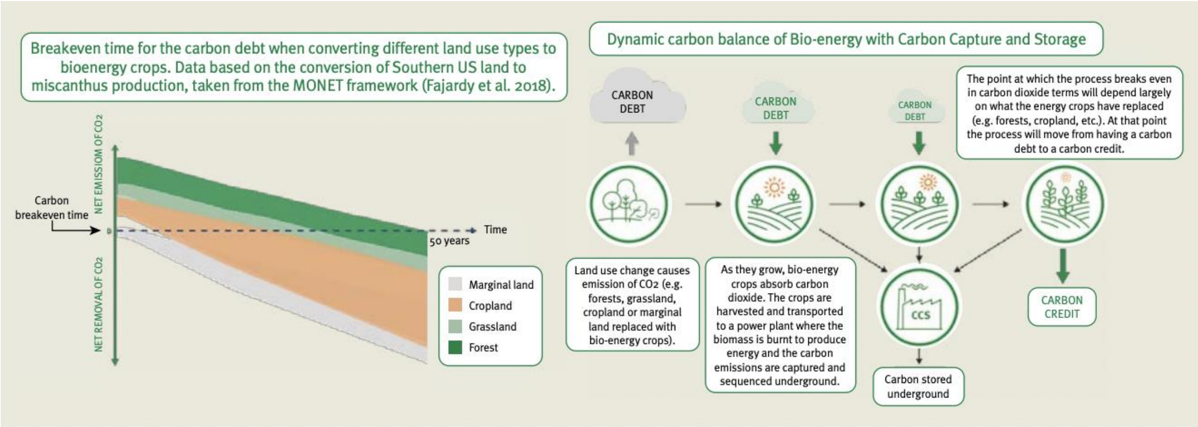


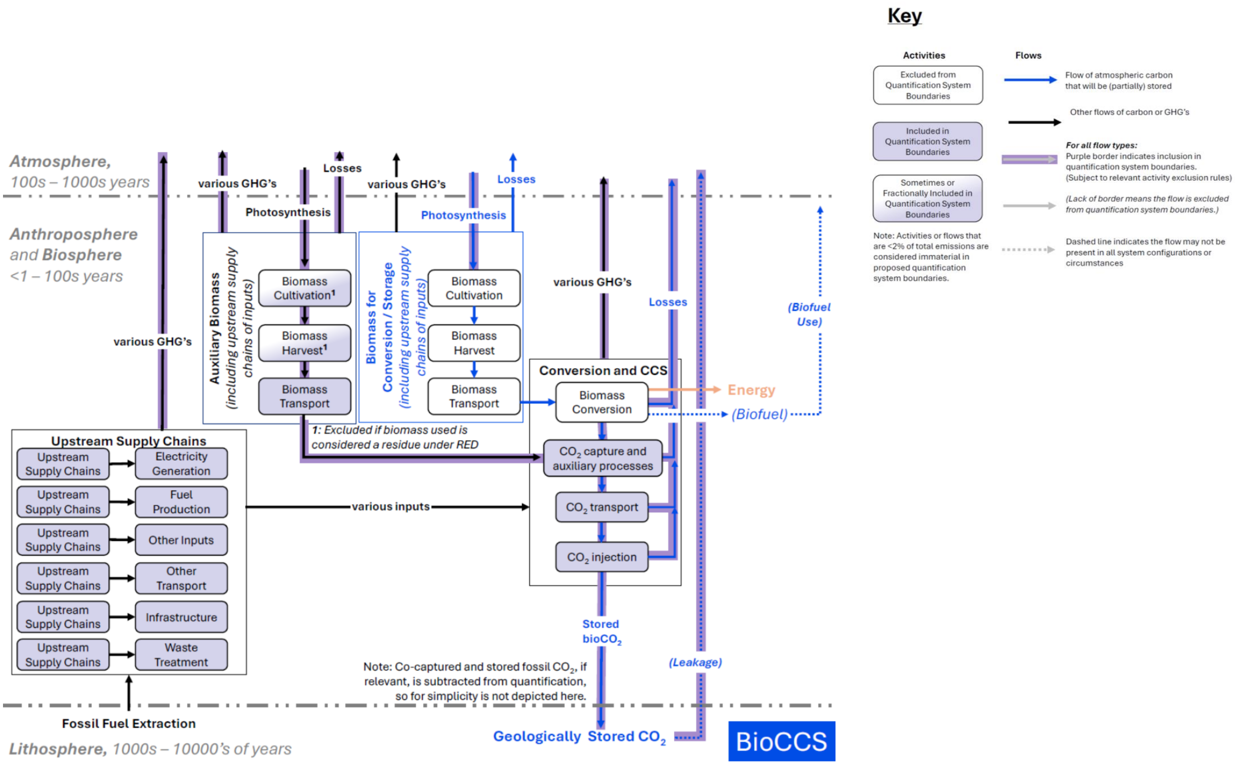
Figure 2: *The Impact of land use change on BioCCS carbon breakeven time taken from Fajardy et al, 2017*[16].

2.3 All supply chain emissions must be taken into account

It is essential that any emissions from the removals process are taken into account, so that net removals are correctly estimated. This implies that lifecycle accounting (LCA) needs to be applied as illustrated in Figure 3.

[16] https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/BECCS-deployment---a-reality-check.pdf

Figure 3: *System boundaries for BioCCS indicating which emissions are included, or not, within the current methodology and a key to understand the diagram. Figure provided by Dr. ir. Samantha Tanzer, University of Technology Delft.*



Many types of removal are energy-intensive:

- DACCS uses substantial amounts of energy for the capture process.
- DACCS and BioCCS both use energy for compression, transport, and injection for CO_2.
- ERW uses substantial energy for mining, transporting, and grinding rock.
- Biomass often has high associated emissions by being transported over long distances.

Any emissions from such energy use or transport need to be taken into account in calculating net removals. However, in line with standard practice in LCA, it will not be appropriate to include embedded emissions only. That would exclude relevant emissions from providing energy in manufacturing any solar panels for example.

As is the case with any LCA, decisions in the selection of a project boundary must be made. Taking as broad a project boundary for CDR projects generating units to counterbalance an emission as may be feasible is necessary to ensure that the outcome results in net-zero emissions to the atmosphere (e.g. cradle-to-grave with indirect land use change in Figure 4).

