

DISCUSSION PAPER // JUNE 2026

A post-2030 climate policy framework fit for reaching the EU climate targets

Recommendations by the German Environment Agency

Imprint

Publisher

German Environment Agency
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
buergerservice@uba.de
Internet: www.umweltbundesamt.de

Responsible units:

Section V 3.3 “Economic Aspects of Emissions Trading, Auctioning, Evaluation” and
Section V 1.2 “Climate and Energy Strategies and Scenarios”

Disclaimer:

The responsibility for the content of this publication lies with the German
Environment Agency

DOI:

<https://doi.org/10.60810/openumwelt-8541>

Dessau-Roßlau, June 2026

German Environment Agency: EU News

Do you want to receive updates on our latest publications, statements and events that are relevant for EU environmental policy? Our newsletter covers EU policies on climate mitigation and adaptation, zero pollution and circular economy and is tailored for policy makers, experts and journalists.

Subscribe to our newsletter at www.uba.de/eu-news.

DISCUSSION PAPER // June 2026

A post-2030 climate policy framework fit for reaching the EU climate targets

Recommendations by the German Environment Agency

by

Julio Fournier, René Lanz, Katja Purr, Jan Weiß
German Environment Agency, Dessau-Roßlau

in collaboration with

Frederike Balzer, Simon Bohn, Sebastian Bolz, Matthias
Futterlieb, Frank Gagelmann, Michael Golde, Tobias
Herzfeld, Julian Hirsch, Karsten Karschunke, Daniel
Klingefeld, Marcel Kruse, Timo Köhler, Benjamin
Lünenbürger, Maik Nagel, Nadine Pauly, Maximilian
Pagel, Frederik Pischke, Dana Ruddigkeit, Fabian Schmid,
Karlotta Schultz, Diana Sorg, Jens Tambke, Kerstin Tews,
Judith Voß-Stemping, Matthias Weyland, Kai
Wehneemann, Karl Zimmermann, Alexandra Zirkel, Hans
Zschüttig
German Environment Agency, Dessau-Roßlau

On behalf of the German Environment Agency

Disclaimer

Any views expressed are the views of the German
Environment Agency and may not under any
circumstances be regarded as an official position of the
Federal Ministry for the Environment, Climate Action,
Nature Conservation and Nuclear Safety or the Federal
Republic of Germany.

Abstract

This discussion paper develops a series of recommendations for a post-2030 EU climate protection architecture that is able to reach the EU climate targets. It begins by outlining and analysing the EU's climate targets, including the recent amendment to the European Climate Law, which sets an EU intermediate climate target for 2040 and provides for a number of flexibilities to meet this target. Subsequently, it provides an overview of the current policy framework and highlights key cross-cutting considerations for the future development of the EU's climate and energy policies, including the need for improved coordination, policy coherence and social justice. Building on this analysis, the paper sets out concrete recommendations for revising and strengthening existing climate and energy policies. These recommendations focus first of all on the core pillars of the EU climate protection architecture, namely the EU Emissions Trading System, the Effort Sharing Regulation and the carbon removal framework. Second of all, the paper addresses key challenges related to the energy system, the transition towards a climate-neutral and sustainable economy, and examines both the social and international dimensions of the EU's climate strategy.

Kurzzusammenfassung

Dieses Diskussionspapier entwickelt eine Reihe von Empfehlungen für eine EU-Klimaschutzarchitektur nach 2030. Damit soll die Erreichung der Klimaziele der EU abgesichert werden. Hierfür werden zunächst die Klimaziele der EU dargestellt und analysiert. Dies umfasst insbesondere die jüngsten Änderungen des Europäischen Klimagesetzes, durch die ein unionsweites Zwischenziel für den Klimaschutz bis 2040 festgelegt sowie eine Reihe vorgesehener Flexibilitätsmechanismen zur Unterstützung der Zielerreichung eingeführt werden. Anschließend gibt das Papier einen Überblick über den aktuellen politischen Rahmen und hebt zentrale übergreifende Überlegungen für die zukünftige Entwicklung der Klima- und Energiepolitik der EU hervor. Dies schließt unter anderem die Notwendigkeit einer verbesserten Koordinierung und der stärkeren Politikkohärenz sowie Aspekte der sozialen Gerechtigkeit ein. Aufbauend auf dieser Analyse formuliert das Papier konkrete Empfehlungen zur Überarbeitung und Stärkung bestehender Klima- und Energiepolitiken. Diese Empfehlungen konzentrieren sich zunächst auf die zentralen Säulen der EU-Klimaschutzarchitektur, nämlich das EU-Emissionshandelssystem, die Lastenteilungsverordnung und den Rahmen für CO₂-Entnahmen. Darüber hinaus adressiert das Papier zentrale Herausforderungen im Zusammenhang mit dem Energiesystem, dem Übergang zu einer klimaneutralen und nachhaltigen Wirtschaft und fokussiert sowohl auf die sozialen als auch die internationalen Dimensionen der Klimastrategie der EU.

Table of content

Abstract	4
Kurzzusammenfassung.....	4
Table of content	5
1 Executive summary for policymakers	7
2 Introduction.....	11
3 The EU’s climate targets and climate protection architecture	12
3.1 The EU’s 2030 climate target and its current climate protection architecture	12
3.2 The EU’s 2040 climate target	14
3.2.1 Brief assessment of the ECL amendment	15
3.3 Shaping the post 2030 EU’s climate protection architecture	17
4 Building blocks of the EU’s climate protection architecture.....	21
4.1 Driving climate ambition: futureproofing the EU ETS.....	21
4.1.1 Set an ambitious cap until 2040 to maintain strong emissions reductions.....	21
4.1.2 Strengthen the CO ₂ price signal in line with social and competitiveness considerations.....	21
4.1.3 Ensure an efficient carbon price trajectory as the market size gets reduced	23
4.1.4 Recognize the existence of unavoidable residual emissions and find a suitable strategy to compensate them.....	24
4.1.5 Foster efficiency through additional flexibilities and policy mix	25
4.2 Taking responsibility: Strengthening the ESR	26
4.2.1 Ensure reduction targets towards 2030	26
4.2.2 Incentivize and support Member States’ compliance	27
4.2.3 Extend the ESR post-2030 and ensure efficient interaction with EU ETS 2.....	28
4.2.4 Enhance mechanisms to reduce GHG emissions in agriculture	29
4.3 Regarding CDR: Stringent and prudent inclusion of CDR in the EU post 2030 climate architecture.....	30
4.3.1 Separate prevention and reduction of GHG emissions	30
4.3.2 The role of CDR in the EU COM’s 2040 climate target proposal	32
4.3.3 Strengthen the LULUCF sink	32
4.3.4 Approach BECCS and DACCS responsibly	33
4.4 Powering the future: Enabling the clean energy transition.....	34
4.4.1 Reduce dependencies on fossil fuels.....	34
4.4.2 Enhance diversification of energy carriers and technologies	35

- 4.4.3 Foster electrification and expand renewable energies utilization 35
- 4.4.4 Improve energy efficiency 37
- 4.5 Building a green economy: Decarbonizing Europe and financing the transition 38
 - 4.5.1 Decarbonisation of sectors with future technologies, know-how and skill development..... 38
 - 4.5.2 Ensure competitiveness through Green Technology..... 39
 - 4.5.3 Enable and support climate management in companies 40
 - 4.5.4 Reduce bureaucracy without sacrificing ambition 41
 - 4.5.5 Finance the green transition..... 41
 - 4.5.6 Ensure a level playing field by incorporating GHG shadow prices into decision making..... 42
- 4.6 Ensuring a just transition: solidarity and fairness as guiding principles 43
 - 4.6.1 Consider and address the risk of social imbalances due to higher CO₂ prices 43
 - 4.6.2 Recycle ETS revenue for targeted support and social compensation of low- and middle-income households during the run up of the EU ETS 2..... 44
 - 4.6.3 Strengthen the Social Climate Fund and extend funding to support poorer Member States in their broader transformation efforts..... 45
- 4.7 Coordinating globally: The EU’s international engagement 46
 - 4.7.1 Strengthen global climate action through EU leadership..... 46
 - 4.7.2 Foster international cooperation, policy coordination and financing 46
 - 4.7.3 Leverage Article 6 cooperative mechanisms (Paris Agreement) to support additional climate action abroad without reducing domestic targets 47
 - 4.7.4 Recognize carbon leakage risk and reinforce prevention measures 49
- 5 References..... 51

1 Executive summary for policymakers



1. **Further develop the climate target for 2040 in potential future reviews and don't jeopardize reaching the 2030 goals - all in view of ensuring reaching climate neutrality in the EU by 2050.** The EU has set itself a net reduction target of 90% compared to 1990 levels by 2040 with the possibility of meeting up to 5% of the target through international credits (under Art. 6, Paris Agreement), corresponding to a domestic reduction of net GHG emissions by 85% by 2040. The German Environment Agency (UBA - Umweltbundesamt) continues to recommend a 95% domestic GHG net reduction target by 2040. This requires a comprehensive implementation of the "Fit for 55" Package to reach the goals for 2030 as a necessary bridge to the 2040 and 2050 targets. An ambitious 2040 target is central to achieving climate neutrality, as a weaker target would shift an unrealistically high mitigation burden to the post-2040 period, with limited scope to correct course. It is our recommendation that the 2040 climate target should not be reduced in future revisions to provide stable, predictable incentives for long-term investment and policy planning. In this respect, the agreed climate target should be reviewed in the coming years with the goal to increase its ambition to more than 90%.



2. **Prioritize emissions reductions, set separate targets for gross emissions reductions and different removal types and advance the carbon removal strategy.** The avoidance and reduction of GHG emissions need to be the primary goal of future EU climate policies, with a coherent set of supporting policies and instruments. This reflects the risks, cost and limited availabilities of carbon capture and storage (CCS) and carbon dioxide removals (CDR). Therefore, emissions reduction targets need to be distinct from removal targets, with separate goals for natural and technical sinks, as they provide clarity and incentives for stakeholders, contribute to implementing policy instruments and provide guidance for the post 2030 policy framework. This needs to be addressed in key legal acts when implementing the recently agreed climate target – in particular in the emissions trading directive and in the effort sharing decision. Aligning policies and increasing investments will help to meet the 2030 targets and build long-term resilience. Complementing technical CDR solutions, accompanied with legislative targets, should be focused on thermal waste incineration, to prevent lock-in effects and address open questions on affordability, permanence, sustainability and security.



3. **Strengthen and expand natural sinks by scaling up land-based climate measures through ambitious post-2030 targets.** Prioritize and coordinate efficient emissions reduction targets and CCS as well as CDR to balance emissions reduction and removal targets. Using biomass and CCS for emissions reduction strategies may limit carbon removal goals. Expanding CCS based on biomass does not generate additional benefits. It merely shifts the impact away from the LULUCF sector. This could lead to conflicts with the

LULUCF target and increase emissions outside the EU. Clear strategies and sustainability criteria are needed to prevent these conflicts.



4. **Set a transparent, evidence-based ceiling on residual emissions.** Due to the risks of large-scale CDR deployment, there is broad agreement on minimizing residual emissions. These should be limited to those that are truly unavoidable based on technological, sustainability and social constraints. This definition should remain flexible and updated as science and society evolve, potentially reducing what is considered unavoidable. A coordinated strategy should be implemented to encourage the development of negative emissions without weakening incentives for emissions reductions.



5. **Ensure that the updated EU climate policies are coherent, coordinated, and capable of aligning national and EU-level actions and ensure Member States efforts on reducing emissions after 2030.** The continuation of the Effort Sharing Regulation (ESR) is therefore crucial for ensuring national emission reduction targets and upholding the subsidiarity principle. However, more effective enforcement and deterrent mechanisms reinforcing Member States compliance are needed. This for example includes an automatic gap-closure adjustments and an EU-wide transparent, harmonised monitoring, verification reporting (MRV) system and national GHG projections to trigger truly effective corrective action measures well before emerging gaps jeopardise the climate targets. Additionally, clarify on how the newly proposed flexibilities between sectors and Member States will function, since poorly designed rules could lock sectors into high-emissions trajectories. Coordinate climate, energy, and further complementary policies and targets in a coherent and complementary way. A well-aligned instrument mix is key to achieving targets efficiently.



6. **Avoid relying on international carbon credits to meet EU's climate targets.** The UBA acknowledges with great concern that a substantial part of the 2040 climate goal (up to 5%) is foreseen to be met with international carbon credits (Article 6, Paris Agreement). These credits can help support climate action abroad, but are not a reliable substitute for domestic effort. Besides quality issues, they can also create perverse incentives, undermine climate goals of third countries, and create new dependencies. Additionally, the availability and price of high-quality credits remain uncertain; they may be scarce and costly, limiting their contribution to reducing overall mitigation costs in Europe. Importantly, this must not create pressure to accept lower-quality credits. In this respect, very strong and clear guidelines for the implementation of Article 6 in the context of the European climate protection architecture need to be set in the relevant implementing legislation in order to balance the risks of this decision.



7. **Introduce flexibilities that enhance efficiency but do not delay necessary domestic emissions reductions.** Flexibilities between sectors and Member States, for instance via the EU Emissions Trading System (EU ETS) and the ESR, will help to increase the efficiency of achieving a common climate target. However, they also carry the risk of slowing down the necessary emissions reductions in a scenario where strong emissions reductions are needed across all sectors. Therefore, new or adapted flexibility strategies for after 2030 should minimize this risk.



8. **Strengthen and futureproof the EU ETS.** Set an ambitious and stable cap until 2040 that reflects the overall climate target, avoid a slower phase-out of free allocations, and do not further delay the introduction of the EU ETS 2. This guarantees a robust and cost-efficient target achievement and creates a strong CO₂ price signal required to effectively incentivize the required emissions reductions in the covered sectors. Ensure that the EU Carbon Border Adjustment Mechanism (EU CBAM) and a consequent recycling of auction revenues effectively aid sectors with higher carbon costs from carbon leakage, while promoting a broad, economy-wide decarbonization and ensuring a socially-just transition. The effectiveness of the EU CBAM and complementary measures are key conditions for a rapid phase-out of the free allocation system. The EU carbon pricing architecture will also play a key role by implementing rules for the efficient use of CCS/U and biomass.



9. **Enable a clean energy transition.** Support scaling up of domestic renewable energy and green technologies, such as green hydrogen, that is in line with the overall climate target and the transformed energy demand of carbon neutral sectors. In addition, this transition reduces external dependencies and diversifies energy sources to strengthen energy security and resilience. Acceleration of electrification, wherever possible, enforcement of clear, binding and consistent rules to boost energy efficiency is a key requirement.



10. **Build and finance the green transition.** Drive sectoral decarbonisation with future technologies, know-how, and skills while ensuring competitiveness through green innovation. Support companies with effective climate management, cut unnecessary bureaucracy without sacrificing ambition, align public spending with climate goals and mobilise private investment. Promote a level playing field by integrating GHG shadow prices into decision-making.



11. **Ensure a just transition that leaves no one behind.** Identify potential negative impacts and develop strategies to prevent disparities to ensure fairness and sustain public support for climate action. Consider and effectively address the risk of social imbalances due to higher CO₂ prices. To do so, a mix of measures for supporting low- and middle-income households and a strengthening of the Social Climate Fund and ETS spending rules for Member States and enhanced support programs are necessary.



12. Actively support and advance climate action beyond the EU. Effective climate action beyond the EU is key to limiting global warming, strengthening EU policy, and enhancing fairness. EU policies should foster international cooperation, policy coordination, climate-focused investment, and avoid carbon leakage. All financial, trade, security, and development policies should consistently support emissions reduction and climate resilience. Article 6 mechanisms offer an additional tool to aid global mitigation efforts.

2 Introduction

On 2 July 2025, the European Commission (EU COM) published its legislative proposal for an intermediate 2040 greenhouse gas (GHG) emissions reduction target, supplementing the 2030 and 2050 targets (European Commission, 2025c). In this proposed amendment to the European Climate Law (ECL), the EU COM outlined the necessary pathway to keep Europe on track to become the first climate neutral continent. This proposal marked the starting point for the discussions between the three European institutions, leading to the amendment of the ECL in March 2026 (Regulation (EU) 2026/667, 2026).

Continuing steadfast on this goal, as well as on the promises of the European Green Deal (EGD) and the “Fit for 55” Package, is necessary to reassure all stakeholders, economic actors and the general public that the European Union (EU) has the capacity and the willingness to reach its own ambitions. Furthermore, as the EU is currently facing a multitude of internal and external challenges and the ongoing, and accelerating, climate crisis, a sound policy package and a clear vision on how to achieve the emissions reduction targets are more important than ever.

An ambitious climate target is important, but it has to be substantiated with measures and instruments. These need to be embedded in a consistent EU climate protection architecture, which serves as the overarching framework for addressing fundamental aspects necessary for achieving the successful and socially acceptable transformation while strengthening the EU’s competitiveness globally. With the 2040 climate target, the EU set the guidelines for this transition, but it is up to the Member States to fill this framework with life and implement policies supporting Europe’s transformation.

Due to the multitude of internal and external challenges and constraints, a new 2040 emissions reduction target and the post-2030 climate architecture consequently need to be seen together and discussed in the bigger picture of necessary emissions reductions, limiting Europe’s energy and resource dependency, and boosting its economy, while guaranteeing a just and fair transition.

Building on the 2040 climate target agreement between the EU COM, the European Council (EUC), and the European Parliament (EP) and the subsequent amendment of the ECL, in this discussion paper we explore how a post-2030 climate protection architecture should look like to keep the EU on track off achieving its 2040 and 2050 climate targets. As will be explored in section 4, this includes issues, such as the EU Emissions Trading System (EU ETS), the Effort Sharing Regulation (ESR), the role of carbon sinks, an energy system focused on renewable power supply and energy efficiency, a green economy and the social and international dimension.

3 The EU's climate targets and climate protection architecture

The EU has committed itself to reach net-zero GHG emissions by 2050, followed by net-negative emissions, as established in the European Climate Law (ECL) (Regulation (EU) 2021/1119, 2021). This fundamental political and legal agreement must remain the north star guiding all climate policy making and implementation activities in the 2030 and 2040 years. Reaching the EU net-zero target requires rapid decarbonization across the economy as well negative emissions to counterbalance any remaining emissions and enabling net-negative emissions after 2050 (European Scientific Advisory Board on Climate Change, 2025b).

To enable these goals, the ECL requires the EU COM to set binding intermediary climate targets for 2030 and 2040, as well as review and propose new legislation to achieve these targets. As stated by the ECL, these intermediate targets are essential as they provide predictability and confidence among all economic actors, ensure a gradual reduction of emissions over time, and guarantee that the transition towards climate neutrality becomes irreversible.

