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Reform of the EU ETS 1 and accompanying instruments:

A policy mix for the decarbonisation of industry

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Summary

The reforms to the European Union's Emissions Trading System (EU ETS 1) for the energy sector, energy-intensive industries, and aviation and maritime transport, due to take place in 2026, must address two key aspects in particular. The provisions of the EU ETS 1 must be adapted to the new framework set by the legally-binding climate targets for 2040 and 2050. As a central pillar of the EU's climate policy, the EU ETS 1 is of particular importance in this context. Furthermore, the reform of the EU ETS 1 must strike a new balance between climate protection and industrial competitiveness and the capacity for transformation. The EU ETS 1 should achieve emissions reductions primarily through investment in climate-neutral technologies rather than through the relocation of production. It should be borne in mind that transformation profiles and rates may vary between sectors and companies. Investments that have already been made require planning certainty. In other areas, infrastructural, regulatory and economic conditions must first be established. During transitional phases, the co-existence of conventional and transformative production processes – which is closely linked to industry modernisation cycles – must also be taken into account.

As emissions reductions in the energy sector advance, the focus of the EU ETS 1 is increasingly shifting towards energy-intensive industry. However, as an instrument for greenhouse gas pricing and for highlighting clear transformation pathways, the EU ETS 1 is not sufficient on its own to ensure the far-reaching transformation of industry needed for climate neutrality. Rather, a coherent policy mix of CO_2 pricing and accompanying measures is required. These include, in particular, technology-specific support instruments for electrification, hydrogen and carbon capture and storage (CCS), which address both investment and operating costs. Contracts for Difference, infrastructure development and measures to reduce electricity system costs are key elements of the necessary policy mix. The establishment of lead markets can also create reliable demand for climate-neutral basic materials, at least in some sectors and through a phased approach.

Maintaining and cautiously expanding the scope. It seems sensible to expand the scope of the EU ETS 1 to include, for example, waste management and the indirect emissions from aviation. More far-reaching changes (e.g. with regard to the EU ETS 2 or sinks) or the opt-out of sectors or installations are not currently recommended due to high systemic risks.

Aligning the cap and the Market Stability Reserve (MSR) with the 2040 target. With a view to individual regulations, particular attention must be paid to the relevant diverse interdependencies. First of all, the emissions pathway must be harmonised with the EU's climate targets. In the short term, the continued ambitious emissions reductions of the energy sector should be taken into account and the current linear reduction factor should be maintained. From 2036 at the latest, a flattening of the trajectory is compatible with the 2040 climate target and is necessary to take account of the constraints on the industrial sector's transition. Market liquidity should be safeguarded by reforming the MSR to create a considerably more responsive mechanism. However, the fundamentally volume-based approach of the MSR should not be altered.

Integrating international carbon credits and offsets only through government channels. The integration of flexibility options – in particular international carbon credits under Article 6 of the Paris Agreement and offsets for carbon sinks – should take place at a central level, e.g. by means of cap adjustments or the MSR, in order to preserve the integrity of the ETS market.

Reforming free allocation as a comprehensive package. Further recommended adjustments relate to the free allocation of emission allowances. The existing roll-over mechanism of the benchmark system is not fit for the future and should be supplemented by a simplified and largely uniform linear mechanism. The introduction of fallback benchmarks suitable for industrial heat applications is also recommended. In view of the existing uncertainties, risks and, in some cases, counterproductive effects relating to the Carbon Border Adjustment Mechanism (CBAM), the time required for necessary adjustments, and the fact that a suitable model for taking exports into account within CBAM has yet to be established, the CBAM-related reductions in free allocation should be frozen for several years.

Using ETS revenues for transforming industry. The EU ETS 1 is not only an incentive mechanism for emissions reductions but also generates fiscal revenue through the auctioning of emission allowances. The use of these revenues should be strictly earmarked. The loss of revenue, primarily due to extending free allocation in the context of CBAM, leads to a substantial decrease in funding for EU programmes supporting industry transformation. However, the extended free allocation primarily serves to offset competitive disadvantages and can therefore only be regarded to a limited extent as additional investment capital available to companies. Such an allocation would, however, be entirely justifiable in the context of carbon leakage structures – that is, with regard to the ratio of operational to investment leakage.

Ensuring protection against carbon leakage. CBAM has created a new instrument, the effectiveness of which, however, still needs to be empirically validated and, where necessary, improved. For the EU ETS 1 to continue to be a central element of the EU's climate policy, it is of paramount importance that CBAM is maintained and further developed as a robust mechanism. Nevertheless, complementary instruments such as the basic materials surcharge or the carefully assessed use of trade policy instruments can also play an important role.