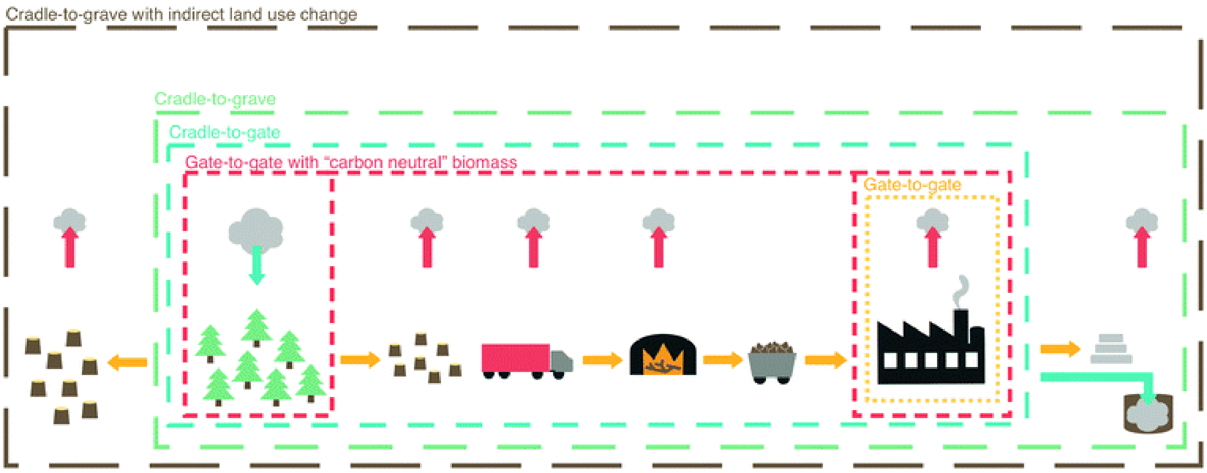


Figure 4: *Different LCA boundaries applied to a stylised steel BioCCS plant*[17].

2.4 Replacing the assumption of zero-rating of biomass

The misleading carbon neutrality assumption of biomass

One clear implication of considering timing and scope of accounting for removals is that **the current assumption that biomass creates no net emissions when being used, especially when being burned for energy production** (usually referred to as zero-rating), **is simply incorrect**. The accounting conventions place the emissions associated with the use of biomass over its lifetime solely within the LULUCF sector. When biomass is harvested, the resulting emissions are recorded in the LULUCF sector. As a result, the emissions from using biomass in the sectors where the biomass is consumed (e.g. the buildings or energy sector) are considered to be zero. A widespread misperception that biomass per se and bioenergy are "carbon neutral" has consequently developed.

The artificial boundary – created by the accounting convention – between the LULUCF sector and the sectors where biomass is used, while being factually correct, has also led to overlooking the negative impacts of current biomass consumption levels on the climate and environment generally, and to policy incentives relatively prioritizing bioenergy usage over climate mitigation potential in the land-use sector more specifically. Both have added to a decline of the land sink. **The missing carbon accounting link between the interplay of ecosystems' carbon balance, the climate effects of harvesting biomass and using it in different sectors has led to a management of ecosystems and natural resources incoherent with climate goals for biosphere-based removals.**

EU land use policy

The EU has set itself a goal for natural sinks of removing 310 $MtCO_2e$ by 2030 with the LULUCF Regulation. This goal is at the heart of EU climate policy, since climate neutrality can only be achieved by maintaining and enhancing natural sinks and maximizing their contribution towards natural climate mitigation and adaptation. This goal is likely not going to be met

[17] https://pubs.rsc.org/en/content/articlelanding/2019/ee/c8ee03338b

through[18] as the capacity of EU's forests sinks have been decreasing over the last decades. Their development is crucial for natural sinks overall, since the LULUCF sector's balance most closely follows the developments of the EU's forest sinks[19]. Most recent research shows that the forest sink capacity to absorb carbon has shrunk due to a combination of increased tree harvesting, climate change reducing tree growth and carbon uptake, as well as climate change induced disturbances[20]. This highlights the relevance of the interconnectedness of (woody) biomass use and land-based climate targets.

Political action and measures to unlock the potential of natural CDR remain available[21], even in the face of unavoidable future climate impacts. Uncertainties concerning climate change's impacts on natural sinks will remain high, and best available science can only provide projections but not forecast with certainty this interaction. The graph below using climate models to project climate change effects on the EU's forest sinks portrays potentially large interannual variations in both ways, positive and negative effects on net carbon uptake. Implementing measures to counterbalance these effects and aiming to increase forest sinks still has enormous cost benefits for achieving climate targets altogether[22].

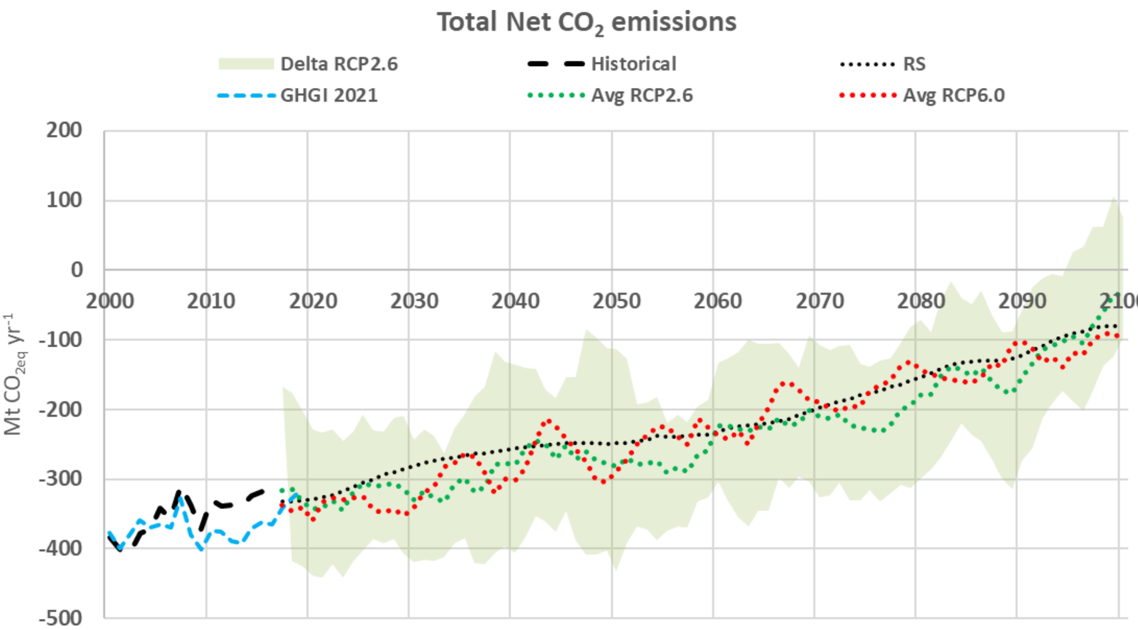


Figure 5: *The European Forest carbon budget under future climate conditions and current management practices*[23].