3.1 The EU's 2030 climate target and its current climate protection architecture

The intermediate EU climate target for 2030 is already stipulated in the ECL, requiring a domestic net emissions reduction of at least 55% compared to 1990 levels. By the implementation of this target, EU and Member States should prioritize swift and predictable emissions reductions, complemented by enhanced removals via natural carbon sinks. Importantly, the contribution of net removals to this target is limited to 225 million tonnes of CO₂ equivalent to ensure sufficient mitigation. The ECL mentions that the size of its net carbon sink by 2030 could be further expanded in view of the climate neutrality target.

To meet this target, the EU has in place a multi-level sector-wide climate protection architecture (climate policy framework). This architecture is organized around three main pillars based on sectoral coverage:

- ▶ the **EU Emissions Trading System (EU ETS)** (Directive 2003/87/EC, 2003),
- ▶ the **Effort Sharing Regulation (ESR)** (Regulation (EU) 2018/842, 2018), and
- ▶ the **Land Use, Land-Use Change and Forestry Regulation (LULUCF)** (Regulation (EU) 2018/841, 2018).

These instruments operate across different levels of governance (EU-wide, national, and sectoral), reflecting the shared responsibility between the EU and its Member States in achieving climate goals. They were reformed during the last years in line with the EU 2030 climate target ("Fit for 55" Package).

The EU ETS guarantees cost-effective emissions reductions in covered sectors by placing an EU-wide cap on their emissions and allowing trading and banking of emissions allowances (EUAs). The EU ETS 1 started 2005 and covers emissions from the energy and industry sectors and more recently from aviation and maritime. It has a reduction target of 62% (compared to 2005) until 2030 in the covered sectors, which together make up around 40% of EU-wide GHG emissions. From 2028 (recently postponed from 2027 under the ECL amendment, see next section), a separate EU ETS 2 will cover the fuels used in the road transport and

building sectors as well as in industry, if not covered by EU ETS 1¹, serving as a key instrument for achieving ESR targets; its cap is therefore derived from the ESR commitments for these sectors (see section 4.2). The target is an emissions reduction in the buildings and road transport sectors by 43% by 2030 compared to 2005, and by 42% in the additional sectors. Together, EU ETS 1 and 2 will cover approximately 75% of all EU-wide GHG emissions by the end of the decade (European Scientific Advisory Board on Climate Change, 2024).

The ESR sets up tailored national reduction targets to allow that all Member States contribute to the overall targets in a differentiated and flexible manner. It currently covers emissions from the domestic transport (without aviation and maritime), buildings, agriculture, small industry and waste sectors, which together account for about 60% of EU-wide GHG emissions. The ESR sets a collective reduction of 40% by 2030 compared to 2005 levels, with binding national targets varying by country. Importantly, from 2028, several sectors will be simultaneously covered by the EU ETS 2 and the ESR.

The LULUCF Regulation establishes how emissions and removals from LULUCF activities are accounted for, ensuring they contribute in a transparent and measurable way to the EU's climate targets. More specifically, it requires Member States to progressively reduce emissions and increase removals from LULUCF activities. It sets a net carbon sink target of at least 310 Mio. t CO₂e removals annually by 2030, out of which 225 Mio. t CO₂e can be counted towards the 2030 climate target. The accounting in the LULUCF sector functions like a balance sheet, recording changes in carbon sinks, storage, and GHG emissions.

The pillars of climate policy already include different flexibility mechanisms within and between each system. Trading and banking flexibilities are not only a characteristic of the EU ETS, but also in the other systems. Under the ESR, for example, Member States can trade emissions allocations (AEAs). Surpluses can be saved for future use, while limited amounts can be borrowed from the next year if needed. Under the LULUCF Regulation, Member States can bank or borrow limited quantities of net removals across compliance periods and, under specific conditions, transfer surplus removals to other Member States. Limited intersystem flexibilities also exist between the systems, including, for example, the ESR flexibilities allowing some Member States the use of credits from the land use sector or EUAs from the EU ETS to comply with their ESR obligations.

The core pillars of the EU's climate architecture are supported by a wide range of additional policies and regulations at both the EU and national levels. These supporting measures primarily aim to drive the **green energy transition**, promote **energy efficiency**, and accelerate the **adoption of low-carbon and green technologies**, especially in industry, transport, and buildings. Key EU-level instruments include:

- ▶ the **Renewable Energy Directive (RED)**, which sets binding targets for the share of renewables in the energy mix (Directive (EU) 2023/2413, 2023),
- ▶ the **Energy Efficiency Directive (EED)**, which imposes energy-saving obligations on Member States (Directive (EU) 2023/1791, 2023) and
- ▶ the **CO₂ emissions standards for vehicles**, which push the automotive sector towards electrification (Regulation (EU) 2023/851, 2023).

¹ This applies primarily to installations smaller than the thresholds for participation in the EU ETS 1.

- ▶ Moreover, **financial mechanisms** like the **Innovation Fund**, **Modernisation Fund**, and the **Social Climate Fund** provide vital support for clean technology deployment, infrastructure upgrades, and a socially fair transition.
- ▶ At the **national level**, **governments implement complementary policies** such as subsidies for building renovation, renewable energy incentives, and national carbon pricing schemes, which align with and reinforce EU targets.

3.2 The EU's 2040 climate target

The EU's 2040 climate target has already been enshrined in the ECL through an amendment adopted in March 2026 (hereinafter the "ECL amendment") (Regulation (EU) 2026/667, 2026). **The new intermediary target sets an EU-wide net GHG emissions reduction target of 90% compared to 1990 levels by 2040.** In addition to formally embedding this new climate target in the ECL, the ECL amendment also introduces a range of flexibilities intended to facilitate the achievement of the target. These flexibilities are introduced and discussed below.

The ECL amendment results from a trilogue agreement reached on 10 December 2025 between the EP, the EUC, and the EU COM (Council of the European Union, 2025a). Starting point for the trilogue negotiations were the EU COM's legislative proposal of 2 July 2025 along with a Communication and Impact Assessment of 6 February 2024 (European Commission, 2024a, 2024b, 2025c). On the basis of the EU COM proposal, the EUC adopted a compromise text on 5 November 2025 that introduced several changes to the flexibilities to help meet the climate target (Council of the European Union, 2025b). This process was followed by a plenary vote in the EP on 13 November 2025, which largely aligned with the key elements of the EUC's position (European Parliament, 2025). Both EP and the EUC supported the 90% net emissions reduction target by 2040 in general, however with new and stronger flexibilities compared to those originally proposed by the EU COM.

The **main flexibilities stipulated in the ECL amendment** are listed below. Of these, only the first, fifth (5.c), and seventh were also originally proposed by the EU COM.

1. Possibility of meeting up to 5% of the 2040 climate target through international credits (under Art. 6, Paris Agreement) starting in 2036, corresponding to a domestic reduction of net GHG emissions by up to 85% by 2040 (compared to 1990 levels). In addition, a pilot phase between 2031 and 2035 may be considered. This goes significantly beyond the EU COM's proposal, which envisaged up to 3% international credits for the year 2040 and explicitly recommended not using these credits for compliance in the EU carbon market. The ECL amendment leave key details, such as specifics on the pilot phase and the phase-in of credits, unclear.² Compared to the EU COM's proposal, the ECL amendment goes into more quality conditions of such credits, and asks the EU to consider stricter criteria than those laid down under Article 6.4 of the Paris Agreement.
2. Every five years, the **EU COM shall assess the need of Member States to use international credits of up to 5% towards their national post-2030 targets and efforts.** It remains unclear whether these quantities will be accepted in addition to the international credits mentioned above or as a subset thereof; furthermore, the delimitation of the national targets remains undefined.

² The ECL amendment doesn't address post-2040 provisions. However, because the ECL mandates that the 2050 target must be domestic, some studies assume that credit use could be extended until 2049 (see e.g. Graichen et al. (2025)).

3. Every five years, the **EU COM shall also propose measures and, if needed, an adjustment of the target if, for example, natural CO₂ sinks do not achieve their expected contribution to achieve the 2040 target.**³ The adjustment should correspond to the shortfalls in performance of natural sinks and remain within these limits.
4. **Every two years, the EU COM shall review the implementation of the 2040 target and decarbonization trajectories, and, if necessary, supplement them with legislative proposals.** The assessment should consider the most recent scientific information, technological developments, and the EU's international competitiveness.
5. EU ETS:
 - a. **The introduction of the new EU ETS 2 for fuels in the road transport, building and additional sectors is to be postponed by one year, from 2027 to 2028.**
 - b. The EU COM should consider a **slower phase-out of the free allowances in EU ETS 1 from 2028 onwards.**
 - c. **The integration of permanent domestic carbon removals in the EU ETS to compensate residual hard-to-abate emissions.** The adopted text does not provide further details on the permitted amounts nor the definition of hard-to-abate emissions.
6. **Low-carbon, zero-carbon and renewable fuels are to continue to be permitted in the transport sector beyond 2030.** This applies in particular to biofuels and represents a response to the debate on the planned phase-out of combustion engines.
7. **Increased flexibilities within and across sectors and instruments** to support a simple and cost-effective target achievement. While achievements in one sector can help close gaps in other sectors, gaps in one sector should not come at the expense of other sectors. The ECL amendment does not include more details on this flexibility.

3.2.1 Brief assessment of the ECL amendment

The inclusion of international credits could effectively reduce the EUs domestic climate target to a net emissions reduction of 85% by 2040 (compared to 1990 levels). Under this scenario, EU net emissions in 2040 could be up to 50% higher than they would be without the use of such credits (Graichen, Gores, et al., 2025). However, the effective reduction could be even lower depending on how the flexibilities are implemented. If international credits allocated to Member States are considered additional to those used to meet the 2040 target and if the target is further adjusted downwards (see flexibilities 2 and 3 above), the overall level of ambition in 2040 would decrease accordingly. **Moreover, the total volume of international credits over time remains undefined.** This is because the ECL amendment does not clarify how the relative usage quotas mentioned in flexibility 1 and 2 are converted into absolute quantities. This lack of clarity creates significant uncertainty regarding the overall impact. Under a worst-case scenario, the 5% limit on international credits in 2040 could be supplemented by separate quotas, for example for the period 2036–2039 and possibly for the period 2041–2049, although the use of credits post 2040 remains undefined in the ECL amendment. Such an approach would substantially increase the cumulative number of credits available (see scenario analysis in Graichen, Gores, et al. (2025)). As result, in 2040 the EU could have 50% or more additional net emissions in 2040 than it would have had without these credits.

With an EU climate target that would allow the use of international credits as outlined above, the ambition in the ECL amendment could lie significantly below the German Environment Agency's (UBA) recommendation of a net domestic emissions reduction of 95% and that of the European Scientific Advisory Board on Climate Change (the Advisory

³ The five-year interval is implied by an amendment to Article 11 of the ECL.

Board) of 90%-95% (European Scientific Advisory Board on Climate Change, 2023; Lanz et al., 2023). The latter corresponds to an EU GHG budget of 11-14 Gt CO_{2e} for the 2030-2050 period. These targets seek to limit global warming to 1.5 degrees Celsius with or without limited overshoot and consider criteria of technological feasibility, environmental risks, cost-efficiency and fairness. Regarding the latter, the Advisory Board notes that even the most ambitious EU emissions trajectories would exceed the EU's fair share of the global carbon budget in 2030–2050 under different equity principles. As a result, it urges the EU to adopt the most ambitious reduction and removal targets, support mitigation in other countries, and aim for net negative emissions after 2050. Importantly, the global remaining carbon budget used for deriving these recommendations has recently been revised downward (Forster et al., 2025), further shrinking the corresponding EU's fair share and increasing the need of a more ambitious target.

The use of international credits (Art. 6, Paris Agreement) for achieving the EU climate target contradicts the recommendations of the UBA and the Advisory Board (European Scientific Advisory Board on Climate Change, 2025b; Umweltbundesamt, 2018).

International cooperation mechanisms should exclusively be used to increase global climate ambition (see section 4.7.3) The risks associated with these credits and the potentially high costs of high-quality credits make them unsuitable for replacing domestic emissions reductions. Additionally, relying on these credits would create new dependencies and limit resources required for investments in European climate protection. The availability of international credits may also encourage short-term offsets over long-term structural changes, such as deep decarbonization of industry and transport. Importantly, international credits should not be used for EU's compliance mechanisms, such as the EU ETS and the ESR.

The “review”-clause (flexibilities 2 to 4) undermine stakeholders' ability to plan effectively and are not an appropriate solution for addressing the potential shortfall in natural removals or the failure of Member States to meet their individual targets. The possibility of reducing the 2040 target due to mitigation deficits in individual sectors and Member States would be de facto a "license to miss the target". The clause directly discourages the development and adoption of robust measures to achieve the objectives, for example in the case of natural disturbances, and their compliance (see sections 4.2.2 and 4.3.3). Moreover, the clause represents a significant paradigm shift in the spirit of the climate protection law. Up to now, the review processes have been designed to examine and implement options for tightening the target. This is now reversed, as reviewing a necessary relaxation of the target would henceforth be the basis of the EU COM's work.

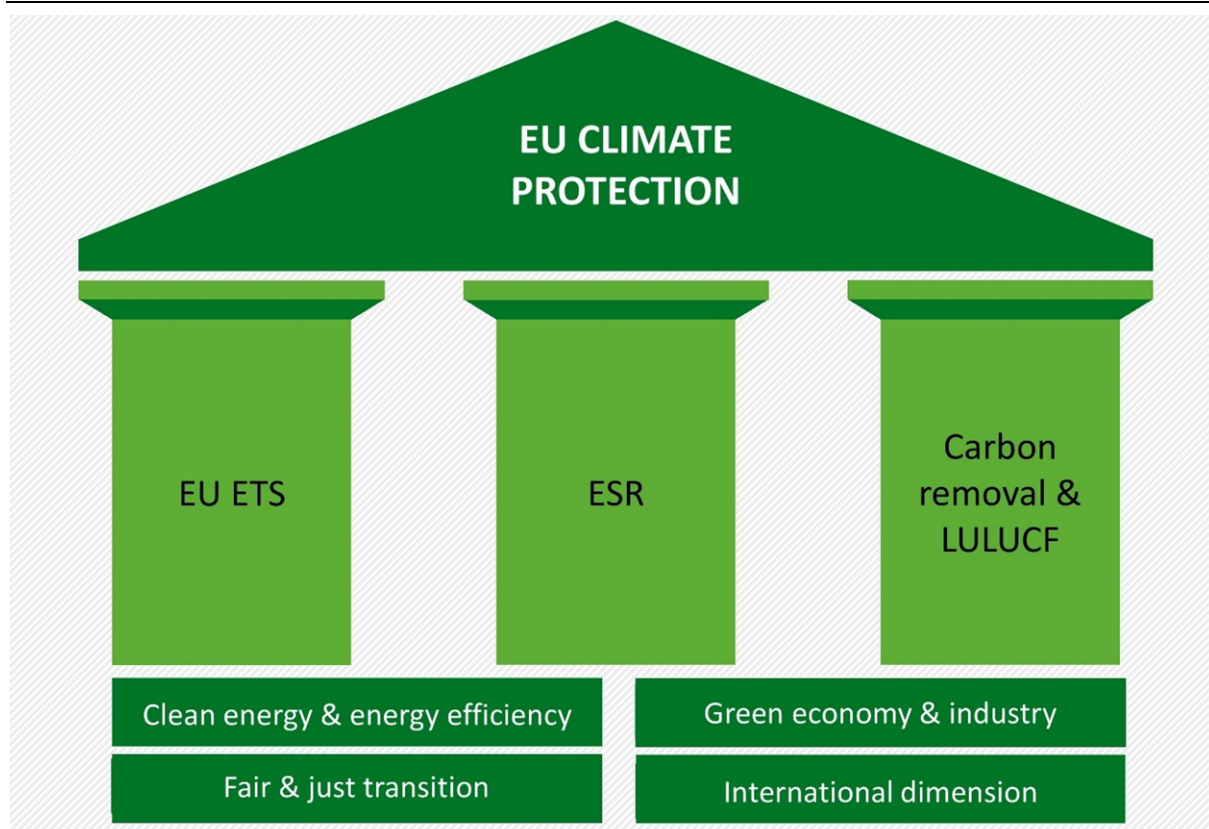
The planned adjustments to the EU ETS and the suggested integration of domestic technical CDR pose significant risks. Postponing EU ETS 2 risks undermining ESR-sector targets (see section 4.2.3) and, given uncertain political will in Member States, may not be used to strengthen building and transport measures or social support - both needed to offset price pressure. This creates a significant political risk of a further postponement of the EU ETS 2 beyond 2028. Slower phasing out of free allocations in EU ETS 1 could weaken incentives for decarbonization in the covered sectors and reduce revenues that could aid industry decarbonization (e.g., via the Innovation Fund). Integrating domestic technical carbon removals into the EU ETS, as recommended by the Advisory Board (2025a), could raise demand for removals and help offset unavoidable residual emissions but brings several risks, including mitigation deterrence and environmental integrity (see section 4.1.4). Although these risks depend on the design of the carbon removal integration (e.g., through limits), the available information does not yet allow for a robust assessment of the advantages and disadvantages of such integration – this is in particular the case for a direct integration of CDR without an intermediary. This proposal should also be compared to other alternatives.

The ECL amendment also leaves essential components of the climate target unspecified. In particular, it does not contain any concrete targets for gross emissions, natural and technical sinks, as also recommended by the UBA and the Advisory Board (European Scientific Advisory Board on Climate Change, 2025b; Lanz et al., 2023). This is remarkable, especially given the increasing importance of carbon removals after 2030. They are essential to compensate residual emissions and allow net negativity after 2050. **By not specifying different targets, the revised climate act leaves de facto the balance between emissions reductions and negative emissions open. This complicates ensuring the prioritization of emissions reductions, impairs the necessary incentives for emissions reductions and the generation of negative emissions,** and reduces planning certainty for stakeholders. Furthermore, it complicates the prioritization of natural over technical sinks, as recommended by UBA (Lanz et al., 2023). The concrete design of the ESR as a key pillar of the climate architecture is not sufficiently reflected in the ECL amendment.

3.3 Shaping the post 2030 EU's climate protection architecture

The 2040 climate target, along with any associated flexibilities, sets the foundation for the EU's climate ambition and directly shapes the revision of its climate protection policies. The EU COM is expected to kick-start this revision process in the coming months by presenting a series of legislative proposals to implement the new ambition. **These policies must ensure that the EU meets its 2040 target efficiently and in an environmentally responsible way,** while carefully addressing potential negative impacts on vulnerable households and companies, sectors and regions. Besides a strong fairness foundation, these policies must also support global climate efforts as well include robust strategies to track progress and ensure accountability.