Creating the conditions for transformation investments. A range of complementary instruments (companion policies) is required to support the transition of industry towards climate neutrality. These primarily concern the provision of cost-effective electricity for industrial electrification (electricity price compensation, industrial electricity price), as well as the ramp-up of the hydrogen and CCS markets. Long-term Carbon Contracts for Difference for hydrogen and for CCS, along with accelerated infrastructure development (hydrogen network, CO_2 transport and storage infrastructure), are key instruments for this. The demand side can be stimulated through green lead markets. Depending on the sector, these tend to be public procurement (particularly for certain building materials such as cement) or private demand signals (for steel and other metals). In the short term, lead markets will primarily involve affordable and readily available CO_2-reduced raw materials such as low-clinker composite cements or secondary steel produced using green electricity. The actual near-zero technologies, such as direct reduced iron (DRI) steel or CCS cement, will only come on to the market in significant quantities at a later stage, but must be addressed at an early stage.

Finally, it should be emphasised that climate policy instruments alone will not be sufficient to safeguard the competitiveness of European industry in the current geopolitical and geo-economic environment. External factors such as international subsidy regimes, exchange rate developments and rising protectionism are creating considerable pressure to adapt. A successful transition therefore requires the EU ETS 1 to be supported by a coherent industrial and trade policy that ensures industrial value creation remains in Europe.

Table of contents

1. Introduction and objectives 13

2. German and European industry in the face of global upheavals 15

2.1. Current economic situation 15

2.2. Industry under pressure 16

2.3. Broader framework conditions as the basis for transformation 16

2.4. Co-existence of conventional and transformative industrial processes as a specific challenge 19

3. The current framework for the reform of the European Union's Emissions Trading System (EU ETS) 21

3.1. The EU's climate policy architecture and the role of the EU ETS 1 21

3.2. The EU ETS for the energy sector, energy-intensive industry, and air and maritime transport (EU ETS 1) 24

3.3. The emission-side quantitative architecture of the EU ETS 1 under current legislation 27

3.4. Free allocation in EU ETS 1 29

3.5. The revenue generated from auctions and its use 30

4. Adjusting the scope of the EU ETS 1 33

4.1. Introductory remarks 33

4.2. Expansion of the scope of the EU ETS 1 33

4.3. Merger of the EU ETS 1 and EU ETS 2 36

4.4. Linking emission trading systems 38

4.5. Exclusion of industrial sectors and opt-out provisions 39

5. Emissions cap and Market Stability Reserve 40

5.1. Introductory remarks 40

5.2. Adjustment of the Linear Reduction Factor 43

5.3. Adjustments of the Market Stability Reserve 45

5.3.1. Background to the MSR 45

5.3.2. Revised calculation of the Total Number of Allowances in Circulation (TNAC) 46

5.3.3. Changes to cancellation rules for Market Stability Reserve 47

5.3.4. Combining a revised LRF with adjustments to the MSR 49

5.3.5. Auctions of remaining NER allowances to finance the Industrial Decarbonisation Bank's Investment Booster 51

5.3.6. Replenishment of the Market Stability Reserve 52
5.4. Conclusion and recommendations 53

6. Price management 54
6.1. Introductory remarks 54
6.2. Cost Containment Reserve and price control via the MSR 55
6.3. Price corridors 57

7. Making compliance more flexible 58
7.1. Introductory remarks 58
7.2. International carbon credits 58
7.3. Removal credits 61

8. Border adjustment mechanisms 65
8.1. Introductory remarks 65
8.2. Carbon Border Adjustment Mechanism 66
8.3. Climate contribution on basic materials 71
8.4. General tariff policy 74

9. Free allocation 76
9.1. Introductory remarks and overview 76
9.2. Basic approach to free allocation in EU ETS 1 78
9.3. Adjustment of benchmarks 79
9.3.1. Introduction and general methodology 79
9.3.2. The specific problem of fallback benchmarks 86
9.4. Conclusion: The development of provisional allocation quantities 91
9.5. Allocation reductions based on the Cross-Sectoral Correction Factor 93
9.6. Reduction in free allocation based on the CBAM factor 95
9.7. Conclusion: Interactions between the various reform options 100
9.8. Investments in the context of higher free allocations 103
9.9. Conclusion, options for action and recommendations 107

10. In focus: revenue frontloading to finance the Investment Booster 110

11. Accompanying policies for industrial transformation 111
11.1. Introductory remarks 111
11.2. Funding 112
11.3. Green lead markets 113

11.4. Investment support 119
11.5. Operating cost support 120
11.5.1. Introduction 120
11.5.2. Electricity price compensation 120
11.5.3. Industrial electricity price 123
11.5.4. Hydrogen support 125
11.5.5. CCS support 130
12. Summary and outlook 135
13. References 139
13.1. Literature 139
13.2. Further legislation 151