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[18] https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-land?activeAccordion=309c5ef9-de09-4759-bc02-802370dfa366

[19] It is important to note, that the LULUCF sector´s balance can be improved by implementing various policy measures in other fields than forestry, most notably by rewetting drained peatlands.

[20] https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/european-forest-carbon-sink-declining-can-we-reverse-trend-2025-07-30_en

[21] Windisch, M.G., Humpenöder, F., Merfort, L. *et al.* Hedging our bet on forest permanence for the economic viability of climate targets. *Nat Commun* **16**, 2460 (2025). https://doi.org/10.1038/s41467-025-57607-x

[22] https://www.nature.com/articles/s41467-025-57607-x

[23] Pilli et al. (2022). The European forest carbon budget under future climate conditions and current management practices. *Biogeosciences Discussions*, *2022*, 1-33. https://bg.copernicus.org/articles/19/3263/2022/bg-19-3263-2022-f09.png

Towards improved biomass accounting

A necessary precondition for achieving net-sink goals is to address the missing link (or "missing limb"[24]) between ecosystem's carbon balance and using biomass to get a full picture on the associated climate effects. Scientists have proposed to calculating effects of using wood in relation to the ecosystems' carbon balance and the effect of harvesting for ecosystem's climate resilience as well as in relation to the life cycle of wood. This research has produced proxies, that while being context specific, can be used to assess to what degree or range using woody biomass has an aggregated positive or negative effect on the climate. Showing, for example, that using woody biomass for energy has a negative effect on climate.

Going forward, any proper accounting system would need to use these proxies, that are based on context-specific data of ecosystems and how biomass use relates land-based sinks to its use in other sectors, to give an accurate representation of the climate effects of biomass. Additionally, data is needed to better understand the life cycle of biomasses, i.e. how long and for what biomasses are used, to account for the various lifecycles. MRV systems need to account for the alternative uses of biomass, since the positive climate effects of using biomass in long-lived products increases over-time, while the substitution potential in energy production decreases[25]. Improving accounting systems by implementing better and more timely accurate monitoring systems of ecosystems and biomass use is crucial for achieving climate targets and policy coherence.

Necessary policy adjustments

The reason why this broad perspective on biomass is relevant for a potential integration of BioCCS into the ETS, becomes apparent when extending the issues of unclear accounting of bioenergy to BioCCS and the policy and climate consequences this includes. As it stands, the zero-rating of biomass means that the storage of biogenic CO_2 is likely to generate a CO_2 removal. **Given the incentives to use biomass are already dysfunctional today, the addition of a reward for biogenic storage will further exacerbate this uneven incentive structure**, likely driving up demand for biomass without sufficiently constraining it in land sector policy. This would lead to higher overall emissions[26].

This also calls for an improved accounting and MRV systems for BioCCS and creating a level-playing field by removing public subsidies for bioenergy under the EU Renewable Energy Directive. An improved accounting system for BioCCS would need to include the considerations for biomass laid out above and CCS related emissions to holistically account for BioCCS climate effects. For example, the nature of the feedstock used and if it is regrown, the carbon stock of the land type before harvesting, its ability to absorb new carbon under a changing climate, indirect land use change emissions, the amount of bioenergy supply chain and CCS supply chain emissions (including transport, processing etc.) would need to be considered.

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[24] Fehrenbach, Horst, et al. "The missing limb: including impacts of biomass extraction on forest carbon stocks in greenhouse gas balances of wood use." *Forests* 13.3 (2022): 365.
[25] Fehrenbach, Horst, et al. "The missing limb: including impacts of biomass extraction on forest carbon stocks in greenhouse gas balances of wood use." *Forests* 13.3 (2022): 365.
[26] ESABCC (2025). Scaling up carbon dioxide removals. Recommendations for navigating opportunities and risks in the EU. P. 36

Within the context of the ETS, **another form of better accounting for biomass could be to use even broader proxies, allocating an emission rating closer to 0 if the biomass from a waste stream and closer to (or above) 1 if the biomass is harvested less sustainably or unsustainably**. Advisably this would follow a precautionary approach, rather rating the biomass according to its carbon content than assuming it to be zero, if better data on its proper climate effect are not available. Consequently, installations would have a price signal to shift towards more sustainable forms of biomass and to minimise the generation and emissions of CO_2 to the atmosphere. While this would require an adjustment of ETS emissions when transposing the accounting into the EU's annual GHG inventory, such an adjustment is already made for biomass that is not compliant with the Renewable Energy Directive (and therefore not zero-rated).

The only existing shortcut to replacing the zero-rating is for the cases where waste biomass (or wood from thinning of newly planted forests) are used for bioenergy or BECCS. These are the only types of biomasses that can currently be assessed to have zero-associated emissions in combustion processes or even positive climate effects (when replacing fossil fuel feedstock or being used in BECCS applications). It should be noted though that **not all waste biomass is sustainable**, as waste allocation is sometimes arbitrary and labelling is not sufficient if economic incentives for using biomass for energy production are powerful. Additionally, the unsustainable production of waste biomass can occur as a loophole of biomass sourcing to fit increasing demand. There may also be instances where the scale of BioCCS could match with unconventional supply of biomass such as invasive species or crops grown contaminated or compromised land not otherwise fit for agriculture.