Figure 1: EU Climate Protection Architecture



Source: own illustration, German Environment Agency

Moreover, the new policy framework must extend beyond short-term goals to **establish a strategic foundation for deep decarbonization and the transition to a net negative economy**. As the critical intermediate milestone on the path to climate neutrality by 2050 - and the subsequent shift to net negative emissions - the EU cannot afford mistakes in achieving its 2040 target, as these could severely jeopardize future objectives without a clear option for correction through an additional intermediate target. **To meet these challenges, the EU needs to strengthen its existing climate policy framework.**

The new EU's climate protection architecture requires deciding which policies will remain in place until 2040, which need to be adapted and if there is requirement for new elements, as well as how they will interact and contribute towards the climate targets.

This includes identifying which sectors will be covered or supported by each policy and how the overall climate goals (including emissions reduction and removals) will be achieved across these policies. Targets of each policy should to reflect the new ambition, ensuring that they are aligned with the overarching climate objectives.

To do this, it is essential to first clearly define specific targets for gross emissions reductions and different removal types, in addition to the overall net emissions reduction target (see section 3.2). Additionally, the EU will need to make key decisions, such as extending the ESR beyond 2030, expanding the EU ETS to additional sectors or merging the EU ETS 1 and 2, keeping certain sectors covered by multiple policies (e.g. ESR and EU ETS), or implementing robust measures to avoid adverse impacts on low-income households. The decision on an updated EU climate protection architecture should be based on prior analyses that generate information on the advantages and disadvantages of different distributions, considering the potential economic, social, and environmental effects of this transition, as well as its feasibility. Importantly, these evaluations should consider some key aspects, which are explored in detail throughout this paper.

For designing the new EU's climate protection architecture, the EU COM must consider the performance of current climate policies as well as the challenges they face after 2030. The EU ETS, for example, is a key instrument and element of the EU climate architecture that ensures efficient emissions reductions in the sectors covered and generates significant revenues. Its functionality, however, could be affected during its fifth phase due to the decline in market size, which could lead to inefficient and volatile prices (see section 4.1.3). The ESR is important to achieve emissions reductions in sectors where carbon prices are less efficient or where there are strategic reasons for implementing national policies. However, with currently implemented policies and measures, the aggregated ESR target will be missed in 2030 (in the WEM scenario, see section 4.2.1). Another key field of action is the RED, which sets binding targets for the share of renewable energy in the EU's overall energy mix. The RED has played a significant role in scaling up renewables, particularly in the power sector. However, challenges remain in sectors like heating, cooling, and transport, where the uptake of renewables has been slower and more uneven across Member States.

The EU COM must also evaluate the need of adding additional policies and measures to complement and enhance the actual climate policy framework. An important area where additional measures are needed is the social dimension. Since climate policies could have negative effects on vulnerable groups, it is essential to implement adequate measures to minimize or even fully compensate potential burdens (see section 4.6). Such interventions will be key to the social acceptance of future climate policy. New measures must be designed efficiently, avoiding unnecessary administrative burden and making use of existing structures and information wherever possible.

Besides this, the updated climate architecture must strengthen the carbon sink strategy due to its growing importance for meeting the climate objectives. This strategy is currently based on the LULUCF regulation, which regulates natural sinks at the Member State level. In addition to emissions reduction and natural sinks, which should be prioritized, achieving the EU climate objectives might also require the contribution of technical carbon sinks. The availability of technical sinks, however, is currently very low, and their development faces several challenges, including the high costs of technologies and the lack of infrastructure. Because of this, the EU COM should develop a robust carbon sink strategy. Importantly, there must be safeguards to ensure that efforts for technical sinks do not undermine emissions reduction and natural removal objectives (see section 4.3).

The EU COM will also need to ensure that the updated EU climate policies are coherent, coordinated, and capable of aligning national and EU-level actions. To this end, the EU COM will need to identify possible interactions between policies and carefully consider their potential consequences. Some of these important interactions that could become (more) relevant in the future include the interaction between the EU ETS 2 and the ESR due to their simultaneous coverage of certain sectors, the interaction between the LULUCF regulation with other policies that promote demand for biomass as feedstock (e.g. policies fostering the upscale of technical sinks or RED), or the interaction between ESR and national policies.

The EU COM should explore strategies to integrate carbon removals into the other climate architecture pillars, with transparent accounting and safeguards to ensure environmental integrity and that emissions mitigation incentives are not reduced.

The EU COM should also assess the performance of existing flexibilities within and across policies, updating them if necessary, and evaluate the need of additional flexibilities.

While some flexibilities already exist, others are still open to consideration. One example is the possible (partly) merger of EU ETS 1 and EU ETS 2 (see section 4.1.6) after 2030. Importantly, while these flexibilities can help achieve the EU climate targets more efficiently, they also entail several risks. Among them, a significant risk relates to the possibility that flexibilities lead some sectors or Member States to slow down or delay their emissions reduction actions, thus jeopardizing the achievement of the EU reduction targets. The advantages and disadvantages of the different flexibility mechanisms should be analysed from the perspective of the EU's new political framework and its objectives.

To provide a coherent ground for aligning the new climate policy framework, the EU COM must consider the achievements of decarbonization of the sectors and the specific challenges they face for future decarbonization efforts. In particular, the EU COM should consider key dimensions of the sectors, including their current degree of decarbonization, their future decarbonization potential, mitigation costs, and technological readiness. Here, there are currently significant differences between sectors, which, however, could change in the future. For example, while the decarbonization of the energy sector is well advanced, the decarbonization of other sectors, such as transportation and construction, still has significant ground to cover. Regarding the reduction potential, there are currently several sectors where residual emissions are projected, implying that their complete decarbonization will be a challenge. Naturally, the EU COM will also have to consider additional aspects, such as the importance of decarbonizing certain sectors due to their contribution to the decarbonization of other sectors.

Finally, the definition and quantification of residual emissions are crucial for setting climate targets and shaping the EU's future climate protection architecture. They directly affect both the volume of negative emissions needed to achieve climate neutrality and the

level of emissions mitigation. Given the risks associated with large-scale deployment of negative emissions, there is broad consensus on minimizing residual emissions as far as possible. To support this, UBA recommends using the term "unavoidable residual emissions" based on the principles of technological, sustainable and social unavoidability of emissions (Umweltbundesamt, 2026). Unavoidable residual emissions refer to those that persist after all sustainable and available mitigation options have been exhausted. This level can be further reduced through a continuous process of democratic consensus-building that defines what is socially legitimate in the face of climate change. For example, just because a manufacturing process involving GHGs is generally technologically unavoidable does not mean that current production volumes are unavoidable. The benchmark must be the preservation of essential social functions, not the status quo. Technological and social unavoidability must also be clearly distinguished from economic "unavoidability" or declining profitability. High mitigation costs alone do not make emissions truly unavoidable, rather they may indicate the need for innovation or shifts in production or consumption patterns.

4 Building blocks of the EU's climate protection architecture

4.1 Driving climate ambition: futureproofing the EU ETS

Since its introduction in 2005, the EU ETS (Directive 2003/87/EC, 2003) has been a cornerstone of EU climate policy and the main tool for achieving climate targets cost-effectively. Based on a cap-and-trade approach, it gradually lowers the emissions cap while allowing trading and banking of allowances. The system also generates significant revenues that support national initiatives and EU-level funds like the Innovation Fund, Modernization Fund, and Social Climate Fund, making it a key financial pillar of the EU's decarbonization strategy. After 2030, the EU ETS will enter its fifth trading phase. Reforms are necessary under the 2026 review (Art. 30, 2003/87/EC) to align the system with the updated climate target.

4.1.1 Set an ambitious cap until 2040 to maintain strong emissions reductions

A first step is to **align current level of ambition of the EU ETS with the new 2040 climate target**. In this context, the different reduction potentials of the sectors included in EU ETS 1 and 2 must be considered. The 90% climate target in the EU COM's Impact Assessment (European Commission, 2024a) assumes higher gross emissions in EU ETS 1 and 2 by 2040 as implied by the current EU ETS directive (2003/87/EC). The current directive sets the cap path via the Linear Reduction Factor (LRF), according to which the cap will fall near zero by 2039 in the EU ETS 1 and by 2044 in the EU ETS 2 (Graichen & Ludig, 2024; Graichen, Skribbe, et al., 2025).⁴ Therefore, aligning the EU ETS ambition with the new 2040 climate target will in the first place require adjusting the LRF accordingly.

Importantly, the cap trajectory for the fifth trading period should be as ambitious as possible to maintain strong incentives for emissions reductions while balancing feasibility considerations. Any deviation from the current cap trajectory must be carefully planned, considering its potential overall impact on achieving the 2040 target. A new cap will not only directly affect emissions reduction incentives in regulated sectors, but also influence the likelihood of effectively cutting emissions in sectors outside the EU ETS. Additionally, as envisaged by the current LRF, the cap should follow a fixed (i.e. not adjusted once its new trajectory is agreed), and efficient path to strengthen the system's credibility and support long-term planning by regulated entities and achieve the 2040 climate target.

4.1.2 Strengthen the CO₂ price signal in line with social and competitiveness considerations

A strong and credible carbon price signal, which allows market participants to anticipate higher future carbon prices, is essential to incentivize the necessary economic and society-wide transformation that enables strong emissions reductions. By accounting for the environmental impact of carbon emissions, strong carbon prices set an incentive for companies and consumers to shift toward cleaner technologies and more sustainable behaviours.

This principle is reflected in the design of the EU ETS 1, where the price of emission allowances (EUAs) is set to rise due to the increasing scarcity of EUAs and the gradual

⁴ Using an annual linear reduction factor (LRF) of 4.3% between 2024 and 2027, and by 4.4% from 2028 onwards.

phase-out of free allocation of EUAs, primarily in the industrial sector. Naturally, the price increases will also depend on other factors, notably the demand for EUAs. This is driven inter alia by the evolution of total production output, the emission intensity of production, which itself is driven by fuel switching and adoption of low-emission technologies, and market design including market stabilization mechanisms. However, as carbon prices rise, it is important to keep social and competitiveness (carbon leakage) considerations in mind. Striking the right balance ensures that the transition remains fair and that actors can adapt without undue hardship.

Social considerations will be of particular importance to guarantee the success of the upcoming EU ETS 2. This is because this new system, primarily covering the road transport and buildings sectors, will put direct financial pressure on private households.

Experts are forecasting prices in the EU ETS 2 above €100/t CO₂ in the 2030s (Pahle, Günther, et al., 2025).⁵ This leads to an increase in fuel prices, particularly in EU Member States without national carbon pricing schemes. As low-income households are more affected by these price increases in relative terms, the financial pressure can lead to social imbalances. Therefore, for the EU ETS 2 to be socially just, it is crucial that its **revenues are used to a great extent to support vulnerable households and small-enterprises to participate in the transition.** These groups could be particularly affected by higher CO₂ prices, as mandated by the ETS-Directive (see section 4.6).

Ensuring the international competitiveness of EU ETS 1 sectors is also indispensable as the EU raises its climate ambitions. Generally, as a market-based climate instrument, the EU ETS 1 entails a number of benefits for the regulated sectors, including driving innovation, reducing costs of emissions reductions, improving productivity, and opening new business opportunities. Nevertheless, rising CO₂ prices in the EU ETS 1 could also reduce the competitiveness of EU companies due to higher carbon costs compared to other regions, posing challenges that need to be addressed alongside these opportunities.

Therefore, an effective protection against carbon leakage needs to be in place, when a shrinking cap can no longer provide sufficient free allocation. To achieve this and strengthen the CO₂ price signal, the EU CBAM will gradually replace free allocation in the EU ETS 1. Starting with its definitive period in 2026, the EU CBAM ensures that imports of certain emission-intensive products⁶ from third countries will bear the same carbon cost as goods produced under the EU ETS 1. **Importantly, the EU COM should periodically evaluate the effectiveness of the EU CBAM in reducing carbon leakage.** While some adjustments are already agreed upon such as major simplifications in the Omnibus I Regulation in 2025⁷, others are under discussion, such as the extension to downstream products and a solution to prevent export leakage.⁸ Further reforms after 2030 may expand sector coverage and consider CO₂ cost compensation programs in Member States. The EU COM should simultaneously also develop and

⁵ In November 2025, the EU COM suggested adjustments to the MSR-Decision with regards to the EU ETS 2 in order to dampen price pressure by auctioning additional allowances which are not covered by EU climate targets (https://climate.ec.europa.eu/news-other-reads/news/commission-proposes-targeted-adjustments-market-stability-reserve-decision-support-smoother-start-2025-11-27_en).

⁶ Iron and steel, aluminium, fertilisers, cement, electricity and hydrogen.

⁷ The proposal of February 2025 can be found here: https://commission.europa.eu/publications/omnibus-i_en (Accessed 21 August 2025)

⁸ „On 17 December 2025, the EU COM published its so-called December package which contains proposal to extend the EU CBAM to certain downstream products which contain steel and aluminium as well as a proposal for a temporary decarbonization fund, which aims to reduce the risk of carbon leakage from EU products in third markets. The EU COM's press release on this can be found here: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_3088„

implement efficient and effective mechanisms to prevent carbon leakage in sectors that cannot be covered by the EU CBAM for any reasons.

To improve the competitiveness of regulated entities it is also essential to **assist firms in switching to zero- or low emissions processes and to incentivise “front-runners” for their central role services in innovation processes. For this, in many cases public support policies are vital complementing policies for the EU ETS 1.** Major examples are the EU Innovation Funds (IF), and the so-called carbon contracts for differences (“CO₂-Differenzverträge” in Germany), which are financed from proceeds of the EU ETS 1 auctions and cover a major portion of the overall additional costs of new technologies.⁹ This includes environmentally friendly substitutes to conventional products as well as approaches for circularity and material efficiency/product longevity. Importantly, the EU COM should assess strategies to ensure that a broad share of regulated entities can benefit from these support measures without compromising the efficient use of public funds.

4.1.3 Ensure an efficient carbon price trajectory as the market size gets reduced

The sharp emission reductions required to bring covered sectors close to GHG-neutrality will lead to an increasingly smaller carbon market – potentially becoming markedly smaller in the late 2030s - as the cap is progressively reduced. **This smaller carbon market could be increasingly hampered in guaranteeing essential market functions and, consequently, reduced ability to serve as an efficient trading tool and (investment) price signal, for example, due to potential price instability.** A smaller market could, for example, increase transaction costs for active market participation and affect market liquidity, thereby increasing uncertainty about firms’ ability to sell or buy EUAs, and potentially also increase the risk of market power misuse.

As this phenomenon, known as the ETS “endgame” (Pahle, Quemin, et al., 2025), still lies relatively far in the future, its effects are difficult to anticipate and will depend on the future development of supply and demand of EUAs. These dynamics may be affected by several factors, such as future abatement options and costs, the behaviour of market participants, which may for example engage in stronger hedging behaviour in anticipation of shortages, future structural changes in the EU ETS (like the inclusion of new sectors or integration with other systems), or the design of the Market Stability Reserve (MSR), which adjusts the number of EUAs in circulation according to predefined parameters. Existing studies on these effects are scarce and highly assumption-dependent, and their findings therefore cannot be regarded as conclusive. As a result, a broader body of research is required to robustly assess the magnitude and timing of these impacts.

For this very advanced stage before reaching climate neutrality but also for the period beyond that point (net negative), the interaction between market-based and regulatory instruments must be carefully analysed and weighed up. Due to the high level of complexity and the considerable uncertainties that currently remain, the possible further development of the EU ETS for the “endgame” and its role in the mix of instruments should be accompanied by a review process, which should be planned for the first half of the 2030s.

The future EU ETS price formation should remain efficient, stable and predictable to incentivise investments for the period of transformation and behavioural shift. To avoid the above-mentioned risks following from the ETS “endgame” and to ensure efficient carbon price trajectories, it is important to anticipate these effects and implement robust measures to

⁹ <https://www.klimaschutzvertraege.info/en/home>

reduce them. In particular, the EU COM should use the 2026 review (Art. 30, Directive 2003/87/EC) to identify potential adverse “endgame effects” and propose strategies to overcome them. These may include adjustments to the MSR, the limited integration of negative emissions in the EU ETS (see section 4.1.4), as well as linking with other systems, including between EU ETS 1 and 2 and with other countries’ systems (see section 4.1.5). **Importantly, while strategies that temporarily expand the market may be beneficial, provided they are in line with the new EU ETS target, it is equally important to develop robust approaches to address the challenges associated with a significantly reduced market size in the longer term.** This remains a gap in current research. One way to address it is to assess the conditions under which a structurally small carbon market can function efficiently (e.g. the stabilization instruments required), and compare this with alternative carbon market designs, including a potential transition beyond climate neutrality through a net negative cap (Lessmann et al., 2026; Rickels et al., 2021).

The EU COM should ensure that the (effective) cap of the EU ETS is not diluted by the injection of additional EUAs into the market, such as EUAs not sourced from an established reserve (e.g., previously withheld EUAs) or not backed by verified negative emissions. Doing so could generate greater liquidity and lower prices, but would entail several risks, including jeopardizing the achievement of the climate targets, imposing higher pressure in subsequent years, reducing predictability, and reducing mitigation incentives. Hence, for any future adjustment of the EU ETS (e.g. an MSR reform), it is crucial that the integrity of the cap is maintained to safeguard the EU climate targets.

4.1.4 Recognize the existence of unavoidable residual emissions and find a suitable strategy to compensate them

The future EU ETS will need to drive substantial emissions reductions across covered sectors, bringing them close to, or even achieving, GHG neutrality. **As some sectors are likely to have unavoidable residual emissions, achieving climate neutrality will require a system that recognizes these emissions and prepares mechanisms to offset them through negative emissions (Carbon Dioxide Removal - CDR).** Doing this, however, presents several challenges. A first one is **the lack of a clear, shared definition of what constitutes unavoidable emissions within the EU ETS and how to operationalize it** (see UBA definition in section 3.3). Determining which emissions are truly residual can be a complex task requiring extensive information, such as sector-specific benchmarks, consideration of evolving technologies, and regular review. Without a transparent and science-based framework, however, there is a risk of inaccurately estimating residual emissions and undermining climate ambition. This uncertainty could also complicate the future design of the EU ETS, for example the setting of the cap and market stabilization mechanisms.