List of figures

Figure 3-1:	Architecture of EU climate policy	23
Figure 3-2:	Development of the EU ETS 1	25
Figure 3-3:	Trends in spot prices for EU ETS 1 emission allowances and key exogenous developments, events and reforms of the EU ETS 1	26
Figure 3-4:	Cap and emissions trends in the EU ETS 1	27
Figure 3-5:	Trends in MSR parameters and volumes	29
Figure 3-6:	Trends in free allocation and auctions under EU ETS 1 (stationary sector)	30
Figure 3-7:	Fiscal revenue from the EU ETS 1, the nETS and the EU ETS 2 for Germany	31
Figure 5-1:	Target-compatible emission scenarios 2030–2040	42
Figure 5-2:	Historical EU ETS emissions and emission scenarios 2013–2040	42
Figure 5-3:	Options for adjusting the LRF that are compatible with 90 %, 88 % and 85 % net climate targets for 2040	44
Figure 5-4:	Trend in TNAC visible to the market following adjustment of TNAC calculation	47
Figure 5-5:	Trend in TNAC visible to the market following an adjustment to TNAC calculation, and without cancellation of allowances in MSR from 2026 onwards	48
Figure 5-6:	Trend in the TNAC visible to the market following an adjustment to the TNAC calculation, excluding the cancellation of allowances in the MSR and with an LRF of 1.4 % from 2036	49
Figure 5-7:	EUA supply and demand based on the reform package, 2031–2040	50
Figure 7-1:	A taxonomy of the risks of international carbon credits	59
Figure 9-1:	Distribution of specific emission values for the various plant groups	80
Figure 9-2:	Comparison of annual changes in emission intensities for the top 10 % of installations in each installation group with product benchmarks	82
Figure 9-3:	Decrease in benchmark values for the 2021-2025 and 2026-2030 allocation periods compared with the 2013-2020 baseline values	83
Figure 9-4:	Example reduction in benchmark values for 2031–2035 allocation period compared with 2013–2020 baseline values under current legislation and proposed alternative option	85
Figure 9-5:	Benchmarking curve for fallback benchmarks	87
Figure 9-6:	Adjustment factors for product-specific benchmarks in the chemicals industry and the fallback benchmarks	89

Figure 9-7:	Trend in provisional allocation quantities	92
Figure 9-8:	Development of CBAM factor across the different variants and resulting effects on revenue for the Innovation Fund	98
Figure 11-1:	Trend in payments made under the electricity price compensation scheme in Germany	122
Figure 11-2:	Comparison of expected price levels for electricity procurement without (future) and with relief (industrial electricity price) and relief for eligible companies	124
Figure 11-3:	Total costs of reducing CO_2 emissions by substituting hydrogen for natural gas	126
Figure 11-4:	Action areas of the necessary policy mix to support the hydrogen ramp-up	127
Figure 11-5:	Current commissioning plans for a hydrogen core network and geographical distribution of anchor customers	128
Figure 11-6:	Total costs of CO_2 emissions reduction as a function of the costs of capture as well as transport, transfer and storage of CO_2	131
Figure 11-7:	Action areas of necessary policy mix for CCS ramp-up	132
Figure 11-8:	Structures of a prospective CO_2 network in Germany in 2045	133

List of tables

Table 5-1:	Target trajectories in the EU climate policy architecture	41
Table 6-1:	Analyst estimates for future allowance price levels	55
Table 8-1:	Goods covered by CBAM by category	67
Table 8-2:	EC proposal to expand the range of goods covered by CBAM from 2028, arranged by category	68
Table 8-3:	Different options for designing climate contributions	72
Table 9-1:	Options for the allocation of emission allowances and distortions of the price signal (pyramid of distortions)	77
Table 9-2:	Development of fallback benchmarks to date	88
Table 9-3:	Proposal for further development of fallback benchmark for heat from 2026	90
Table 9-4:	Effects of different variants for cap and benchmark development on CSCF	93
Table 9-5:	Effects of different variants for developing the cap and the benchmarks on the CSCF, taking the CBAM factor into account prior to determining the CSCF	99
Table 9-6:	Example effects of different variants for developing the cap, the benchmarks and the CBAM factor on free allocation	101
Table 9-7:	Change in quantities of allowances available for auctioning under the various reform variants	102
Table 9-8:	Changes in auction revenues as a result of the various reform options	104
Table 11-1:	Impact and suitability of green lead markets by sector or product	118

1. Introduction and objectives

Over two decades after the launch of the European Union's Emissions Trading System for the energy sector, energy-intensive industries and air and maritime transport (EU ETS 1), a fundamental overhaul of the system is now on the agenda. This is not the first major revision of the EU ETS 1, which was designed to undergo frequent review and revision and is organised into trading periods. As with the previous three trading periods, many regulations will need to be adapted for the fifth trading period (2031–2040).

Three different dimensions are of central importance for these adaptations. Firstly, the system must be adapted to the interim target of the EU's climate policy, which has now been enshrined in law. Secondly, substantial emission reductions have been achieved within the scope of EU ETS 1 in recent decades. These will shift the focus of future emission reductions from the energy sector to industry in the years ahead. This necessitates taking account of the prevailing framework conditions in these sectors, while also safeguarding the economic framework for investments already made or initiated in the energy sector and industry. Thirdly, the economic and political framework conditions for European industry, as well as the transformation of European industry, have changed significantly in recent years. The European economy and society are now facing new challenges.

Last but not least, the EU ETS 1 has developed into a relatively complex instrument over the past two decades. It is also of central importance to the overarching architecture of the EU's climate policy, and is thus more than just a specific implementation tool for greenhouse gas pricing.