Therefore, any interaction of biomass-based removals with the EU ETS is likely to further complicate the achievement of the LULUCF targets, unless changes are implemented in the management of biomass. Bellona has already called for the revamped Bioeconomy Strategy to play a role in rebalancing the incentive structure for biomass harvesting and use. Bio-CCS applications should only be allowed to interact with the EU ETS, as long as the sustainability of the biomass used can be proven. This can be done by either using waste biomass or by proving the actual climate balance.

2.5 Incompatible systems of accounting

Current EU ETS and CDR accounting systems do not align since they serve different purposes. **Where the EU ETS serves as an inventory of emissions occurring within installations covered by the system, the accounting of an individualised CDR unit looks at all emissions resulting from the generation of that CDR unit.** This mismatch between inventory-based accounting and project-based accounting can result in gaps and overlaps. These issues are thoroughly explored in a technical report written for the International Energy Agency Greenhouse Gas R&D Programme[27].

Fundamentally, using CDR units measured on a project-basis within an inventory-based system presents a mismatch in the overall accounting but also in the robustness of the data

[27] https://publications.ieaghg.org/technicalreports/2024-09%20Measurement,%20reporting%20and%20verification%20of%20CDR.pdf

which may be used. Where emissions inventories measure flows of carbon with relative ease, project-based removals accounting often reflects an additional and counterfactual scenario which may not be as robustly measurable.

Any interaction between CDR and the ETS needs to close this mismatch as much as possible to make sure that accounting correctly describes how much carbon dioxide has been emitted and removed, such that fungibility between EUAs and CDR units reflect physical realities. This is immensely challenging and administratively burdensome in practice.

3. Permanence and key challenges to be addressed for an interaction of carbon removals with the EU ETS

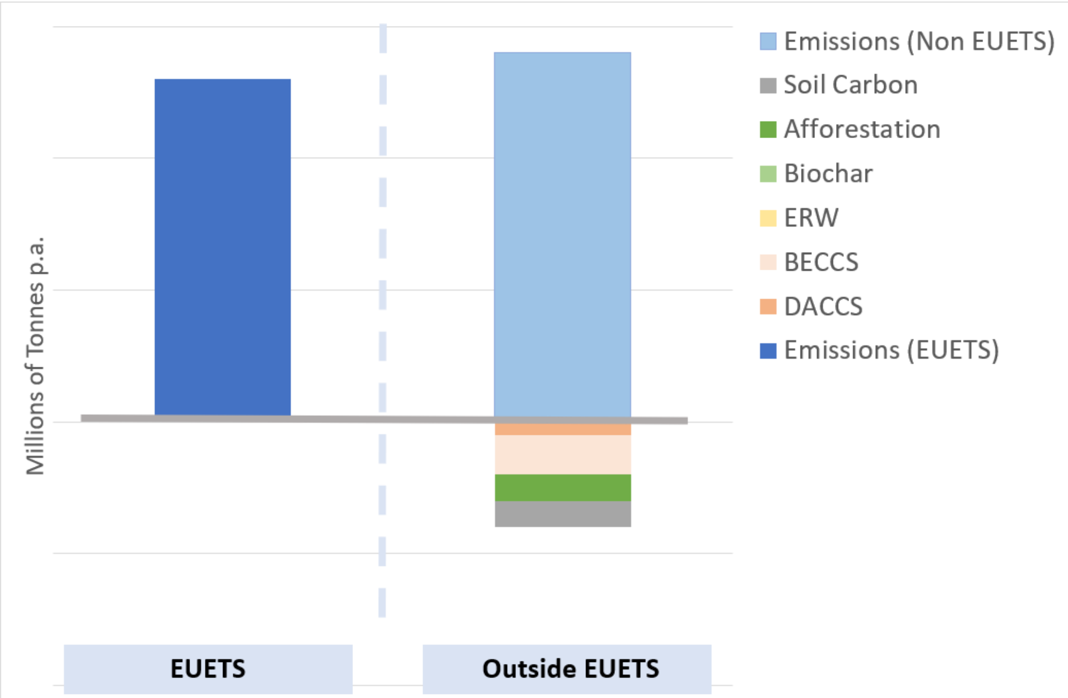
3.1 Comparing approaches to incentivising removals – inside and outside the EU ETS

Any removals included in the EU ETS would need to be equivalent to EUAs for the purposes of trading, since removals could be surrendered instead of EUAs. Removals and EUAs would become fungible (that is, interchangeable, or both capable of discharging the same obligation).

Another approach could be that removals form part of separate markets outside the ETS with their own rules. There would be no direct link with the EU ETS. This implies that both the quantities of removals and their prices would be formed separately from the EU ETS. These markets would only include some removals, whose physical permanence is guaranteed.

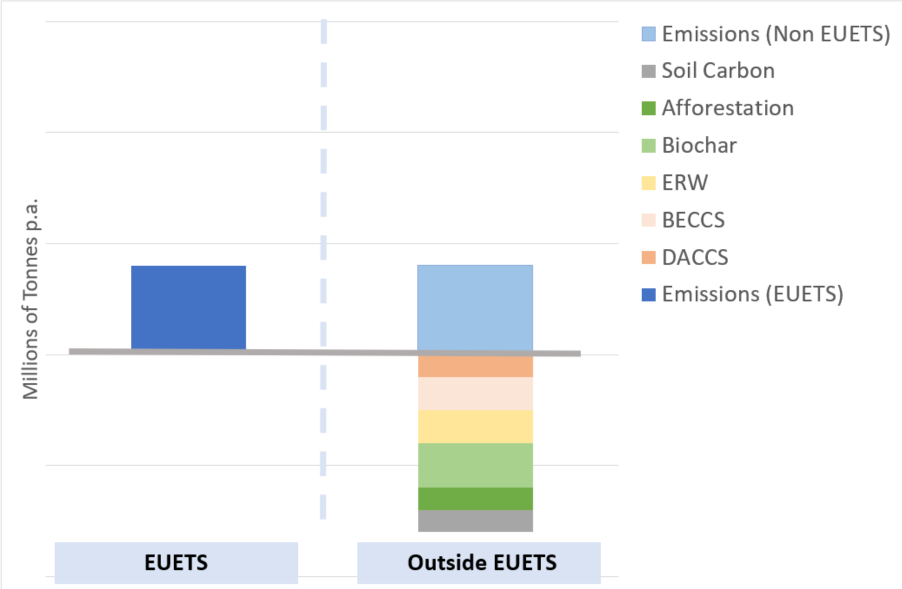
A range of possible degrees of interaction between CDR and the EU ETS may be possible, which may vary over time. This is illustrated schematically in the charts in Figure 7. The current situation – no integration - is shown in Figure 7a. In the early years, large-scale emissions are priced within the EU ETS, with much smaller volumes of removals treated separately. (*Note: All figures are schematic, not to scale and are intended only to illustrate the high-level choices that are needed. They do not address the issue of how removals might be allocated between the EU ETS and other sectors.*)