Several strategies exist to compensate unavoidable residual emissions in the EU ETS and thereby enable climate neutrality. One option is the gradual and limited integration of permanent domestic negative emissions in the EU ETS. As envisaged in the ECL amendment, this approach aligns with the Scientific Advisory Board’s recommendation (European Scientific Advisory Board on Climate Change, 2025a) and is scheduled for evaluation by the EU COM in 2026 (Art. 30, Directive 2003/87/EC). **Before implementation, the EU COM should perform careful analysis of implementation options and their opportunities and risks.** For example, while integrating CDR in the EU ETS could ameliorate the potential negative effects implied by a small carbon market (section 4.1.3) and support CDR development (see section 4.3), it could undermine environmental integrity, weaken incentives for actual emissions reductions and lead to market distortions in the field of negative emissions markets, e.g. by favoring low-cost, lower-

integrity removals, and misaligning deployment with long-term climate targets. **To prevent this, binding qualitative and quantitative limits are essential and must align with the cap to ensure priority remains on reducing avoidable emissions. The EU COM should also assess the possibility of establishing an intermediary institution regulating supply and demand of CDR, especially in view of the uncertainties regarding residual emissions and CDR availability.** How to implement this principle still requires careful analysis of implementation options and their trade-offs.

When analysing the introduction of negative emissions in the EU ETS, the EU COM should carefully consider their interactions with strategies for biomass and carbon capture and storage (CCS). Currently, (certified sustainable) biomass and CCS are allowed in the EU ETS without quantitative limits as mitigation strategies and are regarded as critical components of sectoral decarbonization pathways in various scenarios, including the EU COM's Impact Assessment (European Commission, 2024a). However, biomass and CCS are also core inputs for certain CDR technologies, particularly BECCS (bioenergy with CCS), which plays a prominent role in the EU COM's proposal and ECL amendment, due to, e.g., its relatively higher permanence compared to natural CDR (see section 4.3) and comparatively lower cost compared to direct air CCS (DACCS). Given the limited long-term availability of sustainable biomass and suitable CO₂ storage sites, this setup can imply different risks, including conflicts between emissions reduction and carbon removal goals, distorted incentives, and reduced system efficiency. To prevent this, the EU COM should explore strategies to prioritize and coordinate the efficient use of biomass and CCS, such as sustainability criteria, caps, or differentiated accounting (see section 4.3). Moreover, the strategies must be aligned with other EU climate policies to ensure consistency, avoid overlaps, and safeguard the overall integrity of the climate framework.

4.1.5 Foster efficiency through additional flexibilities and policy mix

Future adjustments of the EU ETS should aim to guarantee and further increase efficiency in attaining European climate targets. One possible strategy is **a full or partial merger of EU ETS 1 and EU ETS 2** during the 2030s (Art. 30, Directive 2003/87/EC). Despite being complex to operationalize due to the different points of regulation of the two systems (EU ETS 2 up-stream vs. EU ETS 1 down-stream), such a merger would create a larger emissions allowance market, enhancing efficiency by enabling more flexible and cost-effective emissions reductions. Current differences in price expectations between the two systems reflect market inefficiencies, with one having access to cheaper abatement options than the other. **However, when assessing this potential linking, the EU COM should find strategies to limit delaying necessary emissions reductions in buying sectors.** Moreover, the EU COM should consider that an effective integration strategy may require first practical experience with the EU ETS 2.

Further relevant strategies **to increase the efficiency of the EU ETS and EU climate policy include coordinating and linking the EU ETS with other carbon pricing systems in other jurisdictions and adding additional sectors to the EU ETS.** In fact, current efforts to establish links between the EU and the UK are gaining momentum. Following a negotiating mandate from the EU Council in November 2025, both parties entered official talks in January 2026. While the associated benefits are substantial, linking also poses challenges, as it requires close alignment of core design features, legal frameworks, and climate ambition in order to function effectively and equitably. The coverage of additional sectors should in particular include the extension of the EU ETS 2 to all fuels not priced by the EU ETS 1 – in particular from transport and agriculture. Importantly, these decisions should be analysed and designed in a comprehensive manner, ensuring that the advantages of its implementation outweigh its disadvantages. Key considerations include social justice, environmental side effects, administrative feasibility, and

the potential to drive innovation and infrastructure investment. Attention should also be paid to carbon leakage risks, public acceptance, and the strategic use of revenues to support vulnerable groups and accelerate the green transition.

Importantly, international carbon credits under Article 6 of the Paris Agreement should not be allowed under the EU ETS given the significant risks associated with their inclusion (see Section 4.7.3).

Finally, it is important to note that while the EU ETS price signal plays a key role in driving economic transformation, additional policies that incentivize emissions reductions are essential for the successful transformation of Europe and its economy (see e.g. [Dimanchev and Knittel \(2023\)](#)). **Higher CO₂ prices combined with the broader climate policy instrument mix, such as specific subsidy programmes, standards and regulations, as well as demand-side policies such as clean lead markets, create strong incentives for investing in and switching to climate-neutral technologies.** An example can be found in the rapid growth of renewable energy in the EU. Complementary policies helped reduce costs and scale up technologies, showing how a strong policy mix is essential for enabling low-carbon transitions. **Complementary policies are essential to provide investment certainty and address market failures such as technology lock-in, infrastructure gaps, and knowledge spillovers, which carbon pricing alone cannot resolve.** Therefore, it will be important to use a relevant portion of the auction revenues for complementing the EU ETS's price and financing effects for novel technologies with explicit funding instruments.

4.2 Taking responsibility: Strengthening the ESR

The EU ETS and the LULUCF regulation aside, the ESR (Regulation (EU) 2018/842, 2018) is the third core element of the EU climate protection architecture, currently covering the emissions outside the EU ETS 1 scope. Under the current rules, the ESR will expire at the end of 2030. For this reason, the EU COM needs to ensure that the indispensable emissions reduction efforts by the EU Member States will continue.

4.2.1 Ensure reduction targets towards 2030

Under the ESR, every Member State carries a legally binding GHG reduction trajectory for the non-ETS 1 sectors, depending on each MS's economic strength. Collectively these trajectories must deliver a 40% cut by 2030, compared with 2005. On the way to that shared goal, the annual emissions ceilings (Annual Emissions Allocations, AEAs) become more stringent each year from 2021 until they reach the -40% level in 2030. The sum of all annual AEAs constitutes the cumulative EU emissions budget for 2021–2030 in the ESR sectors, amounting to about 19 Gt CO₂-eq.

In 2025, the EU-wide “*with existing measures*” (WEM) projections (European Commission, 2024d; European Environment Agency, 2025b, 2025c; Transport & Environment, 2024) show that with currently implemented policies and measures the ESR target will be missed and the emissions are expected to fall by only 31% instead of the required 40% by 2030. Especially in transport and agriculture, emissions reductions were only marginally. The cumulative gap amounts to around 500 Mt CO₂-eq.

Including “*additional measures*” (WAM) planned in updated NECPs lifts the projected reduction to around 38% in 2030 (European Environment Agency, 2025c). This corresponds to a slight overachievement by approximately 100 Mt CO₂-eq. However, this assumes that every planned policy is adopted on time and delivers in full - an assumption that appears overly optimistic. Germany's latest projection report (2025) illustrates this risk: even **after** accounting for its

planned measures, Germany alone would accumulate an ESR gap of **around 200 Mt CO₂-eq.** over 2021-2030 (Förster et al., 2025). This example suggests that the aggregate EU shortfall could likely remain substantial.

In principle, targets under the ESR constitute legally binding commitments for the MS, which they are responsible to fulfil. However, it has to be underlined, that the ESR lacks effective enforcement tools to ensure Member States meet these emission reduction targets. The ESR relies primarily on soft options¹⁰, multiplication factors¹¹, and public pressure rather than clear penalties or sanctions. Furthermore, a “corrective action plans”, under article 8 of the ESR regulation (Regulation (EU) 2018/842), which requires Member States to present the EU COM with mechanisms to reduce the GHG emissions in the ESR sectors. However, if the Member State corrective action fails to meet the EU COM requirements, the ESR regulation does not provide the EU COM with the power to force Member States to improve their plans. Although the EU COM could launch an infringement procedure against a non-compliant MS, the outcome and deterrent effect of such litigation are still unpredictable. Without clear, deterrent-scale repercussions enshrined in secondary legislation, the mechanism remains fundamentally weak. The EU COM will therefore have to assess the implementation of effective enforcement measures that ensure that the reduction targets are met.

4.2.2 Incentivize and support Member States’ compliance

The ESR compliance review starts in 2028 for the period 2021-2025 and in 2033 for period 2026-2030. The EU simultaneously assesses performance under both the ESR and the LULUCF Regulations (Regulations (EU) 2018/841 and 2018/842). This timing is far too late to stimulate forward-looking policymaking in the MS; therefore, **a projection-based, timely and in general strengthened corrective action mechanism becomes all the more important.**

In the first compliance period (2021-2025), Member States who didn’t meet their own targets, will have the opportunity to buy a lot of potentially inexpensive AEAs bilaterally from other MS. To ensure that this process is more transparent and effective, early, transparent price signals are essential. These signals would enable governments and other stakeholders to monitor national progress, plan cost-effective abatement measures, and apply timely peer pressure on Member States falling behind their targets. To achieve this, the EU should consider establishing a transparent trading platform for AEAs for the post-2030 period, supported by harmonized reporting, a central registry, and public disclosure of bid-ask spreads and executed trades. This would transform today’s bilateral, non-transparent transactions into a liquid market, lower transaction costs, and, importantly, anchor climate ambition in a credible, visible price for all.

The ESR includes additional flexibilities Member States can utilize to achieve ESR compliance, in case they miss their individual ESR target. These include flexibilities between the ETS and the ESR¹² and the LULUCF and the ESR¹³. As stated in the ECL amendment, cross-sectoral flexibilities need to be enhanced to achieve targets in a cost-effective way. However, it leaves open how these new flexibilities between sectors will work. They could either extend the above-mentioned

¹⁰ From 2027, Member States who exceed their GHG emission limited, will be temporarily prohibited from transferring any part of its annual emission allocation to another Member State (Regulation (EU) 2018/842).

¹¹ From 2027, a mandatory penalty in case Member States exceed their annual GHG emission limit. Any excess emissions from the current year are multiplied by 1.08 and deducted from the country’s emission budget for the following year (Regulation (EU) 2018/842).

¹² The “ETS flexibility” allows nine Member States to cancel a limited number of ETS allowances in exchange for equivalent allocations under the ESR to meet their ESR targets.

¹³ Member States may use a specified credit quota from the LULUCF sector to comply with their national ESR targets.

mechanisms or introduce entirely new ones. The type and scope of these flexibilities may affect overall mitigation costs and incentives. **Crucially, they must not lead benefiting sectors into high-emissions path dependencies that could delay or jeopardize the EU's climate neutrality transition.**

4.2.3 Extend the ESR post-2030 and ensure efficient interaction with EU ETS 2

As pointed out above, it is currently unclear whether the Member States will reach the 2030 target of a 40% GHG emissions reduction. Nevertheless, the ESR is a crucial piece of legislation, as it puts a legal obligation on MS, addresses the principle of subsidiarity, by involving national, regional and local governments, and is an important driver of national legislation and supporting measures in general. It is therefore necessary to strengthen the ESR, address the above-mentioned flaws and safeguard its impact on European climate goals. With the introduction of the EU ETS for buildings, road transport and additional sectors (EU ETS 2), there will be an overlap of the scope. Although the agricultural sector will not be part of the EU ETS 2, from 2028 onwards Member States have the option to opt-in additional sectors, including fossil-fuel emissions from agriculture (Schrems et al., 2023). Some Member States, for example Sweden, will utilize this opt-in option in general (Delegated Decision (EU) 2025/318, 2025).

Like the EU ETS 1, the EU ETS 2 cap ensures emissions reductions at an overall EU level thanks to its binding emissions cap. The cap in the EU ETS 2 for 2030 is geared towards an overall emissions reduction of 43% compared to 2005 and is therefore slightly more ambitious than the overall reduction target of the ESR.¹⁴ The challenges for reaching comprehensive emissions reductions are particularly high in the building and transport sectors. The current political debate on price-dampening measures in EU ETS 2 ahead of its actual launch in 2028 essentially reflects the fact that climate policy in these two sectors has been too weak to date. The expectation of higher prices in EU ETS 2 is the result of high emissions reduction pressure due to not ambitious enough instruments and measures at the EU level, but especially at the Member State level.

Therefore, more instruments, effective measures and better governance mechanisms are essential in these sectors. Binding national ESR ceilings, complemented with effective enforcement mechanisms as outlined above, represent the most reliable safeguard to ensure that every Member State delivers its equitable share complemented by the EU ETS 2. It is therefore crucial that the ESR will be continued post-2030 in its current scope as a pillar for maintaining the EU's climate governance integrity and fairness.

From a national perspective, however, the combination of national targets in the ESR and an EU-wide target in EU ETS 2 also poses challenges. In the EU ETS 2, it is irrelevant how much reduction is achieved in which Member State, as long as the EU-wide cap is reached across Europe. For Member States with high ESR reduction commitments, significant shortfalls in targets may arise despite the EU ETS 2, while Member States with lower ESR commitments will be comparatively heavily burdened by the EU ETS 2 and will therefore reduce emissions much more than envisaged in the ESR. For the period after 2030, this challenge is likely to become more acute, particularly for those Member States that have been less ambitious to date: this is because the cap in EU ETS 2 will decrease linearly towards zero, which means that those Member States that have been relatively less burdened to date will have to make even greater efforts to reach carbon neutrality and to close the gap with those Member States that have already decarbonized to a greater extent. This, in turn, will place a particularly heavy burden on

¹⁴ In fact, the cap can be increased by additional allowances from the MSR, which makes it more difficult to achieve the ESR target.

the respective populations, which makes it crucial to implement targeted support measures in these countries (see section 4.6). **To respond to this challenge, the future design of the ESR and EU ETS 2 must balance flexibility and economic efficiency in achieving climate protection goals with criteria of fairness. This must be taken into account as a matter of urgency when setting national targets under the ESR, distributing auction revenues in the EU ETS 2, and designing the future Social Climate Fund.**

The ECL amendment only states that they will review Member States' climate targets, considering cost-efficiency and solidarity. Consequently, it remains unclear which sectors will continue to fall under national targets. Currently, all non-EU ETS 1 emissions are the responsibility of Member States under the ESR. With the introduction of the EU ETS 2, this may very well change. Consequently, the EU COM must present its position on this issue in a timely manner to ensure the continuation of the ESR.

In addition to this, reinforced compliance is needed, including automatic gap-closure adjustments and a strengthened corrective action mechanism; as well as a transparent, harmonised EU-wide monitoring, verification reporting (MRV) system and GHG projections to trigger corrective measures well before emerging gaps jeopardise the 2040 and 2050 climate objectives.

4.2.4 Enhance mechanisms to reduce GHG emissions in agriculture

Due to multiple reasons and the very specifics of the sector, it is very likely that only some fossil fuel emissions of the agricultural sector will be covered by the EU ETS 2 after 2030 – so far agriculture is not covered by the EU ETS 1 or 2. **It is therefore important that additional climate protection instruments are implemented in this sector and emissions are reduced in the long term.**

As long as agriculture is not part of an ETS, for which there is currently no distinct indication, it is thus important that existing support instruments, such as the European Common Agricultural Policy (CAP), are designed in such a way that they fully exploit their potential to reduce emissions by promoting climate-friendly farming practices. Studies, including those commissioned by UBA, show that there is still considerable untapped GHG reduction potential and room for improvement in the current CAP (Scheffler et al., 2022; Wiegmann et al., 2023). Promoting the rewetting of peat soils, more efficient use of nitrogen and a regional reduction in livestock numbers could contribute to a significantly more favourable climate balance in the agriculture and LULUCF sectors, as well as more effective use of available funds for climate protection.

Furthermore, the EU COM should consider introducing mandatory GHG pricing in agriculture (particularly nitrous oxide from fertilization and methane from livestock farming) considering potential trade-offs with other environmental goals like biodiversity and avoiding potential adverse effects such as carbon leakage. This could be modelled on the recently adopted Green Tripartite Agreement in Denmark (Eurofound, 2024). Another option would be mandatory climate standards (MCS) for large downstream entities, such as food retailers and processors, which would require them to prove emission reductions. To achieve this, they could in the future purchase certificates under the EU certification framework for permanent carbon removals, carbon farming, and carbon storage in products, known as the EU Carbon Removals and Carbon Farming Regulation (CRCF). The prerequisite are methodologies that ensure robust, transparent and sustainable certification of the activities under the CRCF. Future EU COM's assessments should carefully weigh the benefits and costs of these policy options.

4.3 Regarding CDR: Stringent and prudent inclusion of CDR in the EU post 2030 climate architecture

Reaching climate neutrality at the latest by 2050 and net negativity thereafter is the overarching objective of the ECL. Therefore, unavoidable residual emissions, those that persist after all sustainable and available mitigation options have been exhausted (see also section 3.3), need to be compensated by negative emissions through carbon dioxide removal (CDR).

CDR refers to the removal of carbon from the atmosphere and its subsequent durable storage in geological, terrestrial, marine, or other reservoirs (Intergovernmental Panel on Climate Change, 2022). It can be further divided into categories, where titles and classifications vary depending on the context. Prominent distinctions are made between conventional and novel CDR, terrestrial and marine CDR, natural or land-based and technical or industrial CDR or permanent and non-permanent.¹⁵ The classification of a method is intricate and often not clear-cut.

With regard to some natural land- and ocean-based CDR measures, the term nature-based-solutions defines “*actions to protect, conserve, restore, sustainably use, manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits*” (United Nations Environment Assembly, 2022). While sustainable CDR measures with biodiversity benefits are *nature-based solutions*, the term can be helpful to further clarify natural CDR, if sustainability safeguards for these measures are in place (Umweltbundesamt, 2024).

In general, the sound governance of CDR is essential to ensure climate effectiveness and to align necessary negative emissions with unavoidable residual ones, ideally corresponding to each other. Furthermore, governing sustainability to prevent environmental or social trade-offs and deliver lasting climate benefits is equally important. Since no fully adequate regulatory framework exists yet, the EU COM must continuously refine mechanisms and criteria addressing the climate effectiveness and sustainability of CDR. The main challenge lies here in CDR’s complex, multi-level governance, spanning certification, market and environmental regulation, and national versus global systems. Specifically, sustainability criteria remain often unclear regarding scope, authority, and enforcement, making it crucial for the EU COM to ensure clear responsibilities and accountability.¹⁶

4.3.1 Separate prevention and reduction of GHG emissions

The prerequisite for a sustainable, climate-just and robust climate policy architecture is to avoid and reduce the generation of anthropogenic GHG emissions in the first place. Therefore, a coherent set of policies and instruments must be aimed at that goal, not just at preventing generated emissions from being released into the atmosphere (Purr & Spindler, 2023).