Against this backdrop, the present study discusses the forthcoming reforms in broad terms, covering their various and often interdependent aspects. This includes presenting and documenting the current status and guiding principles of the complex regulations, discussing the various reform options, and formulating corresponding recommendations. It also involves outlining the EU ETS 1 companion policies and their justification. A holistic approach is adopted for all analyses, taking into account economic, legal, political and other aspects of the reform options.

The analysis begins with an overview of the current framework conditions and challenges facing German and European industry. These are of central importance to the reform of the EU ETS, though not exclusively so (chapter 2). As another starting point for assessing the specific reform options, a comprehensive overview of the current state of development of the EU ETS 1 in its various facets is provided in chapter 3.

One of the first areas of reform for the EU ETS 1 concerns the framework conditions for the system as a whole. This includes, above all, the scope of application, with both expansion and reduction options under discussion (chapter 4). Comprehensive analyses of the volume of emission allowances allocated to the system (the EU ETS 1 cap) are provided in chapter 5.2. The future design of the MSR – through which emission allowances are temporarily removed from the market, with some cancelled and some returned to the market at a later date – is also analysed in detail (chapter 5.3).

Looking beyond the planning of the cap on allowances under the EU ETS 1, chapter 6 examines the various options for price management approaches within the system.

Chapter 7 covers a topic in which the planning of the allowance cap and the obligation to surrender allowances in line with the quantities of greenhouse gases emitted under the EU ETS 1 intersect – the introduction of flexibility into compliance by way of, for example, international carbon credits and carbon removals.

The EU ETS 1 functions as a European system within the broader context of international competition and significant variations in greenhouse gas pricing. The purpose of border adjustment mechanisms is to address carbon leakage and broader aspects beyond this (chapter 8).

With a view to the various reform options, Chapter 9 examines the highly complex and multifaceted regulations governing the free allocation of emission allowances in the EU ETS 1. This mechanism is designed to combat carbon leakage and is associated with substantial distributional effects within industry.

An in-depth analysis of the early mobilisation of additional investment funds through auctions under the EU ETS 1 is also offered (chapter 10).

In detailed supplementary analyses, the measures needed with a view to industrial transformation are discussed, both independently of and in conjunction with the EU ETS 1 (companion policies) (chapter 11). These range from green lead markets (chapter 11.3), support for transformation investments (chapter 11.4) and operating cost support (chapter 11.5), through to options for supporting industrial electrification with low-cost electricity (chapters 11.5.2 and 11.5.3), the policy mix to support the hydrogen ramp-up (chapter 11.5.4) and packages of measures to establish carbon capture and storage as a key option for parts of industry in the transition to climate neutrality (chapter 11.5.5).

In the concluding chapter, all the preceding analyses are summarised and concise recommendations are formulated (chapter 12).

2. German and European industry in the face of global upheavals

2.1. Current economic situation

In 2026, the global economy is under considerable pressure. The war in the Middle East is creating additional risks for the global economy that are difficult to quantify. The de facto blockade of the Strait of Hormuz — a vital sea route for energy supplies and the trade of processed goods — and damage to production plants is causing new supply bottlenecks and affecting energy prices at producer and consumer levels. Combined with the ongoing consequences of the war in Ukraine, industrial supply chains and production capacities worldwide are under strain. Inflation is rising and growth is slowing: the global economy is expected to grow by just 2 % in 2026, while global trade in goods is forecast to expand by only 1.7 % (Bardt et al. 2026). However, the forecast remains subject to a high degree of uncertainty, as the actual impacts depend largely on the duration of the conflict. A political solution can, at best, be treated as an assumption, not as a reliable forecasting variable.

Germany finds itself in this complex situation amidst an already tense climate. The existing pressures caused by the war in the Middle East and the supply and production disruptions expected throughout the year mean that price- and working-day-adjusted gross domestic product (GDP) will barely move during 2026. The annual average growth in real GDP of approx. 0.4 % is largely due to a positive calendar effect (Bardt et al. 2026). Exports continue to decline as a result of the global slowdown, and private-sector investment is failing to gain momentum. The renewed surge in energy prices is driving the inflation rate up to an annual average of approx. 3 % and causing private consumption to stagnate (Bardt et al., 2026). Domestic demand is primarily driven by increasing government spending and defence investment. Against a backdrop of rising expenditure and a weak economy, the German government is expected to post a deficit of an estimated EUR 156 billion (3.4 % of GDP) in 2026. Meanwhile, the number of people in employment has fallen by around 190,000, while unemployment has risen slightly to around 3 million (Bardt et al. 2026).

This cyclical weakness is rooted in a structural issue. The German business model, which is characterised by an industry-based structure complemented by services and oriented towards exports and regional balance, is currently under considerable pressure (Hüther, 2025). Since 2018, industrial production has been contracting and gross value added has stagnated. At the same time, the German economy can no longer benefit from the global economy to the same extent as before. This is due to declining price competitiveness and waning innovation leads, coupled with mounting geopolitical risks. The situation is exacerbated by insufficient private and public investment. Government investment, in particular, lags substantially behind international benchmarks, meaning infrastructure is becoming obsolete and necessary modernisation is failing to materialise. This puts pressure on productivity and growth prospects at a time when climate policy necessitates structural change by 2045.