Figure 7a. Emissions are covered by the EU ETS with separate treatment of CDR



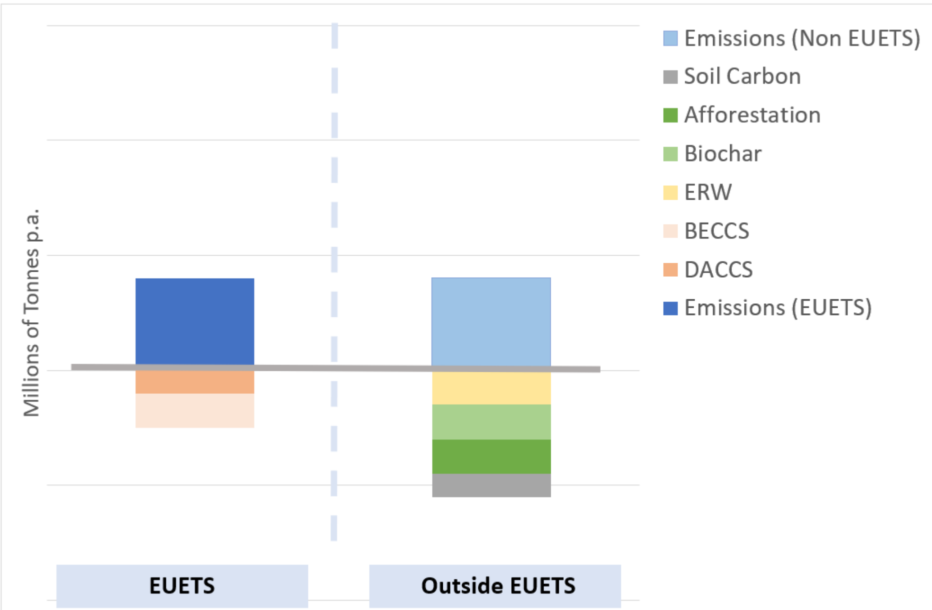
Reaching net-zero may be achieved with continued separation of markets. Under this approach, **residual emissions continue to be managed by the EU ETS, with separate markets enabling removals** (Figure 7b). The quantity of removals may exceed residual emissions to cover risks and uncertainties, and so to give a high degree of confidence that net-zero targets are met in practice. They would also be a step towards net-negative emissions.

Figure 7b. Net zero balances residual emissions managed by the EU ETS with separate treatment of CDR



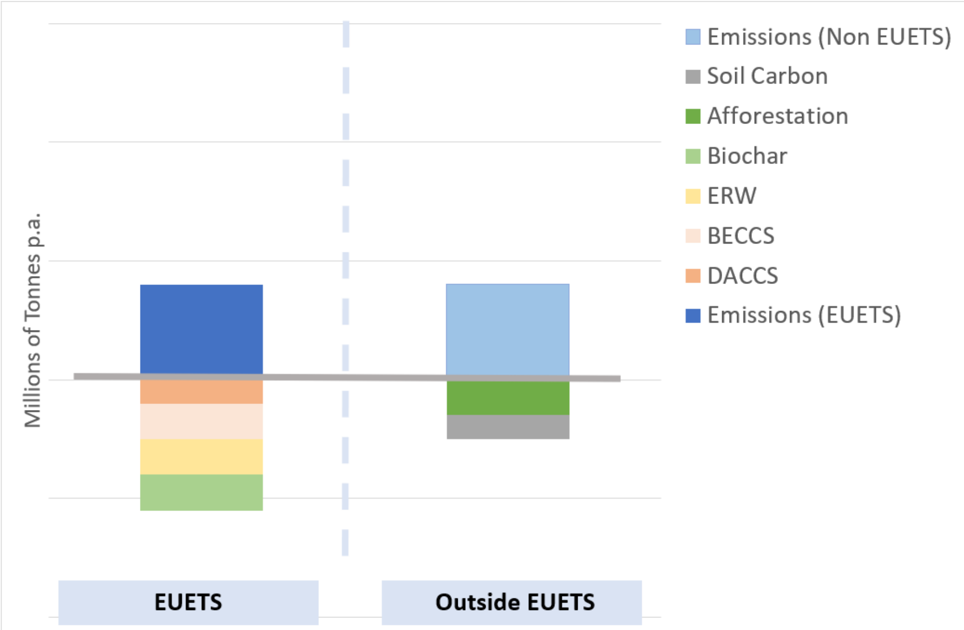
Alternatively, in the future, **some types of removal may be included within the EU ETS** (Figure 7c), with others remaining outside. The chart shows a case with DACCS and BioCCS (in the graph referred to as BECCS) eligible for inclusion in the EU ETS. The goal of balancing residual emissions with all types of CDR remains, but some removals are supported by their participation in the EU ETS.

Figure 7c Some types of removal are included in the EU ETS



Over time, **more types of removal may become eligible for inclusion as technologies develop, MRV and accounting systems are strengthened and experience is gained,** leading to a phased approach. However, some types of removals are likely never to be suitable for inclusion in the EU ETS (Figure 7d).

Figure 7d: A wider range of CDR is eligible for inclusion in the EU ETS



Note: Eligibility is unlikely to conform exactly to the categories shown. For example, some BioCCS projects may be included in the EU ETS, while other BioCCS projects may be supported in other ways.

3.2 Necessary preconditions and exclusionary criteria for the integration of removals in the EU ETS

Enabling the inclusion of removals in the EU ETS requires overcoming several types of challenges. In considering these, we do not assume that the inclusion in the EU ETS is the preferred option. **As it stands, Bellona does not see the direct inclusion of CDR into the EU ETS as a viable or desirable scenario.** Nevertheless, the choice between approaches will depend on the relative weight given to the advantages of inclusion, and the continuing difficulties.