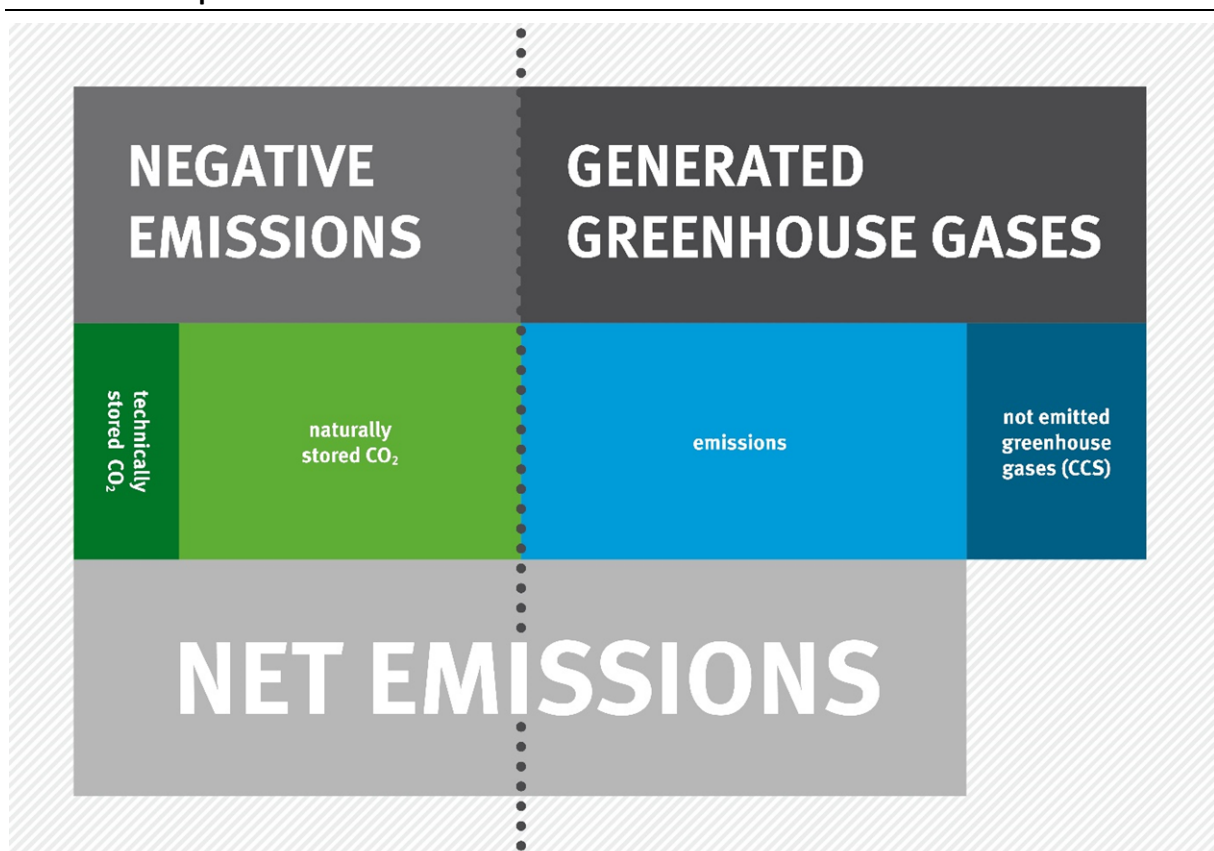
In consideration of the latest scientific knowledge and societal acceptance, the generated GHG up to the level of unavoidable GHG must be continuously monitored and accounted for as well as,

¹⁵ The Carbon Removals and Carbon Farming (CRCF) similarly defines carbon removal as „the anthropogenic removal of carbon from the atmosphere and its durable storage in geological, terrestrial or ocean reservoirs, or in long-lasting products“ (Regulation (EU) 2024/3012, 2024).

¹⁶ It has to be mentioned, that the CRCF sets out sustainability criteria including focusing on „do-not-significant-harm.“ An overview can be found in Böttcher et al. (2023) and Fallasch et al. (2024).

when needed, re-defined. Therefore, it needs a separation and transparent monitoring of the generated GHG (without considering CCS) and of the emitted GHG emissions (with consideration of CCS). According to this logic, first of all stands avoiding and reducing the total amount of generated GHG. Followed by avoiding, reducing and balancing the total emitted GHG emissions. The balance is achieved by prioritizing natural CDR (ideally as nature-based solutions) and only additionally by technical CDR.

Figure 2: Schematic overview of target accounting framework for ambitious climate protection



Source: Purr et al. (2025).

Up to reaching climate neutrality in 2050, the goal should be to minimize the total generated GHG to the amount of unavoidable emissions. This is possible by sustained societal ambitions, rapid and steady implementation of the latest CO₂-saving technologies and the effective implementation of a robust climate policy package in line with the climate objectives. But if the chosen mitigation pathways are not ambitious enough, generated GHG emissions would exceed the level of unavoidable residual emissions and possibly the net zero goal could not be reached. Only if avoidance is exhausted and total generated GHG are minimized, this is where other forms of CCS could kick in to mitigate the GHG emissions. A possible starting point for CCS is utilizing CCS at waste-to-energy plants, as here the least lock in effects are to be expected (see also section 4.3.4). Furthermore, there is potential for negative emissions without additional incentives for the energetic use of biomass (Purr & Spindler, 2023).¹⁷

¹⁷ With the help of fossil-CCS, only parts of the generated GHG emissions can be prevented from being emitted to the atmosphere. Experts estimate that even with high technological efforts a percentage of 15% of the carbon captured cannot be prevented from being released to atmosphere (Bisinella et al., 2021; Purr & Spindler, 2023).

To ensure effective policy implementation, generated and emitted GHG have to be separated and it needs transparent decision processes with respect to their differentiation.

4.3.2 The role of CDR in the EU COM's 2040 climate target proposal

According to the EU COM's scenario "2.5", the mean value of the Impact Assessment scenarios 2 and 3, on which the EU COM's 2040 climate target proposal is based, negative emissions amount to approximately -380 Mio. t CO₂e. in 2040 and approximately to -450 Mio. t CO₂e. in 2050 (European Commission, 2024a). These are the projected amounts needed to compensate for remaining emissions. Therefore, both natural and technical CDR are considered. Natural CDR, in this context, refers the land use, land use change and forestry (LULUCF) sink, while technical CDR refers to BECCS and DACCS. Contrary to LULUCF removals, the development and market implementation of technical removals are still in their infancy.

In the following, we take a closer look at these two CDR categories, as they feature most prominently in the EU COM's Impact Assessment (European Commission, 2024a), with regard to their recent development and trends as well as challenges and barriers.

4.3.3 Strengthen the LULUCF sink

The LULUCF sector has considerable potential for reducing emissions. It can act both as a carbon sink (absorbing CO₂) and source. Its performance depends heavily on soil and forest management, but is increasingly undermined by climate impacts such as heat, droughts, storms, fires, and pests; Europe is particularly vulnerable, with 2024 recorded as the hottest year to date (Copernicus Climate Change Service, 2026). Looking at historic trends, between 2014 and 2023, the LULUCF sink has declined by almost one third amounting to about -200 Mio. t CO₂e, compared to the previous decade (European Environment Agency, 2025a), and in 2023, the LULUCF sink amounted to about -257 Mio. t CO₂e. Looking at the post-2030 years, the EU COM's Impact Assessment projects a rather moderate pathway of the LULUCF sectors: by 2040 the sectors balance should reach -317 and by 2050 -333 Mio. t CO₂e (European Commission, 2024a). With regard to these developments, the EU COM's outlook on the LULUCF sink performance seems rather pessimistic as little increase of the LULUCF sink is projected.

Considering the current development of the LULUCF sink, it is evident that efforts to sustain and enhance the natural sink have to multiply. Against the background of the longer time periods of land-based climate actions to come into effect, increased land-based climate measures need to be implemented as soon as possible. Not only for the 2030 target but also for the years ahead to make the sector more resilient against natural disturbances.

Investments into the LULUCF sector come with a number of co-benefits:

- ▶ These relate for example to ecosystems services such as filtering water, preservation of the landscape water balance and cooling down the landscape.
- ▶ Furthermore, healthy and humus rich soils as well as vital and climate resilient forests form the basis for long-term profitable agriculture and forestry.
- ▶ In addition to this, from an economic as well as from a societal point of view, it is important to sustain and enhance the LULUCF sector.
- ▶ Furthermore, healthy ecosystems create synergies with other EU legislations such as the EU Nature Restoration Regulation and the planned Soil Monitoring and Resilience Directive and

EU strategies such as the EU Biodiversity Strategy, EU Adaptation Strategy and the Forest Strategy 2030.

For these reasons, it needs ambitious measures and instruments at Member State level to achieve the 2030 LULUCF-target. After 2030, building on the 2030 targets, it needs further ambitious target values at EU and Member State level. This provides incentives and clarity for an unrestrictedly sustainable and ecological land use path for stakeholders. What's more, to achieve a trend reversal of the LULUCF sink development, targeted policies enhancing the synergies between regulations such as with the EU Nature Restoration Regulation and revisiting existing unsustainable policies are needed.

The most prominent example is to phase out incentives and support for the energetic use of forest wood. Finally, policy instruments such as the Common Agricultural Policy (CAP) and the CRCF could be tools to help to incentivise and finance the urgently needed investments in the land sector. Whether the CRCF achieves climate effective removals including mitigation in the land sector critically hinges on the soundness and robustness of the methodologies.

4.3.4 Approach BECCS and DACCS responsibly

BECCS and DACCS processes rely on the capture of atmospheric carbon and its permanent geological storage. The process of BECCS begins with the accumulation of carbon through photosynthesis in biomass, e.g. energy plants. Subsequently, after harvesting and, preferably, following the cascade principle, the energy from biomass is utilized for direct combustion, e.g. in waste-incineration plants, or combustion after conversion, for example, to biogas, biomethane or bioethanol before the carbon is captured (Lübbers et al., 2026). DACCS describes a process in which carbon is captured through physicochemical mechanisms where CO₂ is filtered from the atmosphere using specialised facilities before being geologically stored (Lübbers et al., 2026). To date, both the BECCS and DACCS technologies are almost non-existent, with only very few pilot facilities in Europe. Barriers include open and unsolved questions on the functionality of the CCS processes, high energy consumption and costs, lack of business case for removals, missing infrastructure and the provision of sufficient and safe storage sites along with ensuring permanence of the carbon stored. Moreover, there are environmental and sustainability concerns.

In the EU post 2030 climate architecture, BECCS and DACCS are labelled as permanent sinks and are most prominently discussed, e.g. in the EU 2040 Impact Assessment (European Commission, 2024a). In addition to BECCS and DACCS, biochar, which is part of permanent removals under the CRCF, is mentioned as a potential CDR avenue. However, biochar is not yet assumed to play a role in the CDR portfolio post 2030 (European Commission, 2024a).

To date, there is only limited legislation on carbon removals either through BECCS and DACCS or any other technical removal method. Up to 2030, only BECCS is projected to remove about -4 Mio. t CO_{2e}. BECCS and DACCS are projected to remove -62 by 2040 and even -115 Mio. t CO_{2e} by 2050 (European Commission, 2024a). With this development, the share of technical CDR on carbon removals amounts from approximately 0 per cent by 2030 to 15 per cent in 2040 and even 25 per cent by 2050.

In light of the many open questions on the affordability, permanence, sustainability and security of technical CDR, this massive ramp up of the BECCS and DACCS technologies in the next 15 to 25 years seems to be at odds with their current development and risks a reliable target architecture.

However, accelerated climate change impacts may further threaten the LULUCF sink and could prevent its increase in the next decades. Therefore, BECCS and DACCS, could represent an additional option to secure climate neutrality (Duscha et al., 2026; Tsekeris & Karjalainen, 2024). To ensure climate neutrality, technical CDR should be very moderately scaled-up to acknowledge the current state and limitations of these technologies. Therefore, UBA recommends to begin with thermal waste treatment plants (WACCS)¹⁸ because no lock-in effects exist here, and the biomass used is at the end of a long utilization cascade (Pagel et al., 2025; Purr & Spindler, 2023).

For this, targeted policy measures and instruments are required:

- ▶ **In particular, investment in transport and geological storage infrastructure need strong policy support and incentives.**
- ▶ **To support the expansion of technical CDR, high expectations are set upon the CRCF,** which could contribute to their further development. Again, it requires robust and sound methodologies for technical carbon removals under CRCF to contribute to the sink development. Nevertheless, the characteristics of the methodologies under development regarding integrity and sustainability need to be carefully assessed and improvements may be needed.
- ▶ **In addition, legislative targets for technical CDR can provide incentives to stakeholders and guidance for the post 2030 policy framework.** However, when implementing science-based targets for technical CDR, the EU COM has to ensure safe geological storage sites, regulate liability issues, e.g. in the case of carbon leakage and environmental impacts, and ensure societal acceptance. Furthermore, it is important that technical CDR targets are regularly reviewed and adjusted to the amount or unavoidable residual emissions. Simultaneously when planning and implementing the gradual phase in, the phase out of technical CDR has to be likewise on the political agenda.

4.4 Powering the future: Enabling the clean energy transition

As emphasized not only by the EU COM, but a wide range of different stakeholders, electrification will be central to the successful transition towards climate neutrality. To make this possible, clean, reliable and affordable energy must be ensured. Achieving this requires the EU COM to take a comprehensive approach, i.e. reducing dependencies, increasing diversification, expanding renewable energy production and improving energy efficiency.

4.4.1 Reduce dependencies on fossil fuels

Between 2000 and 2019 between 56% and 60% of the energy needed was imported, most prominently fossil fuels from Russia (Eurostat, 2026). With the Russian war of aggression against Ukraine, energy prices skyrocketed and the EU experienced an energy crisis with dramatical repercussions for individuals and the industry, highlighting the un-healthy reliance on third countries for energy imports. To counteract this, the EU COM presented the REPowerEU plan, focusing on energy savings, accelerating the clean energy transition and the diversification

¹⁸ WACCS: „Waste Carbon Capture and Storage“ (Purr & Spindler, 2023).

of the EU's energy imports. With this, the EU reliance on Russian gas dropped from 45% in 2021, to about 15% in 2023 (European Commission, 2024c).

To further reduce dependencies and overreliance on fossil fuels, the EU COM must boost the utilization and deployment of renewable energies, produced within the EU. This also includes actively harnessing Europe's own potentials. This, amongst other things, means that the EU should assume a forward-thinking role in the production of hydrogen and becoming an active player in building additional green hydrogen capacities beyond existing projects and plans, as outlined in the REPowerEU initiative (Lünenbürger et al., 2023).

Shifting towards clean energy not only benefits the EU decarbonization ambitions and increases its geopolitical independence, but can also trigger innovation and support the transition towards a more circular economy.

4.4.2 Enhance diversification of energy carriers and technologies

Closely linked to the reduction of dependencies is the diversification of energy carriers and technologies. The 2020 EU Reference Scenario shows a carrier shift in final energy consumption away from petroleum products, gas, and electricity (European Commission, 2021). This reflects a diversification of energy sources, with growing shares of hydrogen, biomass, geothermal, and other renewables, supported by EU policies, e.g. REPowerEU, RED, and the EU Hydrogen Strategy.

In order to increase diversification, it is necessary to:

1. **address high up-front cost**, that can hinder the deployment and utilization of alternative energy carriers. Furthermore, for some industries the transition towards alternative energy sources is currently not possible, e.g. too expensive or the necessary technologies are not matured fully;
2. **provide the appropriate infrastructure**, e.g. a complete hydrogen transportation network, to facilitate the deployment of alternative fuels;
3. **establish a coherent and comprehensive policy and governance framework** that can keep pace with the growing complexity of a diversified energy system; and
4. **integrate consumer behaviour, environmental concerns, lack of skilled labourers or lack of cross-border coordination** in decision-making processes.

Another strategic concern for the EU is the diversification with regards to imported energy technologies. Especially the production of solar panels and energy storage is dominated by China (Lekavičius et al., 2024). The EU COM must ensure its support for the production of critical energy technologies within Europe and reduce this significant vulnerability by relying on only a few or a single trading partner.

Consequently, the EU needs to create a coherent and harmonized legislative framework, which helps to foster diversification, taking into account the mentioned challenges. This requires not only integrated EU-level planning, but also the harmonisation of national regulations with European legislation to avoid fragmentation. It is furthermore crucial to not only address the supply side, but also strengthen efforts on the demand side, and additionally support new energy alternatives, adhering to the highest sustainability standards, and provide financial support and support for research and innovation.

4.4.3 Foster electrification and expand renewable energies utilization

In Europe's effort to decarbonize its sectors, the most straightforward approach is the utilization of electricity from renewable sources. The EU COM needs to ensure that this is

done swiftly in order to guarantee the successful and needed electrification in all sectors. It furthermore needs to ensure that it sets in place incentives for the uptake of electrified processes, e.g. heat pumps and e-mobility (including a cross-border loading infrastructure), sufficient financial instruments to transform the overall energy infrastructure and guarantee affordable energy prices. Especially the latter is an important incentive for the market participants to switch their production towards energy and, subsequently, improve global competitiveness. Additionally, the EU COM needs to enable planning security, especially for the industry, through long-term, reliable and stable policy frameworks. Consequently, policies that are already in place, such as the EU's fleet-wide CO₂ emissions target of 0 g/km for new light-duty vehicles by 2035, which corresponds to a 100% reduction, should not be watered down.

A strong and expanding renewable energy system is the essential precondition for achieving the EU's decarbonization goals. Every reduction in energy consumption directly increases the share of renewables in the energy mix, a simple but often overlooked fact. **Renewable energy is expected to form the backbone of the EU's strategy to fully decarbonize the power system and to achieve the net GHG emissions reduction targets.** On the European level, the share of renewables in electricity generation is expected to cover between 81 and 87% by 2040 (European Commission, 2024a). This ambitious target emphasizes the need for massive expansion of primarily wind and solar power.

The deep renewable energy integration affords a fast and comprehensive grid expansion and modernization. The interconnections between the Member States inside of the European grid should be strengthened and financed while efficient and grid-supportive behavioral changes are encouraged. Apart from the mere capacity expansion, storage and flexibility options play an increasingly central role for allowing renewable energy capacities to be integrated. Especially battery storage capacities which operate in support of the grid are expected to offer important system services. Solutions for electricity storage are needed on different timescales, from hours to days and even months. As pointed out by the Advisory Board, while the deployment of wind and solar power and batteries are on track with the 2040 target, this has to be maintained by the supply of infrastructure and regulatory prerequisites (European Scientific Advisory Board on Climate Change, 2024).