The economic policy response to these challenges should, first and foremost, be clearly focused on improving supply-side conditions. This involves increasing investment and innovation. To achieve this, targeted investment incentives are required, alongside reduced regulation, a lower tax burden on companies, and reforms to electricity prices and social security contributions. These policies must take into account key framework

conditions, such as demographic change, the path to climate neutrality, and geopolitical uncertainties arising from a reorientated defence policy.

2.2. Industry under pressure

Industry is a cornerstone of the German economy. It accounts for around one-fifth of the gross value added and employs around 16 % of the total workforce (BCG; BDI; IW 2024). By contrast, in the US, industry accounts for just 11 % of value added and 10 % of the workforce (BCG; BDI; IW 2024). Including the industrial services sector — that is, services used in industry, such as trade and logistics — the core industrial sector accounts for approx. a third of gross value added.

However, its growth momentum has recently slowed noticeably. Following the challenging period of the Covid-19 pandemic, the energy crisis in particular caused production in energy-intensive sectors to slump. This occurred at the end of a period during which investment in improving the business environment had already stagnated for some time. Furthermore, the vast majority of investment is directed towards replacing existing assets. The proportion of investment going towards new capacity and products is well below the EU average (EIB 2025a).

Since the energy crisis, rising energy costs have exacerbated traditional cost disadvantages in terms of wages, taxes and levies to such an extent that previous locational strengths, such as high productivity and innovative capacity, can no longer offset them. Germany now lags behind relevant competitors such as the USA and China in around two-thirds of the key locational indicators (BCG; BDI; IW 2024).

Unlike previous crises, the current weakness is structural in nature, with several pillars of Germany's past industrial success beginning to falter simultaneously. Russia's war of aggression has brought an end to the era of cheap fossil gas imports for the foreseeable future. Demographic change is transforming the traditionally strong labour supply and pool of skilled workers into a shortage, and decades of technological advances, such as those in combustion engine technology, are losing their significance. Overall, around one-fifth of industrial value added is at risk in the medium term, primarily due to high energy costs and shrinking markets for Germany's traditional technologies (BCG; BDI; IW 2024).

2.3. Broader framework conditions as the basis for transformation

A country's competitiveness is determined by a range of factors, including economic conditions, innovation strength and structural framework conditions. Alongside an appropriate mix of policy instruments, these framework conditions play a decisive role in the success of the impending industrial transformation (EFI 2024). Five of these are particularly relevant.

Bureaucracy and approval procedures

Companies complain about high bureaucratic burdens. At the start of 2024, information obligations under national law alone cost around EUR 66.5 billion annually, with bureaucracy-related expenditure accounting for between 1 % and 5 % of annual turnover, depending on company size. This fixed-cost nature hits smaller companies particularly hard (BCG; BDI; IW 2024). In a business survey conducted by the German Economic Institute

(IW), 85 % of companies cited regulation and bureaucracy as a barrier to productivity, with 61 % describing it as a major barrier (Bardt and Grömling 2025). New and, in some cases, overlapping reporting and documentation requirements, such as those arising from supply chain legislation, as well as increasingly complex application procedures, tie up staff resources. This issue is exacerbated by the 'gold-plating' of EU requirements at a national level.

The duration of these procedures also has a serious impact. Although the time taken to obtain environmental permits for wind turbines has fallen in recent years, it still averages over 16 months (FA WS 2026). The construction of a new 30-kilometre stretch of national railway, meanwhile, takes an average of 23 years from the preliminary planning to opening (Deutscher Bundestag 2021). This is due to complex technical specifications, the authorities' need for a high level of legal safeguards and insufficient digitisation of administrative processes; individual procedures involve up to 25 authorities. Significantly faster digitisation, accelerated procedures and a paradigm shift towards dismantling inefficient regulation are therefore needed. Currently, depending on the individual federal state, the proportion of digitised administrative procedures ranges from 15 % to 43 % (Büchel et al. 2026).

Transport infrastructure

Germany's infrastructure has long since ceased to be a flagship feature of the country. While the country has benefited from a reliable electricity supply and a dense road network, there is a growing backlog in digital infrastructure, as well as in the road and rail networks. According to the national government, the rail network has accumulated an investment shortfall of EUR 90 billion over the past few decades. Dilapidated signal boxes, points, and bridges require extensive refurbishment. In 2023, around 35 % of long-distance trains and 30 % of freight trains were running late (Deutscher Bundestag 2024a). The road network is also deteriorating, with over 4,000 of the approx. 28,000 motorway bridges in urgent need of refurbishment. In a global infrastructure comparison, Germany still ranks 13th (IMD 2026). Added to this is the considerable need for modernisation of the waterways, given that a fifth of the locks on national waterways were built before 1900. The consequences are clearly felt in day-to-day business operations: in a recent survey conducted by the German Economic Institute (IW) in spring 2025, 84 % of companies reported being regularly affected by infrastructure deficiencies – an increase of almost 5 percentage points since 2022 – with roads and railways causing the greatest problems (Puls et al. 2025).