3.2.1 The need for physical permanence

An emission to the atmosphere is effectively permanent: CO_2 emitted stays in the atmosphere for centuries to millennia. To balance emissions and have an equivalent climatic effect, any removals must also be permanent.

However, different types of CDR have very different degrees of permanence. In some cases, removal is intrinsically impermanent[28], as in the case of soil carbon. In other cases, for example reforestation, the risk of reversal might be high, for example due to the risk of wildfires. Conversely, geological storage can in principle be permanent, but there are risks of reversal and re-release of CO_2 into the atmosphere (although the probability of this is negligible[29]). For biochar and enhanced rock weathering, a certain proportion may be expected to be permanent, but with inevitable uncertainty about how much.

Only the physically permanent proportion of removals should be counted as eligible to counterbalance residual emissions. The quantity of physically permanent removals should be calculated with conservative assumptions and allow for unanticipated reversals (e.g. leakage).

The **CO_2 Storage Directive** exhibits important safeguards here. As an existing Directive that addresses liabilities for long-term storage, it should provide a tractable basis for dealing with similar liabilities for removals. The Carbon Removal Certification Framework (CRCF) states that permanent CDR methods must be "consistent with" the monitoring and liability requirements laid out in the CO_2 Storage Directive.

[30] the possibility of contractual permanence, in the form of obligations on holders of allowances. Such obligations may have a place in the wider set of measures to manage removals. However, they cannot make a physically temporary removal equivalent to a permanent removal suitable for balancing a (permanent) emission. In other words, there should not be any fungibility between types of removals in terms of permanence and risks of reversals and who is liable *in fine.*

The risk of reversals can be managed in various ways. There may be requirements on the holder of the removal certificate to provide:

- a replacement certificate in the event of reversal.
- compulsory insurance.
- contributions to buffer stock or reserve, which is then drawn down in the event of reversal.

Such measures may contribute significantly to maintaining removals over the long term. Financial instruments analogous to those found in other markets may emerge to help manage risks.

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[28] Removals stemming from forestry and soil carbon are "impermanent", because ecosystems are subject to constant carbon fluxes. That is the constant exchange of atmospheric CO_2 that is being newly sequestered in living ecosystems - the biosphere - and released. It is important to note that permanence does not constitute a value judgement but is a distinction of the physical qualities of different CDR methods. On an aggregate level the amount of carbon sequestered and stored in ecosystems, like e.g. in forests, can remain the same over time, decrease or increase.

[29] IPCC, 2005: IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [Metz, B., O. Davidson, H. C. de Coninck, M. Loos, and L. A. Meyer (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 442 pp.

[30] https://bellona.org/publication/addressing-differences-in-permanence-of-carbon-dioxide-removal

However, guarantees of permanence will always be imperfect, and cannot credibly guarantee permanence over the required time period of several centuries to the extent that physical permanence can. This is why, as explained earlier in the report, **removals that only rely on "contractual permanence" must not be integrated in the EU ETS**. This is especially the case when the risk of reversal is relatively high, as is the case for much land use. There are several overlapping reasons for this:

- There will be a strong incentive to maximise profit by extracting value from the sale of the removal, leaving insufficient funds to meet the costs of reversals, and causing default by the guarantor.
- Even with prudent behaviour by guarantors, there may be default, for example if the costs of managing the risk of reversal rise strongly and unexpectedly over time. This may be partially managed by requirements such as holding margins, but the risk cannot be eliminated.
- The liability is unlikely to be balanced by assets. For example, a forest carbon store may produce less revenue than the cost of maintaining the store, further increasing the risk of default.
- The very long timescales lie beyond the time horizon of almost all commercial planning and contracting.
- Buffer stocks may be exhausted over time, and vulnerable to systemic risks.
- The scale and duration of the risks make it unlikely that Member States will be willing to take on the risks to the extent required as the insurer of last resort.
- Arrangements are vulnerable to political, social, and cultural changes, especially over such a long period.

3.2.2 Uncertainties in quantity of CO_2 removed

For some types of removals, there may be substantial uncertainties about how much CO_2 has been removed from the atmosphere over time, even with the best available MRV. Such uncertainties differ from reversals in that they are expected to be present, rather than an unexpected possible outcome such as a leak from a geological store. These unavoidable uncertainties need to be recognised in any mechanism to make EUAs and CDR units equivalent.

Uncertainties may be due to limitations on measurement, or intrinsic variation in a physical process, or the behaviour of a carbon store over time. For example:

- the amount of carbon stored in a forest is variable due to a wide range of factors, including harvesting raters, changes in climate and following consequences for water regimes, resilience to heat stress and pests (see Figure 4);
- ERW is subject to major uncertainties as to how much is actually captured by the process within a given time period;
- for biochar applied to soils, it may be impossible to measure the total net amount of removal, even with continued monitoring of land.

Uncertainties may reduce for subsequent projects as further research is carried out and experience is gained. However, some uncertainties may remain.

In some cases, for example biochar, there may be both temporary and permanent components to removal. If a tonne of CO_2 is initially removed, some of this may return to the atmosphere over time, while the remainder may remain permanently stored due to its different chemical properties. The proportion that is certain may be possible to estimate after the pyrolysis process, although long-term monitoring is likely to be impossible.

3.2.3 Challenges of systemic risks

Potential incorporation in the EU ETS may not explicitly take systemic risks into account. Of particular concern **is large-scale simultaneous re-release of CO_2 from multiple storage sites,** which leaves the system unable to meet its obligation for example, if land-based removals were to be included and facing a large-scale reversal of storage covering many different carbon reservoirs, the inclusion could lead to the ETS never been able to reach a zero-emission goals. As happened in the last years, climate related disturbances as wildfires or forest die-back, have led to a reversal of the land's-carbon balance from net-negative to net-emissions. In contrast, storage in different geological formations may have risks of leakage, but these appear unlikely to happen simultaneously across different geological formations in ways that will lead to systemic risks.