In addition to grid expansion and flexibility options, high energy costs for the CO₂ neutral technologies remain a key barrier. Financial support for renewable energy can help to reduce the costs and improve the competitiveness of electrified process heat. Furthermore, clear regulatory frameworks, together with a strong and transparent EU ETS price (see sections 4.1.2 and 4.1.3), and support for research and development are essential for ensuring planning security for large industrial power-to-heat consumers.

For expanding the renewable energy utilization beyond the mere electricity supply, a further progress in sector coupling is crucial. Heat pumps are the focal point to decarbonize the heat supply at low and medium temperatures. Renewable hydrogen and its follow-up products will help to decarbonize applications like seasonal electricity storage and non-electrifiable transportation among others. A significant share of renewable hydrogen, especially for applications in the chemical industry and traffic, might have to be imported. The main challenges for hydrogen imports are the current lack of transport infrastructure, the current high production costs and regulatory uncertainties surrounding low-carbon hydrogen. In addition, limited production capacity and weak demand create a 'chicken-and-egg' problem, as buyers wait for lower prices while producers need early demand to scale up and reduce costs. Finally, the imported, renewable hydrogen must strictly meet environmental, social and governance (ESG) standards.

Furthermore, the EU COM needs to make sure that all procedural, planning and permitting bottlenecks are removed to provide as much planning security as possible for investors and the industry. The EU COM has recognized and prioritized these necessities listed above.

Concerning the use of biomass and waste, there is a significant increase observed in some scenarios of the Impact Assessment (European Commission, 2024a). According to the Advisory Board, the need for bioenergy usage can be limited by fast implementation of non-biomass renewables and extensive electrification (European Scientific Advisory Board on Climate Change, 2024). Generally, the utilization scheme of biomass should follow the cascading principle, where material use takes precedence over energy use, also underlined in the Impact Assessment (European Commission, 2024a). This means prioritizing the material use of biomass, for example in wood products that act as natural carbon sinks, thereby enhancing their contribution to Europe's overall climate balance (see also section 4.3).

4.4.4 Improve energy efficiency

Last but not least also improving energy efficiency, thus reducing energy consumption, is a cornerstone of Europe's clean energy transition and a critical pillar of its climate protection strategy. Although energy efficiency directly contributes to the EU's climate targets, it remains formally independent from the EU's emissions reduction goals and has not yet been taken up in the debate around the post-2030-climate architecture. **To date, the significant gap is the need to establish an independent, binding, and ambitious energy efficiency target that aligns with and supports the EU's broader energy and climate objectives.**

With regard to the ECL amendment, no specific energy efficiency target for 2040, comparable to the 2030-target for final energy consumption¹⁹, has been proposed so far. Instead, ECL amendment reinforces general principles such as energy affordability, security of supply, energy efficiency, and the "energy efficiency first" principle. However, all three scenarios of the underlying Impact Assessment build on the continuation and upscaling of energy efficiency (European Commission, 2024a). So, defining an independent target as successor of the expiring 2030 energy efficiency legislation of the EED, that is harmonized with key objectives such as renewable energy and emissions reduction, would form a coherent and ambitious policy package. Much like the "Fit for 55" Package or formerly the 20-20-20 targets this will help to generate stronger political momentum and accelerate the exploitation of the full energy efficiency benefits across Member States. Past EU energy efficiency policies have led to tangible progress in Member States, and these successes should serve as a foundation for future action.

Consequently, the main challenges for the next EU Energy Efficiency framework in order to tap the full potential are:

- ▶ **Define an energy efficiency target for 2040 with an ambitious target level²⁰**
- ▶ **Include important regulation details such as a binding character of the target and the specific baseline, e.g. fixed base year and absolute reduction targets**

¹⁹ The energy efficiency target for 2030 according to Art. 4 EED amounts to a reduction of 11,7 percent compared to the projections of the EU-reference scenario 2020 respectively at the most 765 Mtoe final energy consumption.

²⁰ For different suggestions see e.g. négaWatt Association (2023).

- ▶ Further improve the corresponding legislation by creating **simple, transparent, binding and standardized rules** that ensure consistent implementation.

Looking beyond 2030, scaling up energy efficiency policies offer a range of benefits:

- ▶ Significantly enhanced **energy security**;
- ▶ **Cost savings** in the short and long-term;
- ▶ **Positive social impacts**; and
- ▶ Creation of **sustainable jobs**, and **support for industrial transformation and economic resilience**.

However, this requires overcoming political hurdles and securing Member States' commitment.

4.5 Building a green economy: Decarbonizing Europe and financing the transition

Renewable energies and electrification are the backbone of Europe's transition efforts, but the successful decarbonisation further rely on the development of low- or zero-carbon technologies, know-how and skills, industrial competitiveness and sustainable financing. These aspects have to be supported by a circular economy, ensuring efficiency and long-term resilience, and reduced bureaucracy without sacrificing ambition.

4.5.1 Decarbonisation of sectors with future technologies, know-how and skill development

Some of the main push factors of decarbonization are connected to the EU ETS (see section 4.1):

- ▶ The gradual phasing out of free allocation in the EU ETS 1 by 2034 (related to EU CBAM sectors),
- ▶ The successive tightening of the cap, and
- ▶ The expected rising CO₂ price for energy-intensive industries (EU ETS 1),
- ▶ The extension to other industries and services (EU ETS 2), as well as the cost for fossil energy and for renewable power generation.

Potential pull factors that are important for the final investment decision:

- ▶ Development of a "green consciousness" for climate-neutral products, creating purchasing incentives, and standardized labels for the CO₂ footprint
- ▶ Provide planning security through competitive energy costs and achievable target paths for industrial and climate policy over a period of more than 10 years
- ▶ Promote location advantages and make them usable through infrastructure planning
- ▶ Align support measures both with the development of new technologies and the transformation of existing facilities

The majority of all industrial processes can be electrified. For this purpose, various types of furnaces and dryers must be consistently converted to power to heat, e.g. heat pumps or resistive heating elements. Furthermore, heat pumps based on natural refrigerants are already market-ready in the range up to 300 °C, with capacities up to 100 MW, even on a large industrial scale. The development must be consistently advanced and promoted so that, in the future, these technologies will be available not only for high-temperature applications but also for well-developed heating and cooling networks. The focus of thermal utilization of hydrogen must be on the use only where no more efficient or direct use of electricity is possible, and where it is used as a reagent or enables the utilization of chemical molecules, replacing fossil feedstock. Similarly, only biomass that constitutes genuine residues and is unsuitable for material use should be considered for fuel purposes.

To encourage companies to adopt hydrogen and renewable electricity, their prices must stay competitive with those of fossil fuels. Subsidizing and securing energy costs when carrying out GHG reduction measures improve planning for businesses. In addition, measures to increase efficiency contribute to the reduction of primary emissions. Easily implementable measures must increasingly establish themselves as yet-to-be-defined standards in the market, while only more complex innovative measures should continue to receive support.

A flexibilization of the electricity and heat market as well as a circular economy will contribute to further CO₂ savings. To support the generation of renewable electricity in a system-friendly manner, various energy storage systems and sector coupling technologies are needed, as pointed out in section 4.4. By managing production processes intermittently, a temporally limited surplus of electricity can be made usable. Incentives must be created for this, as these processes require a production overhead.

The remaining share of industrial processes can either be decarbonized directly through CO₂-reduced alternative processes or must be decarbonized through subsequent CO₂ capture, i.e. CCS/CCU. These technologies should however first and foremost be implemented for waste treatment facilities, as here there is the lowest risk of lock-ins. Capturing of unavoidable raw material-related CO₂ emissions should in regular and predetermined intervals be re-evaluated in terms of available alternatives, in material and process.

In addition to the construction of a CO₂ network, the material utilization of CO₂ (CCU) must be promoted. This includes the transformation in the chemical industry through increasing reliance on non-fossil CO₂ sources, the use of bio-based raw materials, waste and by-products as well as carbon from the atmosphere and the acceptance of CO₂ as a raw material to establish a sales market.

Through the development of a value-creating circular economy strategy, residual materials of all kinds can be made usable for material recovery. This includes pure material flows and improved sorting. Thermal recovery should only be considered for non-recoverable residual materials and as an unavoidable pollutant sink. For this, regulations need to be revised, the disclosure of product information should be promoted, and local/national and European-wide cycles should be established.

4.5.2 Ensure competitiveness through Green Technology

The green technology sector is not only vital for securing a sustainable future, but also offers significant potential to boost the competitiveness of the EU. In recent years, the green technology industries, like energy efficiency, renewable energies, and many more, outpaced other sectors in growth, have demonstrated greater resilience during periods of economic

volatility and have established themselves as a key industry within national economies (Bechhaus et al., 2025).

To fully capitalize on this potential, the EU should intensify efforts to stimulate both the supply and demand for green technologies. **Unlocking the full value of green tech requires strong political commitment and a stable, long-term and reliable policy framework, providing clear rules, consistent incentives, and predictable support mechanisms.** Such an environment would reduce technological and market risks, provide planning certainty for businesses, and foster the conditions necessary for viable low-carbon business models. This, in turn, would foster confidence in the private sector to invest in sustainable technologies. In this respect, the ECL amendment lacks the necessary guidance for investment and business models. More stringency in the policy framework would be helpful and would give more guidance to business and society.

The EU should prioritize truly green technologies, i.e. renewable energy, which do not produce GHG, but substitute GHG intensive energy carriers. By embracing energy efficiency strategies and accelerating the development and deployment of renewable energy technologies, there remains still hope, that residual emissions can largely be counterbalanced by natural sinks. However, it has to be emphasized, that utilized technologies should not include nuclear technologies, as they pose significant health and environmental risk (Umweltbundesamt, 2020). Additionally, the final disposal of nuclear waste, similar to the permanent storage question of CCS technologies, remains unsolved, highly conflictual and leaves an enduring legacy of responsibility. The ECL amendment emphasises technological neutrality, which carries the risk that non-green technologies, such as CCS and nuclear, see above, are prioritized.

4.5.3 Enable and support climate management in companies

The business sector does not only contribute to GHG emissions but is also strongly affected by climate change due to production losses, interrupted supply chains or rising costs for energy and raw materials.

A successful strategy for a green economy also needs to be based on bottom-up management approaches in companies to reduce GHG emissions and control climate risks. This includes the implementation of corporate climate and environmental management schemes in line with basic requirements, such as verifiable GHG inventories, climate targets, action plans, climate reporting and verification by independent experts. Climate policies can foster this by mainstreaming existing voluntary schemes, such as the European Eco-Management and Audit schemes (EMAS) for which UBA has developed a climate management module which we recommend to adopt at EU level.

Furthermore, existing legal requirements, such as those for corporate climate transition plans and climate reporting should be strengthened and better coordinated with other climate policy instruments (see sections 4.1 to 4.4). Support for companies should be provided in the form of consulting and information programmes, basic digital tools for GHG inventories, such as UBA's emission factor list²¹, and platforms (e.g. the EMAS platform²² or the sustainability reporting platform of the German Sustainability Code - DNK²³).

²¹ <https://www.umweltbundesamt.de/emissionsfaktoren>

²² <http://www.emas-plattform.de/>

²³ <https://report.deutscher-nachhaltigkeitskodex.de/>

4.5.4 Reduce bureaucracy without sacrificing ambition

Streamlining regulatory processes is essential to ensure that Europe's path to sustainability remains environmentally ambitious and economically viable. Excessive bureaucracy can hinder innovation, slow down investment, and discourage companies, particularly SMEs, from engaging meaningfully in the green transition.

A balanced approach for reducing bureaucratic constraints that enhances efficiency without undermining ambition can be achieved through better coordination across regulatory frameworks, greater consistency in compliance requirements, and enhanced government support for implementation. Digital tools and targeted measures to simplify compliance can significantly ease the regulatory load on businesses, particularly small and medium-sized enterprises.

The planned simplification of EU law through the several Omnibus initiatives offers opportunities for streamlining existing rules and coordinating them coherently in order to speed up the transition towards climate neutrality. The aim of these initiatives, however, must be to make EU law easier and faster to implement in order to reduce the compliance burden, but not to sacrifice ambition. Therefore, the EU COM must ensure a systematic approach to simplification. This entails, among others, the development of simplification strategies before opening up and amending individual legal acts, conducting impact assessments to better evaluate the actual relief effects of simplification proposals and to establish links between different Omnibus procedures (sustainability, batteries, environment, chemicals etc.) to avoid 'omnibus silos' which can create additional inconsistencies and legal uncertainties.

The redefined scope of the EU CBAM under the Omnibus package is a successful example how less bureaucratic burden can go hand in hand with a strong climate ambition.

4.5.5 Finance the green transition

Delivering the green transition and scaling up green technologies will require substantial, long-term investment across all sectors of the economy. Once made, investments shape development paths for 25 to 30 years, due to the lifetime of the technologies, machinery or infrastructure involved. The 2024 Draghi report shows that investment needs, for example 500 billion euros over the next 15 years for the decarbonisation of the four largest energy-intensive industries, are massive (European Commission, 2025b). Thus, **both public and private funding need to be mobilised to achieve climate neutrality in industries, but also society as a whole.**

With the Clean Industrial Deal (CID), the EU COM has outlined the cornerstones needed to leverage both public and private funding to incentivise investments (European Commission, 2026). Starting in 2025, the EU COM will provide up to 100 billion euros, mobilising private investments, and reforming State aid over the years. In addition, the CID also addresses the demand side mainly with the creation of clean lead markets. As such, the approach of the EU COM is to tackle the decarbonisation of industry with a variety of instruments and steering the way to a more sustainable economy in 2030 and afterwards.

In addition to financial support for industry, it is crucial to make public funding available for municipalities and regions in order to provide the needed infrastructure and to finance transition in especially affected regions and sectors to ensure regional and social fairness. Currently, Cohesion Policy including the Just Transition Fund are used for such purposes. It is important that future multiannual financial frameworks of the EU not only address and support big, energy-intensive industries, but also regions, SMEs and vulnerable people. This can be done by earmarking of funds for climate issues in funding schemes, cross-cutting instruments such as Do-No-Significant-Harm (DNSH), and quotas. These instruments can

contribute to ensure that public funding is spent on climate issues and not only on immediate political issues (Winkler & Biewald, 2025).

While public funding provides an essential foundation, it alone will not suffice. Mobilising private capital is crucial and this is where transition finance plays a central role: bridging the gap between current financial flows and the massive investment needs required to decarbonise key industries, and particularly those green technologies that are needed in industries that are hard to abate.

In order to do so, the EU Sustainable Finance Framework, including the EU Taxonomy and the Corporate Sustainability Reporting Directive (CSRD), is a crucial foundation to the mobilisation of capital for future-proof business models and help companies in cooperation with their investors steer towards climate neutrality and sustainability.

Rather than scaling back ambition and reducing their scope, as currently foreseen in the Omnibus I-package, the EU Taxonomy and CSRD should be simplified in terms of streamlining requirements to what is essential, enhancing practical usability and expanding legal clarity.

Through a comprehensive and coordinated approach - anchored by clear and stable regulatory and financial environment - the EU lays the strategic foundation investors need to assess credibility, allocate capital effectively, and support companies on their decarbonisation pathways. This includes advancing the EU Taxonomy and expanding legal clarity to encompass credible transition plans. Financial instruments such as green bonds, sustainability-linked loans, and blended finance mechanisms can help de-risk investment and attract institutional capital, thus complete the approach.

4.5.6 Ensure a level playing field by incorporating GHG shadow prices into decision making

The integration of monetized climate impacts into investment and policy decisions contributes to the internalization of external effects from GHG emissions and thereby to the creation of carbon-neutral and competitive economies and societies. To facilitate this, it is important to create a **level playing field for sustainable political decisions and business models**. One key contribution to this is the widespread adoption of scientifically sound GHG shadow prices²⁴ in public and private decision making. The widespread use of shadow prices in regulatory impact assessments (ex-ante as well as ex-post) can contribute to more effective legislation that systematically considers the environmental impacts of different policy alternatives.

Table 1: Based on the GIVE (Greenhouse Gas Impact Valuation Estimator) model, the following value factors for GHG emissions are recommended beyond 2030 (Eser et al., 2026):

Year of emission	Climate costs in € ₂₀₂₅ /t GHG					
	CO ₂		CH ₄		N ₂ O	
	0% PRTP	1% PRTP	0% PRTP	1% PRTP	0% PRTP	1% PRTP
2030	1,050	375	10,660	7,020	303,800	131,700
2040	1,150	440	14,200	9,950	339,900	154,500
2050	1,240	485	16,580	12,100	355,400	167,800

²⁴ Shadow prices include the monetized environmental impacts of an additional ton of GHG emissions into the benefit-cost-analyses of investment or policy decisions.

Two distinct values are given for the three GHGs (carbon dioxide, methane and nitrous oxide), reflecting two different normative assumptions with respect to the consideration of future welfare. A 0% pure rate of time preference (PRTP) reflects an equal weighting of future and current well-being, whereas a 1% PRTP reflects a stronger focus on today's well-being.²⁵

It is crucial to recognize that also monetized environmental impacts beyond climate effects have to be systematically incorporated into economic and political decision-making processes. To achieve this goal, further efforts on the international standardization of shadow prices and their application is required.

4.6 Ensuring a just transition: solidarity and fairness as guiding principles

As recognized by the ECL amendment, the EU's climate objectives must be achieved in a manner that is fair to its citizens, sectors, and regions, ensuring a just transition that leaves no one behind. To achieve this, it is crucial to identify potential negative impacts early and develop adequate strategies to minimize or avoid social, economic, and regional disparities. These strategies will not only prevent unfair policy outcomes but also increase the acceptability of EU climate policies. In this section, we delve deeper into these issues, focusing on the potential implications of rising CO₂ prices. Although other climate policies, such as standards and subsidies, also impose costs on consumers, we focus here on CO₂ prices as their impact on consumers is salient and therefore can be clearly determined.

4.6.1 Consider and address the risk of social imbalances due to higher CO₂ prices

Achieving the EU climate targets requires a significant increase in the rate of emissions reduction after 2030, particularly in sectors like buildings and transport. These sectors have traditionally lagged behind due to behavioural inertia, infrastructural limitations, and fragmented regulatory frameworks. With the introduction of the EU ETS 2 as part of the policy mix, carbon prices will create financial incentives for low-carbon choices (see section 4.1.3).

The EU ETS 2 will put a binding cap on CO₂ emissions and therefore contribute substantially to climate policy goals achievement while generating significant public revenues that can be used to foster transition in the covered sectors. Yet this transformation could come with relevant distributional effects and therefore must be accompanied by further measures.