Digitalisation and artificial intelligence (AI)

The quality of digital infrastructure is now one of the key prerequisites for companies to be competitive and, consequently, for business locations to be attractive (Engels et al. 2025). In particular, high-performance broadband and mobile networks enable the use of digital applications and data-driven business models. This applies not only to digital sectors such as e-commerce, streaming and data centres, but increasingly also to traditional economic sectors that are adopting digital solutions, e.g. in logistics, production and maintenance.

For the upcoming AI-driven transformation, Germany needs a comprehensive digitalisation drive, particularly with a view to expanding telecommunications networks, improving education and research, and AI-capable computing and server capacities. In terms of

fibre-optic rollout, the country ranked second-last in the EU in 2023, with only 30 % coverage — well below the average of 64 %. However, the rollout has recently gained momentum, with household coverage doubling from 18 % to 36 % between mid-2022 and mid-2024 (BNetzA 2025a). The record is less impressive when it comes to the digitalisation of public administration. Despite the German Online Access Act, which was passed in 2017 and defines 575 administrative services (Deutscher Bundestag 2024b), only 29 % of these services were available online nationwide in spring 2025, with significant variations between the federal states. Furthermore, the Act merely translates these services from analogue to digital form without simplifying the underlying processes (Küper et al. 2025). What is needed are modernised, interconnected registers in line with the 'once-only' principle, for which Germany currently ranks second-last among EU Member States (EC 2024e). Finally, companies themselves must take responsibility: in 2024, around one in five companies used AI, slightly above the EU average of 13 % (Eurostat, 2026), with large enterprises adopting AI significantly more frequently than medium-sized enterprises (28 %) and small enterprises (17 %; Destatis 25 November 2024).

Demographics and skilled labour

Demographic change is one of the greatest threats to future industrial growth. By 2030, the number of people of working age is expected to fall by over 5 million compared to 2021, due to the retirement of the baby boomers and the impact of low birth rates (BCG; BDI; IW 2024). The costs are already substantial today, with the skills shortage costing more than EUR 90 billion annually – a figure that is set to rise. The situation is particularly critical for the energy transition. A shortfall of between 600,000 and 750,000 full-time equivalents is expected by 2030, primarily in the construction, metalworking, and electrical trades. This situation is exacerbated by the fact that the education system is currently failing to address this issue. Performance in mathematics, German and the natural sciences has declined, and Germany now only ranks in the middle of the OECD field internationally. This trend can only be reversed through increased investment in education, greater immigration of skilled workers, more extensive use of automation and robotics, and better utilisation of the existing labour potential.

Deglobalisation and geopolitical risks

The German economy, which is heavily export-orientated, is particularly vulnerable to the growing fragmentation of the global economy. US tariff policy remains one of the biggest burdens in this regard. Although the effective tariff rate on US imports fell to around 10 % following the US Supreme Court ruling in February 2026 – thus being only half as high as it had been shortly after 'Liberation Day' in April 2025 (OECD 2026) – the impact on Europe was only marginal, and trade policy uncertainty remains high (Bardt et al., 2026). At the same time, the pandemic, Russia's war of aggression, and geopolitical tensions have exposed the risks of having dependencies in just one place. These risks are particularly pronounced in the case of critical raw materials. For several key materials, Germany sources over 80 % of its imports from just five countries. In the case of graphite, cobalt, manganese, and rare earths, these imports often come from high-risk countries. China frequently ranks among the most important suppliers (BCG; BDI; IW 2024). Added to this is a high degree of dependence on foreign markets for sales, as in key sectors such as chemicals and pharmaceuticals, electrical and digital industries, mechanical and plant engineering, and automotive, where more than half of turnover was generated abroad in 2023, primarily in the US and China. For example, exports to China

have already fallen by almost a quarter between 2022 and 2025. However, this is also due to structural and crisis-induced declines in industrial production (Destatis 20 February 2026). The economic policy debate therefore centres on ‘de-risking’ – the targeted diversification of trade and supply relationships to strengthen the economic sovereignty of Germany and Europe.

2.4. Co-existence of conventional and transformative industrial processes as a specific challenge

As emission reductions in the energy sector have been disproportionately high to date, the emission reductions required under the EU ETS 1 will shift significantly towards industrial emitters in the years ahead. Due to their high volumes of CO_2 emissions, this will primarily affect the basic materials industry.

However, the emission reductions incentivised by the carbon pricing of the EU ETS 1 are encountering plant structures and operational concepts that differ considerably from those in the energy sector, which was previously the focus of emission reductions, particularly in electricity generation. Due to the high short-term volatility of the electricity market and its pricing mechanisms, power plants are operated much more flexibly than traditional industrial plants, particularly in the basic materials industry. Decisions on operation and decommissioning of the production plants, which are often highly capital-intensive, are frequently binary in nature: a utilisation rate of significantly below 80 % is considered critical as this generally falls below the break-even point. Prolonged underutilisation increases the risk of plants having to be taken out of service or even decommissioned entirely.