A reserve of some form seems likely to be necessary to address even smaller risks. In addition, the presence of systemic risk implies the exclusion of some types of removals in the EU ETS. Creating a diverse portfolio of different types of removals could reduce some of the systemic risks associated with removals. A diverse portfolio can be achieved in various ways. Any form of interaction of CDR with the ETS would need to consider these measures to address systemic risks:

- separate types and levels of support for different types of removals, similar in principle to support for different types of renewable energy;
- limiting the volume that each type of removal may supply to the EU ETS;
- establishing a variety of approaches, for example buffer stocks, to addressing difficulties with some types of removals.

3.2.4 Scarcity of permanent removals

Scarcity of permanent removals stands in contradiction to the very solution that an integration proposes. **If only a limited amount of permanent removals will be available, a thin and illiquid market could be a consequence**.

The leading candidates for inclusion in the EU ETS may not be available in the quantities needed to balance residual emissions. In particular, DACCS is still in its early stages, with total removals to date ranging in the tens of thousands of tonnes. Consequently, there is a possibility that only limited removals into geological storage will be available. Even if DACCS is incorporated into the EU ETS, it may not be enough on its own to ensure net zero. This could lead to thin, illiquid markets.

Additionally, shortages of available removals credits may be exacerbated by competition from long-haul aviation, where emissions at the point of use are unavoidable, and are likely to remain so in many cases for the next decades.

This may affect decisions about which removals can be included in the EU ETS. It may be necessary to broaden eligibility for inclusion if there is a need to ensure that the EU ETS must meet a net zero cap and could lead to calls from some stakeholders to include impermanent or low-quality removals to artificially increase liquidity while actually introducing all of the risks laid out in this report.

3.2.5 Risk of disincentives for emissions reductions

Measures to increase the availability of removals including subsidies, may dilute incentives to reduce emissions. For example, subsidies for DACCS may make it seem less expensive than certain forms of high-cost emissions reductions, even though it is not, potentially encouraging removals when emissions reductions would be more efficient. While financial support for early-stage technologies is often needed, this needs to be treated with care to avoid disincentivising emissions reductions.

To mitigate this risk, this may require **limiting the total amount of CDR eligible under the EU ETS**, especially in the early stages. Such limits are similar in principle to the limits on (international) offsets that are found in many emissions trading systems. These limits would be in addition to pre-conditions for robust MRV and permanence on all eligible CDR.

There are several forms that a quantity limit could take:

- Specifying the maximum absolute quantity of removals each year, which may change over time.
- Specifying the percentage of the cap that may be met through removals, which may also change over time.
- A conditional limit reflecting the balance of supply and demand for EUAs in the system. Specifically, it will not be appropriate to include removals in the EU ETS while there is a surplus of EUAs.

In practice, a surplus is best defined as continuing transfers to the MSR. For example, **there could be a rule which prevents the inclusion of removals in the EU ETS until there have been no transfers into the MSR for at least three consecutive years**. A more stringent criterion would be that **withdrawals from the MSR are required before CDR is eligible for inclusion**. Such rules may need to be adjusted over time to reflect developments in the MSR.

3.3 Timing of possible incorporation of removals

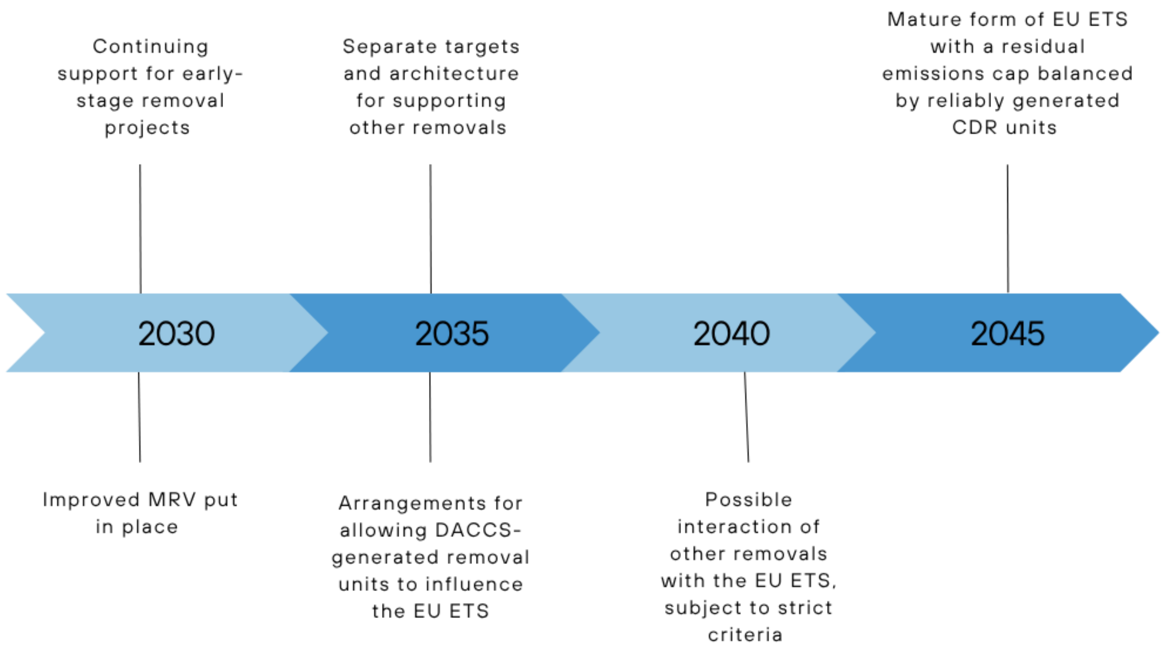
The prospects for interaction of removals with the EU ETS remain unclear. Consequently, it is too early to set out a precise schedule for any reform. However, Table 1 below indicatively shows an optimistic estimate of possible progress. **Vigorous emissions reductions are assumed to continue throughout the period, as is both necessary and projected in the EU's long-term climate modelling**.

This schedule indicates **the need for rapid development of improved MRV**. If this is not put in place promptly, there may be insufficient time to meet subsequent milestones at the rate needed to achieve net zero.