Higher CO₂ prices, as forecasted in many EU ETS 2 projections, are expected to cause noticeable cost increases for private households, especially after 2030 (Burger et al., 2022; Pahle, Günther, et al., 2025). CO₂ prices disproportionately affect low and medium-income households relative to their income, potentially leading to significant individual, social and political challenges if no adequate targeted support measures are implemented. Furthermore, large differences in the income and wealth structure of households across Member States could imply stronger impacts on less wealthy Member States. In Eastern and South-Eastern Europe in particular, low- and middle-income households, which have a particularly high fossil fuel consumption for structural reasons and are therefore particularly affected by carbon pricing, make up a much larger proportion of the population structure than in wealthier Member States (Schwab et al., 2026). As acknowledged in the ECL amendment, future EU climate policies should therefore promote

²⁵ Further information on these value factors can be found in the handbook on environmental value factors "Methodological Convention 4.0" (Eser et al., 2026).

solidarity by accounting for national circumstances, fostering convergence, and ensuring fairness both within and between Member States.

To ensure a just transition, revenues from the EU ETS 2 and the Social Climate Fund should be used to ease the burden on private households. Returning CO₂ pricing revenues to citizens is a core principle of EU law and broadly applicable across Member States (see section 4.6.2). The SCF, with its focus on supporting vulnerable households, will be central to this effort and should continue to play an important role beyond 2032 (section 4.6.3).

4.6.2 Recycle ETS revenue for targeted support and social compensation of low- and middle-income households during the run up of the EU ETS 2

In the early years of the EU ETS 2, part of the ETS revenue should be refunded to low- and middle-income households on an individual Member State basis by a targeted social compensation-mechanism that works in combination with targeted support programs for efficiency and decarbonization measures. Such a mechanism provides basic safeguard to those particularly affected by potential rising CO₂ prices. Such a transitional safeguard system is crucial until there are sufficient cost-effective and widely available options for households with low and medium incomes to switch to CO₂-free or on an interim basis low-carbon options in the mobility and heating sector.

Major revenue shares should be used for targeted support programs for efficiency and decarbonization measures. Vulnerable households, with high fossil fuel demand and low income, are particularly affected by carbon pricing and have limited means to adapt, often lacking resources for energy-efficient renovations or electric vehicles. This includes those living in poorly insulated homes with oil or gas heating and long-distance commuters reliant on combustion cars due to limited alternatives. Social support could be, for example, integrated into energy-efficient building refurbishment programs to complement income bonuses for heating system replacement. Public transport access, especially in rural areas, must be improved to reduce car dependency. Where this is not feasible, e-mobility options like “social leasing” as implemented in France, should be promoted for vulnerable households.

Such programs are crucial for a socially responsible climate policy due to the strong synergies between climate protection and social goals: they reduce GHG emissions and help lower household energy costs in the long term. These programs should be financed proportionately from the revenue generated by carbon pricing. However, a broader funding base is also necessary. This is logical, as the funding not only addresses the effects of carbon pricing, but also permanently enhances resilience to sudden increases in energy prices as well as provides further co-benefits, for example enhanced comfort with respect to better-insulated houses and apartments.

In view of the tightening of the cap of the EU ETS 2, the relationship between a transitional basic safeguard mechanism and support programs will shift after 2030. If support programs for private households are successfully implemented, the proportion of households that are dependent on relief through compensation payments to mitigate financial burdens will decrease, while the pressure on households with continued high fossil fuel consumption will increase due to the expected rise in CO₂ prices. A consistent decarbonization of private households in combination with high CO₂ price levels will therefore ensure fewer cases of hardship, but will hit the remaining ones – those who are not (yet) fully decarbonized – all the harder. EU and national policymakers must take this into account and align social policy accompanying the new ETS accordingly.

4.6.3 Strengthen the Social Climate Fund and extend funding to support poorer Member States in their broader transformation efforts

Future EU policies must consider the diverse circumstances and needs of vulnerable households across Member States, and implement sufficient support measures that reflect these differences. The Social Climate Fund - entering into force already in 2026 - will support parts of the most affected vulnerable groups in the transition to climate neutrality. Funded by a share of EU ETS 2 revenue, it will redistribute resources among Member States based on economic and social indicators, helping to ensure a fair and balanced implementation of carbon pricing. Member States can use SCF funding for long-term investments targeted on vulnerable households - such as building renovations, greener heating, and sustainable mobility - as well as for temporary and declining direct income support where needed.

However, future adjustments may be necessary for the SCF to effectively address the evolving social challenges of the climate transition. As a central flexibility, the SCF framework should include mechanisms for periodic reassessment and adjustment of required funding levels. As currently structured, the total size of the SCF budget will be limited to the EU ETS 2 revenue based on a CO₂ price level that is likely to be significantly exceeded in the next decade. If actual carbon prices rise significantly, the fixed size of the SCF budget will not keep pace with the increasing financial needs. Without enhancement, vulnerable households risk insufficient support during critical phases of the green transition.

The EU COM should also consider extending funding to support low-income Member States in their broader transformation efforts. In its current form, the SCF will be limited to the financial burdens of the EU ETS 2. In this context, wealthier Member States have more resources to financially support climate-neutral technologies such as electric cars, public transport, building insulation, heat pumps, as well as low-emissions or climate-neutral industrial processes. At least in the ESR scope, these Member States are expected to take larger actions before 2030 – both because they have more resources and because they are subject to higher emissions reduction targets (see also section 4.2). After 2030, Member States that are further away from the more stringent climate goal of 2040 or even net neutrality in 2050, will face increased pressure to raise their ambition levels, likely requiring additional support to do so.

Support via the SCF and other social funding sources should continue beyond 2032. Without such extension, vulnerable groups risk losing crucial assistance during a critical period of decarbonization. This ongoing support can be financed not only through EU ETS 2 revenues but also by reallocating funds from fossil fuel subsidies, which would simultaneously contribute to positive climate impacts by discouraging fossil fuel consumption.

Future policies should also consider indirect climate policy costs. Issues of fairness may also arise from transformation costs in the other sectors (energy, industry, agriculture) as they might be passed on to private households in the form of moderately higher product costs and/or possible job losses. Ensuring an innovative and competitive internal market within the EU will be crucial for affordable consumer prices and cost effectiveness of the transformation process.

4.7 Coordinating globally: The EU's international engagement

The new EU climate protection architecture must be built on a strong foundation of international engagement. Effective climate actions in countries outside of the EU are essential not only to limit global warming, but also because they influence the effectiveness and acceptance of EU climate policies and objectives. Supporting climate mitigation efforts abroad is also essential to compensate for the EU exceeding its fair share of the global carbon budget from 2030 to 2050, even under its most ambitious emissions reduction paths. For this, mitigation efforts abroad should not serve to ease the achievement of domestic EU targets, but contribute to additional climate ambition abroad. To support global climate efforts, EU policies should promote international cooperation, coordinate cross-border actions, and address the risk of carbon leakage.

4.7.1 Strengthen global climate action through EU leadership

The international community agreed in the Paris Agreement in 2015 to hold the increase in global temperature to well below 2 °C and pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

Within this framework, the EU plays a pivotal role by setting ambitious climate targets, implementing robust policies, and actively engaging in international diplomacy. The EU's commitment to climate neutrality by 2050 and its progressively more ambitious Nationally Determined Contributions (NDCs) serve as a benchmark for global action. By fostering cooperation, sharing expertise, and supporting other countries, the EU helps to strengthen the collective ambition necessary to meet the Paris Agreements goals and ensures that climate efforts are equitable and effective worldwide.

The EU has over the years taken pride in building bridges in international climate negotiations and showing leadership in its efforts to reduce GHG emissions. This leadership is ever more important with the United States' disengagement from the international climate negotiations under the Paris Agreement and offers significant economic opportunities not only in avoided damage but also in an overall increase in GDP (OECD & UNDP, 2026).

By maintaining its role as a climate diplomacy leader, the EU can facilitate stronger international cooperation and help ensure a more coordinated and effective global response to climate change. Importantly, the ambition of the EU's 2040 climate target and its new NDC for 2035 as well as the success of the consistent transformation towards climate neutrality and biodiversity protection within the EU is crucial for the EU's credibility in international engagement. The positive effects, for example on human health, ecosystems and the economy, should be demonstrated and experience and expertise shared internationally.

4.7.2 Foster international cooperation, policy coordination and financing

Climate policy opens up opportunities for cooperation across the globe. These should be expanded in order to achieve progress in international climate negotiations and thus contribute to raising the global ambition level.

The EU should increasingly support ambitious environmental and climate policies outside the EU by supporting the transformation of energy systems and socially just economic structural transformation. Importantly, the EU's work with global partners to build international carbon markets, which are a key instrument to create economic incentives for climate action, must continue in the context of the UNFCCC as well as through bilateral cooperation.

The EU should actively pursue the development of country platforms, participate in and strengthen the climate club. The climate club, launched at the COP 28 in 2023 and currently counting 46 members, intends to foster industry decarbonisation by providing a forum to countries for exchange and formulating as well as coordinating policies. With a view to carbon pricing, its work programme entails inter alia harmonising metrics for measuring embedded emissions to ease the burden inflicted by incompatible MRV systems around the globe and coordinating domestic measures to deal with carbon leakage. In the status quo with domestic carbon pricing schemes and emerging anti carbon leakage instruments, such as the EU CBAM and the UK CBAM, coordination is needed to improve the efficiency in emissions reduction efforts globally as well as to increase global ambition in climate action.

The EU should ensure that all investments and financial flows as well as trade, security, and development policies, consistently pursue mitigating GHG emissions and strengthen resilience to climate change. Building a financial system that supports sustainable global growth, keeping in mind climate and biodiversity issues, is crucial as this could lead to substantial economic opportunities (OECD & UNDP, 2026). This in particular entails shifting subsidies away from fossil fuel consumption toward the promotion of sustainable lifestyles and green technologies. Additionally, the EU must also work to mobilize private investment to support climate action abroad, align capital markets with climate targets, and promote innovative finance instruments to drive sustainable development and climate action.

To enhance global climate action, the EU should intensify cooperation with other countries and regions. In the first place this includes countries that have a high economic dependence on the extraction and export of fossil energies and other natural resources with negative environmental impacts. These countries frequently oppose ambitious action in international climate policy due to, e.g. concern over economic stability and development. At the same time, the EU should support for countries with limited institutional, financial, or technological capacity to implement effective climate policies. By providing targeted assistance, such as capacity building, climate finance, technology transfer, and policy advisory, the EU can help these countries not only meet their NDCs, but potentially exceed them. Such support is vital to ensuring a just and inclusive global transition. Additionally, cooperation within the framework of the G20 should continue to be used by the EU to demand consistent climate and biodiversity protection, which also has an important signaling effect to United Nations processes.

4.7.3 Leverage Article 6 cooperative mechanisms (Paris Agreement) to support additional climate action abroad without reducing domestic targets

Part of the global climate architecture under the Paris Agreement are the cooperative mechanisms defined under Article 6, including market (Articles 6.2 and 6.4) and non-market approaches (Article 6.8). While Article 6.2 provides a decentralized accounting framework and infrastructure for countries to voluntarily trade emissions reductions through bilateral agreements, Article 6.4 defines a centralized “Paris Agreement Crediting Mechanism” under the control of an international supervisory body.

Market approaches allow countries and private actors on their behalf to generate, quantify and transfer mitigation outcomes including emissions reductions and carbon removals. Resulting credits from approved activities can be used for the achievement of NDCs by countries, for compliance under international mitigation schemes like CORSIA or voluntary mitigation activities including neutrality claims by public or private entities.

International carbon credits offer an important opportunity to support mitigation action abroad in different ways. The targeted use of the cooperation mechanisms of Article 6 allows

to intensify cooperation with partner countries and to mobilize private sector investments in climate protection. Cooperative approaches could, for example, be used as a results-oriented quantification instrument for climate financing, which only should be accounted for if the credits are not transferred to any other user for compliance purposes. Moreover, cooperative approaches are an option for a voluntary additional contribution to mitigation by committed countries (e.g. Sweden) or private entities, on top of the binding target as an individual approach to carbon neutrality.

However, Article 6 mechanisms still require refinement to ensure environmental integrity and enable higher ambition. Guidance, standards and methodologies are still being developed to enable robust implementation of international carbon credits. The EU has strongly advocated for transparent, environmentally sound Article 6 mechanisms with high safeguards to prevent loopholes and maintain climate ambition. Implementation should align with long-term net-zero strategies, the 1.5°C goal, and be consistent with countries' NDCs and LTS, requiring ambitious eligibility criteria and credible baselines. The Article 6.4 Sustainable Development Tool, aiming to ensure project integrity currently lacks minimum environment safeguards, leaving environmental responsibility largely to host countries.

At this point in time, UBA recommends use of Article 6.4 instead of Article 6.2 mechanisms due to its multilateral character and its higher level of transparency by international supervision. The requirements and guidance documents under Article 6.4 must serve as a benchmark when considering other forms of co-operation.

Cooperative mechanisms under Article 6 that meet the highest quality standards should not be considered as a cheap and easy option to meet the EU's climate targets by reducing domestic emission reduction obligations. The ECL amendment foresees a flexible use of international certificates in 2040 of up to 5% in terms of basis emissions in 1990. Our position to set restrictive guidelines for the implementation of this decision in the central legal acts (in particular ETS, ESR, LULUCF) is grounded in several concerns:

1. These mechanisms involve significant risks such as non-additionality, non-permanence, and often overlooked carbon leakage, which make them an unreliable substitute for domestic emission reductions that are certain and verifiable.
2. They can create perverse incentives, for instance, if credit sellers increase emissions or reduce ambition to profit from subsequent emission reductions (European Scientific Advisory Board on Climate Change, 2025b).
3. Their use could weaken incentives for mitigation, particularly if actors expect the credit supply to expand in the future.
4. Past experience with the Clean Development Mechanism and Kyoto Protocol credits revealed serious issues, including oversupply, poor credit quality, and market distortions.
5. The availability and price of high-quality credits remain uncertain; they may be both expensive and scarce, e.g. due to the need to comply with own commitments of the host countries, limiting their availability and reducing their potential to lower overall mitigation costs. This could in turn create pressure to accept lower-quality credits.
6. Finally, basing (part of) the target on international certificates will create new dependencies with foreign countries and external markets and may lead to a deviation of financial flows towards other countries instead of investment in the transformation of the domestic infrastructure.

However, as the EU has decided to allow for up to 5% of high-quality international credits to achieve its climate goal for 2040, it is necessary to **implement strict rules to minimize the total volume of credits used. These credits should serve as a safety net, to be used only in**

exceptional circumstances, in line with the precautionary principle. One option in this direction could be to use these credits only as a guarantee (buffer) in case natural CO₂ sinks do not achieve their expected contribution to achieve the 2040 target (see flexibility 3 in section 3.2) but to avoid an integration in the EU ETS and the ESR which would result in a reduction of domestic ambition. *Importantly, credits should not be used for compliance by individual operators in EU carbon markets.* Instead, an adequate institutional set up at EU level or at Member States level could be developed, which serves to provide credits according to the politically defined and legally fixed quality criteria at EU level. A race to the bottom aiming for low prices not considering quality has to be avoided. The impact of these credits on the three pillars of EU climate policy (EU ETS, ESR, CDR/LULUCF) has to be assessed carefully including expected prices and volumes.

Additionally, clear and strict regulations regarding the origin and types of credits must be established to address the above-mentioned risks and short-comings. Part of the procurement criteria should be a careful selection of host countries considering the quality and robustness of their NDC. Any risks of jeopardizing ambition must be avoided and establishing strategic partnerships with selected countries, based on existing cooperation in climate policy, may be helpful in this regard. Regarding the quality of credits, the requirements have to be developed in detail. The modalities and procedures for crediting under Article 6.4 have been developed considering the experiences with the CDM and to overcome the deficiencies, but the EU as a buyer should make an own assessment and add criteria, e.g. regarding co-benefits, transformative effects, sustainable development or human rights, or exclude specific project types or sectors.

At this point in time, UBA does not recommend the inclusion of international credits based on natural or technical sinks (CDR) during the EU's pathway to climate neutrality. Important issues regarding MRV, baseline setting, non-permanence and environmental integrity are not addressed appropriately yet. For example, carbon stored in natural sinks can be reversed due to droughts or wildfires and may be overstated due to weak or inflated baseline assumptions. In contrast, technical CDR solutions may face risks such as carbon leakage if monitoring, site management, and long-term stewardship are insufficiently robust, as well as unintended impacts like the use of unsustainable biomass. These issues could be further exacerbated when CDR are generated outside of the EU, where regulatory standards, enforcement mechanisms, and transparency requirements may differ substantially.

UBA notes that regarding the inclusion of international credits, many questions remain open, so the development of EU implementing legislation has to be accompanied thoroughly. The rules for Article 6 are further developed continuously as well at UNFCCC.

4.7.4 Recognize carbon leakage risk and reinforce prevention measures

Carbon leakage occurs when the mitigation efforts of a specific country or region result in an increase in GHG emissions in other countries or regions. Carbon leakage can occur through various channels. For instance, it may occur when EU climate policies lead to the replacement of EU-made products with more carbon-intensive imports, or when reduced demand within the EU lowers global fuel prices, spurring increased fossil fuel consumption elsewhere (Görlach & Zelljadt, 2018; Yu et al., 2021). Carbon leakage is enabled by the fragmentation of global climate policies; while the ambition of non-EU countries' policies could increase in the future, these policies will likely remain heterogeneous (in line with the logic of the Paris Agreement). Therefore, carbon leakage can be expected to undermine the effectiveness of the EU's climate targets, risk considerable economic losses, and may ultimately threaten the overarching objective of the Paris Agreement.

Future EU climate policies should consider the risk of carbon leakage and implement measures to prevent it. As part of the “Fit for 55” Package, the EU CBAM was introduced to gradually replace the free allocation of allowances as the central anti-leakage instrument. Beginning in 2026 it will impose a carbon price on embedded emissions of imported goods mirroring the CO₂ price signal of the EU ETS 1. As such, the EU CBAM prevents leakage by reducing competitiveness losses (section 4.1.2). Moreover, the CBAM sets incentives for third countries to advance their actions towards implementing domestic carbon pricing instruments, which in the medium run should reduce the severity and likelihood of carbon leakage. To this end, under the EU CBAM, carbon prices of third country schemes are recognised and the obligation of importers is reduced accordingly. Thereby, the criteria for third country carbon price recognition – which set the incentives for actors in third countries - should continue to apply only to genuine carbon pricing policy instruments aimed at meaningful emission reduction. Thus, next to installing a level playing field for private enterprises and supporting decarbonisation within the EU, the EU CBAM incentivises third-country producers to foster abatement along their value chains.

Crucially, the EU must not only implement anti-leakage measures but also directly address the underlying factors that cause and increase carbon leakage risk. These include disparities in climate policy ambition and implementation, the emissions intensity of global production, and shifts in fossil fuel supply and demand outside the EU. While measures such as technology transfer and international climate policy support can help mitigate these risks, the EU should explicitly integrate these drivers into its policy planning and develop targeted strategies where needed.