Furthermore, it can be assumed that cost-effective emission reduction measures are particularly feasible and economically viable when integrated into the modernisation cycles of the respective power plants. While these cycles are influenced by pricing within the EU ETS 1, modernisation cycles of 10 to 20 years must still be taken into account for typical plants in the basic materials industries.

Given these timeframes, the next 10 to 15 years in particular present a new challenge with a view to the necessary modernisation of production processes in industry. It is highly likely that there will be a prolonged period during which conventional power plants will coexist with transformative production processes. In the long term, transformative plant concepts are generally only likely to become profitable if the EU ETS 1 features ambitious price levels. However, in the context of long modernisation cycles, these price levels may simultaneously create incentives for decommissioning at an early stage. This is particularly true given that, in the EU ETS 1, price levels are currently primarily determined by fuel switching costs from coal to natural gas in the electricity sector. In future, they will move more strongly towards the abatement costs of transformative industrial plant concepts, e.g. electrified process heat generation, CCS and hydrogen (chapter 11). Investments in new or adapted production technologies often considerably exceed the scale of typical modernisation investments. At the same time, these funds must generally be financed from the revenues of existing conventional plants. Additionally, switching energy sources or capturing CO_2 emissions will result in higher ongoing operating costs in the short term.

If plants are decommissioned substantially earlier without immediate reinvestment in transformative industrial processes, there is a risk of site closures without replacement.

Such follow-on investments may fail to materialise for various reasons, such as abatement costs remaining too high, investment funds being lacking due to no prospect of profitability for climate-friendly production given higher operating costs, limited capacity in industrial value chains, or the need to avoid concentration risks. Furthermore, subsequent transformation projects will be considerably more difficult if sites are closed, as they will no longer be able to draw on the synergistic benefits of using established sites. Current geopolitical upheavals, the global competitive landscape and upcoming demographic developments will clearly exacerbate this situation.

For the reform of the EU ETS 1 and the development of a more comprehensive policy mix for industrial transformation, it is crucial to appropriately take into account this phase of coexistence of conventional and transformative industrial processes. The associated areas of tension must be addressed in a targeted manner: on the one hand, sufficiently strong incentives are needed to encourage companies to switch to transformative, climate-neutral industrial processes. On the other hand, conventional industrial plants should not be forced out of the market prematurely by overly strong price signals, before the necessary conditions have been created and transformative follow-on investments are possible. This tension will necessitate a new level of exploratory processes and practical experience. The forthcoming reforms should therefore consider this aspect as a design requirement at the earliest possible stage.

3. The current framework for the reform of the European Union's Emissions Trading System (EU ETS)

3.1. The EU's climate policy architecture and the role of the EU ETS 1

The European Union's climate policy – with all its implications for other policy areas, as well as for society and the economy – operates within a comprehensive regulatory framework. These regulations concern specific implementation instruments based on a variety of approaches, such as pricing, regulatory measures, financing and support, and information and motivation. They do not necessarily regulate greenhouse gas emissions directly nor operate solely within the context of the European Union's other energy, industrial or social policy objectives. A range of climate policy instruments, through targets and other framework provisions, constitutes the fundamental architecture of the EU's climate policy. In some cases – particularly those that involve EU ETS 1 – the instruments form part of both the architectural pillars of EU climate policy and the specific implementation instruments. This dual function gives the EU ETS 1 a prominent position. However, given the various facets of this instrument within the context of the climate policy architecture, specific requirements for changes to the EU ETS 1 must always be considered.

The European Climate Law (EU 2026) provides the framework for the EU's climate policy and climate policy architecture. In addition to establishing many aspects of procedures, this law sets out the EU's overarching climate targets. Under current legislation, the following provisions are relevant and must also be taken into account for the reform of the EU ETS 1:

- By 2050 at the latest, the EU aims to ensure that no more greenhouse gases are released into the atmosphere than are removed from it, thereby achieving net-zero emissions. The aim for the period after 2050 is to achieve negative emissions (Article 2(1) of the European Climate Law).
- These commitments are based on the territory of the EU. All greenhouse gas emissions and sinks within the EU are used to calculate the baseline for emission reductions. Additionally, a proportion of emissions from international aviation and maritime transport are taken into account. These emissions arise from international aviation and international deep-sea shipping, both of which are regulated under the EU ETS 1. However, emissions from incoming flights from Norway, the United Kingdom and Switzerland are not counted towards the EU's climate policy targets. As in the EU ETS 1, half of the emissions on routes to and from EU ports are attributed to the EU with regard to international deep-sea shipping (EC 2025a).
- By 2030, the EU's net emissions, as defined above, should be reduced by at least 55 % compared to 1990 levels (Article 4(1), first sentence, of the European Climate Law). To achieve this, up to 225 Mt CO_2 from negative emissions (including those from forestry) may be counted towards the target (Article 4(1), third sentence, of the European Climate Law), although the aim is to achieve a higher level of carbon sinks (Article 4(1), fourth sentence, of the European Climate Law), set at 310 Mt CO_2eq (see below). Given that the carbon sinks in the 1990 base year stood at approx. 240 Mt CO_2eq, achieving the target will require a reduction in the EU's gross GHG emissions of at least 53 %.
- By 2040, the EU's net emissions must be reduced by 90 % compared to 1990 levels (Article 4(3) of the European Climate Law). This target is to be implemented through