Given the necessary improvements to MRV, governance, and technological development, this phased approach should provide a clear and ambitious timeline for those to materialise, without cutting corners nor generating unrealistic expectations. The suggested indicative timelines assume that by such a time (e.g. 2030 for Phase 1), there have been significant improvements. Subsequently, if by 2030 MRV frameworks or CDR technology have not sufficiently matured, the plan to move to the next phase should be reconsidered. However, such flexibility in the progression of support schemes for CDR may not be feasible if the EU chooses to directly integrate CDR into the ETS by a fixed date. Strict deadlines could create unrealistic expectations and lead to premature inclusion of removals before the overall CDR framework is ready. **This pressure might lower the quality for CDR units, undermining the credibility and effectiveness of the EU's main climate mitigation tool.**

Table 1: Indicative schedule for a phased interaction of removals in the EU ETS

Date	Activity
Phase 1 (e.g. by 2030)	Improved MRV put in place Continuing support for early-stage removal projects
Phase 2 (e.g. by 2035)	Arrangements for allowing DACCS-generated removal units to influence the EU ETS Separate targets and architecture for supporting other removals
Phase 3 (e.g. by 2040)	Possible interaction of other removals with the EU ETS, subject to strict criteria
Phase 4 (e.g. by 2045)	Mature form of EU ETS with a residual emissions cap balanced by reliably generated CDR units



3.4 Additional support measures for CDR

Regardless of the way in which CDR will interact with the EU ETS, additional measures will be necessary to support its timely development. For instance, while CCS has been an available option for ETS installations to abate their emissions and fulfil their obligations since 2009, the first project to actually do so only materialised this year in 2025[31]. Nevertheless, this project is extensively supported with additional public financing from both Norway and the EU, with the ETS price signal having been clearly insufficient to singlehandedly support the development of CCS.

The types of CDR that may initially interact with the ETS, namely DACCS and BioCCS (under strict sustainability requirements for the used biomass), are effectively subsets of CCS. Therefore, it is fair to assume that these approaches will also require additional support measures in the short to medium term to bring them towards a level of commercialisation where they can interact with the ETS with minimal additional support. The form these additional support measures may take are extensive, but much could be reproduced from existing national schemes, such as Denmark's NECCS fund (for negative emissions via CCS) and Sweden's reverse auction for BioCCS.

Given the suggestion to gradually phase in the interaction between CDR and the EU ETS, the Commission should explore the development of short-term support measures instead of a short-term direct integration of CDR into the ETS. The possible development of an EU purchasing mechanism[32] could help plug this short-term gap.

[31] https://norlights.com/what-we-do/
[32] https://www.ecologic.eu/sites/default/files/publication/2025/71502-WorkshopPreread-PermCDR-Purchasing-Programme.pdf

4. Recommendations

1: General recommendations for effective CDR policy

1 Emissions reductions must remain the core priority

The EU ETS should continue to focus on driving direct emissions reductions, with CDR playing only a limited role to address hard-to-abate residual emissions.

Prioritising emissions reductions is essential because they directly prevent greenhouse gases from entering the atmosphere, while CDR introduces risks such as supply uncertainty, potential reversals, and weakened incentives for decarbonisation.

Even as CDR options develop, the ETS must maintain strong pressure to continuously minimise residual emissions.

2 Set separate targets for emission reductions and carbon removals

Establish clear, separate targets for emissions reductions and for carbon removals outside the EU ETS and ESR, to prevent removals from diluting the ambition of existing targets.

This approach enables the EU to support CDR technology deployment while ensuring removals serve a defined role within broader climate objectives.

3 Reassess the carbon neutrality assumption for biogenic emissions

Allowing biomass-based removals to generate CDR units for the ETS is likely to exacerbate the imbalance of incentives and further deplete the land sink.

Urgently revise the zero-rating of biogenic emissions, ensuring that biomass use is accurately accounted for in relation to ecosystem carbon balances.

Until robust safeguards and accounting are in place, biomass-based removals should not interact with the ETS.

4 Establish new frameworks and institutions for CDR

Create new regulatory frameworks and institutions, such as buffer stock requirements, intermediaries, or a CDR Bank, to support CDR deployment whether inside or outside the ETS.

2: Specific recommendations for an interaction of CDR with the ETS

1 Limit the quantity and type of CDR allowed to interact with the ETS

Introduce strict quantitative limits on CDR eligible to interact with the ETS, possibly with different limits for different removal types.

Exclude CDR from the ETS while a surplus of EUAs exists (e.g., only allow CDR after three consecutive years without transfers into the Market Stability Reserve).

Allow only permanent CDR to interact with the ETS and keep land-use-based removals out, due to high measurement uncertainty and reversal risks, which threaten market stability.

2 Establish robust MRV and accounting frameworks

Develop and implement rigorous Monitoring, Reporting, and Verification (MRV) and accounting systems before allowing any CDR to interact with the ETS.

These rules should:

- Account for the timing and climate equivalence mismatch of emissions vs. removals.
- Cover the full scope of emissions for the generation of CDR units.
- Ensure additionality and exclude projects with negative environmental or social impacts.
- Replace the current zero-rating of biomass with accurate lifecycle carbon accounting.

These frameworks are essential for any credible CDR support system, regardless of ETS inclusion.

3 Phase the interaction of removals with the ETS

In a first phase, consider only removals from Direct Air Capture with Carbon Storage (DACCS), provided robust MRV and accounting are in place.

DACCS offers permanent storage with low leakage risk but is likely to be available only in limited quantities and at high cost and may be an option for sectors like long-haul aviation.

Other removal methods (e.g., Enhanced Rock Weathering) should not interact with the ETS until their effectiveness and risks are better understood and quantified.

4 Develop additional policy instruments for CDR beyond the ETS

The ETS alone is insufficient to support the scale-up of CDR. Mobilise complementary tools such as Carbon Contracts for Difference (CCfDs), reverse auctions, and dedicated financing mechanisms.

Clearly communicate the limited, targeted role of CDR within the ETS to manage expectations and focus on residual emissions.

5 Implement a strong liability regime for permanence and storage risks

Establish a robust liability regime to address reversal risks across all CDR technologies, with permanent responsibility for storage.

This is particularly important for BioCCS, given uncertainties in managing above-ground carbon stocks.

In light of the upcoming revision of the EU ETS, these recommendations aim to ensure that CDR supports, rather than undermines, the EU ETS's primary goal of emissions reduction, while laying the groundwork for robust, science-based integration of removals into broader EU climate policy.

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