5 References

- Bechhaus, P., Bichlmeier, T., Dietzsch, N., Draeger-Gebhard, J., Hutzenthaler, P., Lambert, J., Norporth, R., & Wechner, V. (2025). GreenTech made in Germany 2025 - GreenTech-Atlas for Germany (Brochure / flyer). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7955>
- Bisinella, V., Hulgaard, T., Riber, C., Damgaard, A., & Christensen, T. H. (2021). Environmental assessment of carbon capture and storage (CCS) as a post-treatment technology in waste incineration. *Waste Management*, 128, 99-113. <https://doi.org/10.1016/j.wasman.2021.04.046>
- Böttcher, H., Fallasch, F., Schneider, L., Siemons, A., & Meyer-Ohlendorf, N. (2023). Sustainability criteria for carbon dioxide removals: Requirements for sustainability criteria in the EU CRCF proposal and elements to be included in a delegated act (Factsheet). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-3297>
- Burger, A., Lünenbürger, B., Tews, K., Weiß, J., Zschüttig, H., Frey, K., Hendzlik, M., Herbstritt, C., Kühleis, C., Lange, M., Schuberth, J., Steinbrenner, J., & Verse, B. (2022). CO₂-Bepreisung im Verkehrs- und Gebäudebereich sozialverträglich gestalten - Herausforderungen, Strategien, Instrumente (47/2022). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-2568>
- Copernicus Climate Change Service. (2026). 2025 Global Climate Highlights. ECMWF. Bonn, Germany. <https://doi.org/10.24381/b3nm-p354>
- Council of the European Union. (2025a). Outcome of proceedings on the proposal for a regulation amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality - Letter to the Chair of the European Parliament Committee on the Environment, Public Health and Food Safety (ENVI) (ST 17086/25; Interinstitutional File 2025/0524 (COD)). <https://data.consilium.europa.eu/doc/document/ST-17086-2025-INIT/en/pdf>
- Council of the European Union. (2025b). Outcome of proceedings on the proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality (ST 14960/25 INIT; 2025/0524 (COD)). <https://data.consilium.europa.eu/doc/document/ST-14960-2025-INIT/en/pdf>
- Dimanchev, E., & Knittel, C. R. (2023). Designing climate policy mixes: Analytical and energy system modeling approaches. *Energy Economics*, 122, 106697. <https://doi.org/10.1016/j.eneco.2023.106697>
- Duscha, V., Al-Dabas, K., Deac, G., Eckstein, J., Frank, F., Weißenburger, B., Neuner, F., Emele, L., Böttcher, H., Hennenberg, K., Hesse, T., Ludig, S., Scheffler, M., Wiegmann, K., & Popovski, E. (2026). Pathways to an EU in 2050 with net-zero GHG-emissions (18/2026). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-8104>
- Eser, N., Matthey, A., & Bünger, B. (2026). Handbook on Environmental Value Factors - Methodological Convention 4.0 for the Assessment of Environmental Impacts (Broschüren). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-8331>
- Eurofound. (2024). The Green Tripartite (Measure DK-2024-47/3588, Measures in Denmark). European Foundation for the Improvement of Living and Working Conditions. Retrieved 27 May 2026 from https://static.eurofound.europa.eu/covid19db/cases/DK-2024-47_3588.html
- European Commission. (2021). EU reference scenario 2020: Energy, transport and GHG emissions - Trends to 2050. Publications Office of the European Union. Luxembourg. <https://doi.org/10.2833/35750>
- European Commission. (2024a). Commission Staff Working Document: Impact Assessment Report accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Securing our future –

Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society (SWD(2024)63 final). [https://ec.europa.eu/transparency/documents-register/detail?ref=SWD\(2024\)63&lang=en](https://ec.europa.eu/transparency/documents-register/detail?ref=SWD(2024)63&lang=en)

European Commission. (2024b). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Securing our future – Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society (COM(2024) 63 final). Strasbourg. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52024DC0063&qid=1733224872906>

European Commission. (2024c). In focus: EU energy security and gas supplies. Directorate-General for Energy. Retrieved 20 March 2026 from https://energy.ec.europa.eu/news/focus-eu-energy-security-and-gas-supplies-2024-02-15_en

European Commission. (2024d). Report from the Commission to the European Parliament and the Council on the operation of the European Climate Law and of the Effort Sharing Regulation, and on the Emissions Trading System Directive in the context of the global stocktake (COM/2024/196 final). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52024DC0196>

European Commission. (2025a). Commission Delegated Decision (EU) 2025/318 of 27 November 2024 on the unilateral inclusion of sectors by Sweden in the emissions trading system within the Union for buildings, road transport and additional sectors pursuant to Article 30j of Directive 2003/87/EC of the European Parliament and of the Council. https://eur-lex.europa.eu/eli/dec_del/2025/318/oj

European Commission. (2025b). The future of European competitiveness: Part A, A competitiveness strategy for Europe. Publications Office of the European Union. Luxembourg. <https://doi.org/10.2872/9356120>

European Commission. (2025c). Proposal for a regulation of the European Parliament and of the Council amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality (COM/2025/524 final) (COM(2025) 524 final). EUR-Lex. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025PC0524&qid=1751704085443>

European Commission. (2026). Clean Industrial Deal - A plan for EU competitiveness and decarbonisation. Directorate-General for Communication. Retrieved 27 May 2026 from https://commission.europa.eu/topics/competitiveness/clean-industrial-deal_en

European Environment Agency. (2025a). Enhancing Europe's land carbon sink: status and prospects (17/2024). Publications Office of the European Union. Luxembourg. <https://doi.org/10.2800/2836317>

European Environment Agency. (2025b). Progress towards national greenhouse gas emissions targets in Europe. Retrieved 12 January 2026 from <https://www.eea.europa.eu/en/analysis/indicators/progress-towards-national-greenhouse-gas?activeAccordion=546a7c35-9188-4d23-94ee-005d97c26f2b>

European Environment Agency. (2025c). Trends and projections in Europe 2025 (TH-01-25-028-EN-N). Luxembourg. <https://doi.org/10.2800/6474400>

European Parliament. (2025). Framework for achieving climate neutrality - Amendments adopted by the European Parliament on 13 November 2025 on the proposal for a regulation of the European Parliament and of the Council amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality (COM(2025)0524 – C10-0137/2025 – 2025/0524(COD)) (P10_TA(2025)0262). Strasbourg. [https://www.europarl.europa.eu/RegistreWeb/en/search/simpleSearchHome.htm?references=P10_TA\(2025\)0262&sortAndOrder=DATE_DOCU_DESC](https://www.europarl.europa.eu/RegistreWeb/en/search/simpleSearchHome.htm?references=P10_TA(2025)0262&sortAndOrder=DATE_DOCU_DESC)

European Parliament and the Council of the European Union. (2003). Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission

allowance trading within the Community and amending Council Directive 96/61/EC (Text with EEA relevance). <https://eur-lex.europa.eu/eli/dir/2003/87/oj/eng>

European Parliament and the Council of the European Union. (2018a). Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU. <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32018R0841>

European Parliament and the Council of the European Union. (2018b). Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement (Effort Sharing Regulation). <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32018R0842>

European Parliament and the Council of the European Union. (2021). Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), OJ L 243. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119>

European Parliament and the Council of the European Union. (2023a). Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast). <https://eur-lex.europa.eu/eli/dir/2023/1791/oj/eng#>

European Parliament and the Council of the European Union. (2023b). Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652. <https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng>

European Parliament and the Council of the European Union. (2023c). Regulation (EU) 2023/851 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2019/631 as regards strengthening the CO₂ emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R0851>

European Parliament and the Council of the European Union. (2024). Regulation (EU) 2024/3012 of the European Parliament and of the Council of 27 November 2024 establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products. <http://data.europa.eu/eli/reg/2024/3012/oj>

European Parliament and the Council of the European Union. (2026). Regulation (EU) 2026/667 of the European Parliament and of the Council of 11 March 2026 amending Regulation (EU) 2021/1119 as regards the setting of a Union intermediate climate target for 2040. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202600667

European Scientific Advisory Board on Climate Change. (2023). Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030–2050. <https://doi.org/10.2800/609405>

European Scientific Advisory Board on Climate Change. (2024). Towards EU climate neutrality: Progress, policy gaps and opportunities. Luxembourg. <https://doi.org/10.2800/73564>

European Scientific Advisory Board on Climate Change. (2025a). Scaling up carbon dioxide removals: Recommendations for navigating opportunities and risks in the EU. Luxembourg. <https://data.europa.eu/doi/10.2800/3499931>

- European Scientific Advisory Board on Climate Change. (2025b). Scientific advice for amending the European Climate Law - Setting climate goals to strengthen EU strategic priorities. Publications Office of the European Union. Luxembourg. <https://doi.org/10.2800/1978453>
- Eurostat. (2026). Energy import dependency by products (sdg_07_50). https://doi.org/10.2908/sdg_07_50
- Fallasch, F., Böttcher, H., Schneider, L., Herrmann, H., Jörß, W., Anne, S., Flohr Reija, M., & Meyer-Ohlendorf, N. (2024). The EU Carbon Removal Certification Framework: Options for using certified removal units and funding mitigation activities (44/2024). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7524>
- Förster, H., Repenning, J., Borkowski, K., Braungardt, S., Bürger, V., Cook, V., Emele, L., Görz, W. K., Haller, M., Hennenberg, K., Jörß, W., Kasten, P., Koch, M., Ludig, S., Mendelevitch, R., Moosmann, L., Nissen, C., Scheffler, M., Steinbach, I., . . . Vos, C. (2025). Treibhausgas-Projektionen 2025 für Deutschland (Projektionsbericht 2025). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7906>
- Forster, P. M., Smith, C., Walsh, T., Lamb, W. F., Lamboll, R., Cassou, C., Hauser, M., Hausfather, Z., Lee, J.-Y., Palmer, M. D., von Schuckmann, K., Slangen, A. B. A., Szopa, S., Trewin, B., Yun, J., Gillett, N. P., Jenkins, S., Matthews, H. D., Raghavan, K., . . . Zhai, P. (2025). Indicators of global climate change 2024: Annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, 17(6), 2641-2680. <https://doi.org/10.5194/essd-17-2641-2025>
- Görlach, B., & Zelljadt, E. (2018). Forms and channels of carbon leakage (16/2018). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-2586>
- Graichen, J., Gores, S., Böttcher, H., Schumacher, K., Kasten, P., & Schneider, L. (2025). The EU's 2040 climate target - Assessment of the proposal by the European Council [Policy Brief]. Ö.-I. (ed.). <https://www.oeko.de/fileadmin/oekodoc/PB-Council-2040-target.pdf>
- Graichen, J., & Ludig, S. (2024). Supply and demand in the ETS 2: Assessment of the new EU ETS for road transport, buildings and other sectors (09/2024). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-2593>
- Graichen, J., Skribbe, R., Gores, S., Lauer, S., & Hennenberg, K. (2025). The EU ETS and the 2040 Climate Target. Öko-Institute (ed.). <https://www.oeko.de/en/publications/the-eu-ets-and-the-2040-climate-target/>
- Intergovernmental Panel on Climate Change. (2022). Global warming of 1.5°C: IPCC special report on impacts of global warming of 1.5°C above pre-industrial levels in context of strengthening response to climate change, sustainable development, and efforts to eradicate poverty. Cambridge University Press. <https://doi.org/10.1017/9781009157940>
- Lanz, R., Gibis, C., Purr, K., & Weiß, J. (2023). Setting an ambitious EU climate target for the year 2040 - Recommendations by the German Environment Agency (Scientific Opinion Paper). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-3816>
- Lekavičius, V., Balsiūnaitė, R., Bobinaitė, V., Konstantinavičiūtė, I., Rimkūnaitė, K., Štreimikienė, D., & Tarvydas, D. (2024). The diversification of energy resources and equipment imports in the European Union. *Energy*, 307, 132595. <https://doi.org/10.1016/j.energy.2024.132595>
- Lessmann, K., Gruner, F., Kalkuhl, M., & Edenhofer, O. (2026). Emissions trading with clean-up certificates: How carbon debt can increase climate ambition levels. *Journal of Environmental Economics and Management*, 137, 103307. <https://doi.org/10.1016/j.jeem.2026.103307>
- Lübbers, S., Lengning, S., Muralter, F., Kulkarni, P., Krob, F., Köhler, A. R., & Jörß, W. (2026). Techno-ökonomische Analyse von CO₂-Entnahmetechnologien und Bewertung der CO₂-Speicherkapazitäten und -Projekte in Europa (02/2026). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7960>

- Lünenbürger, B., Purr, K., & Schultz, K. (2023). Ambitionierter Klimaschutz: Fallstricke und Bedingungen des Gelingens (04/2023). (Climate Change). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-2606>
- négaWatt Association. (2023). Climate neutrality, energy security and sustainability: A pathway to bridge the gap through sufficiency, efficiency and renewables. Paris, France. https://clever-energy-scenario.eu/wp-content/uploads/2023/10/CLEVER_final-report.pdf
- OECD, & UNDP. (2026). Investing in climate for growth and development: The case for enhanced NDCs. Paris. <https://doi.org/10.1787/16b7cbc7-en>
- Pagel, M., Schultz, K., Pfeiffer, D., Voß-Stemping, J., Steinbrenner, J., Lünenbürger, B., Lange, M., Lambrecht, M., Hölting, P., Kleemann, J., Kahrl, A., Balzer, F., Sorg, D., Schwetje, A., Obermaier, N., Purr, K., Werlein, M., Herbener, R., Weyland, M., & Umweltbundesamt. (2025). Bis 2040 Treibhausgase um mindestens 90 Prozent mindern – So kann es gehen! (Position). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-8262>
- Pahle, M., Günther, C., Feindt, S., & Edenhofer, O. (2025). Wie weiter mit dem ETS2? Vorschläge und Erwägungen zur Stärkung der Glaubwürdigkeit. Konrad-Adenauer-Stiftung e. V. <https://www.kas.de/documents/252038/33607021/Wie+weiter+mit+dem+ETS2.pdf>
- Pahle, M., Quemin, S., Osorio, S., Günther, C., & Pietzcker, R. (2025). The emerging endgame: The EU ETS on the road towards climate neutrality. *Resource and Energy Economics*, 81, 101476. <https://doi.org/10.1016/j.reseneeco.2024.101476>
- Purr, K., & Spindler, J. (2023). Carbon Capture and Storage (CCS) - Diskussionsbeitrag zur Integration in die nationalen Klimaschutzstrategien. Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-3631>
- Purr, K., Voß-Stemping, J., & Schultz, K. (2025). Treibhausgasneutralität und die Ziele der natürlichen Kohlenstoffsенke sind noch erreichbar (Fact Sheet). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7880>
- Rickels, W., Proelß, A., Geden, O., Burhenne, J., & Fridahl, M. (2021). Integrating Carbon Dioxide Removal Into European Emissions Trading. *Frontiers in Climate*, 3. <https://doi.org/10.3389/fclim.2021.690023>
- Scheffler, M., Wiegmann, K., Lakner, S., Sommer, P., & Meyer-Jürshof, M. (2022). How much climate action is offered in the first pillar of the CAP? An analysis and policy recommendations (Fact Sheet). Umweltbundesamt (ed.). <https://doi.org/10.60810/openumwelt-3217>
- Schrems, I., Fiedler, S., Zerkawy, F., & Hecker, J. (2023). Introduction of an emissions trading system for buildings, road transport, and additional sectors in the EU (Fact Sheet). Umweltbundesamt (ed.). <https://doi.org/10.60810/openumwelt-3267>
- Schwab, T., Hagemann, S., Többen, J., Rhoden, I., Venghaus, S., & Linßen, J. (2026). Heating Up Inequality?: Socio-spatial impacts of ETS2 on European housing and cohesion. Bertelsmann Stiftung (ed.). Gütersloh. <https://doi.org/10.11586/2025112>
- Transport & Environment. (2024). National climate targets off track: Six years left to course correct and avoid penalties (Briefing). [https://uploads.transportenvironment.org/production/files/National climate target off track 07 2024.pdf?dm=1727707277](https://uploads.transportenvironment.org/production/files/National%20climate%20target%20off%20track%2007%202024.pdf?dm=1727707277)
- Tsekeris, D., & Karjalainen, J. (2024). Paris Agreement compatible scenarios (PAC) 2.0: Executive summary. Climate Action Network Europe (ed.). Brussels. <https://caneurope.org/content/uploads/2024/09/PARIS-AGREEMENT-COMPATIBLE-SCENARIO-2024.pdf>

Umweltbundesamt. (2018). Re-aligning European Union's climate policy to the Paris Agreement - Short-term implications of the IPCC Special Report "Global warming of 1.5°C". <https://doi.org/10.60810/openumwelt-3599>

Umweltbundesamt. (2020, 15.06.2020). Kernenergie und Reaktorsicherheit. Retrieved 10 January 2026 from <https://www.umweltbundesamt.de/themen/klima-energie/energieversorgung/kernenergie-reaktorsicherheit>

Umweltbundesamt. (2024, 07.06.2024). Naturbasierte Lösungen für den Klima- und Biodiversitätsschutz. Retrieved 15 February 2026 from <https://www.umweltbundesamt.de/naturbasierte-loesungen-fuer-den-klima>

Umweltbundesamt. (2026). Carbon Dioxide Removal: Klimapolitische Einordnung, rechtliche Vorgaben und Anforderungen aus Nachhaltigkeitsperspektive zu CO₂-Entnahmen aus der Atmosphäre [Unpublished manuscript].

United Nations Environment Assembly. (2022). Resolution adopted by the United Nations Environment Assembly on 2 March 2022 - Nature-based solutions for supporting sustainable development (UNEP/EA.5/Res.5). United Nations Environment Programme (ed.). Nairobi, Kenya. <https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content>

Wiegmann, K., Scheffler, M., Schneider, C., Lakner, S., Sommer, P., & Meyer-Jürshof, M. (2023). Klimaschutz in der GAP 2023 - 2027 - Wirkungsbeitrag und Ausgaben 2. Auflage (103/2022). (Texte). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-6320>

Winkler, K., & Biewald, A. (2025). A future-oriented Cohesion Policy post 2027 (Scientific Opinion Paper). Umweltbundesamt (ed.). Dessau-Rosslau. <https://doi.org/10.60810/openumwelt-7956>

Yu, B., Zhao, Q., & Wei, Y.-M. (2021). Review of carbon leakage under regionally differentiated climate policies. *Science of The Total Environment*, 782, 146765. <https://doi.org/10.1016/j.scitotenv.2021.146765>