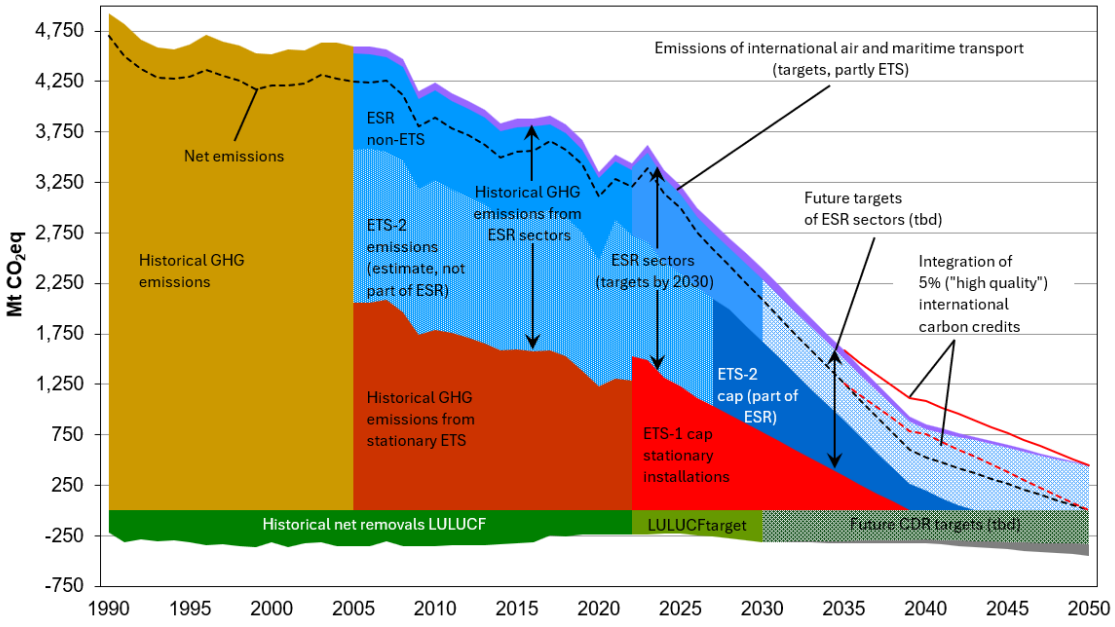
specific measures, taking into account a number of different aspects. For instance, up to 5 % of the 90 % reduction target may be covered by the use of 'high-quality' international carbon credits, in line with Article 6 of the Paris Agreement. A phased approach to the use of these credits may be considered (Article 4(5)(a) of the European Climate Law). Furthermore, permanent sinks are to be developed to offset residual emissions that cannot be avoided from installations covered by EU ETS 1 (Article 4(5)(b) of the European Climate Law). Additionally, uncertainties related to the development of carbon sinks must not be transferred to other economic sectors (Article 4(5)(c) of the European Climate Law). This means that if the carbon sink targets cannot be met, buffers must be provided elsewhere within the climate policy framework. Provided the above-mentioned condition regarding the effects on other economic sectors is met, these can only be international carbon credits. Therefore, these should only be taken into account in part for the target definitions of the ESR (or the corresponding final settlement rules) and the EU ETS 1.

Progress assessments regarding the aforementioned targets are to be based on indicative, linear trajectories for the respective interim periods (Article 8(1), (2) of the European Climate Law).

The overarching targets and interim targets of the European Climate Law are underpinned by three schemes designed to ensure that targets are met in the various sectors and areas of action (Figure 3-1):

- The EU ETS 1 forms the first pillar of the EU's climate policy framework. The relevant directive (EU ETS Directive, EU 2023c) regulates emissions from stationary installations in the energy sector and from emission-intensive industries, as well as from aviation and deep-sea shipping. The quantitative cap on permissible greenhouse gas emissions under the EU ETS 1 is directly linked to other quantitative targets under EU climate policy, defining its role as a pillar of the EU's climate policy architecture. At the same time, the allocation of tradable emission allowances under the EU ETS 1 provides a concrete implementation tool for achieving the overarching emission targets of EU climate policy. The price signals generated by the EU ETS 1 directly impact the regulated economic entities; in this respect, the EU ETS 1 is a directly effective implementation tool which, while requiring transposition into national legislation by Member States, is now largely Europeanised in regulatory terms. The cap has direct implications for the necessary measures in other sectors, meaning there are close interdependencies between the overarching climate policy targets, the cap and the required levels of ambition in other areas. Consequently, changes to the overarching emission reduction targets must also be reflected in the design of the EU ETS 1 cap. However, any alterations to the scope of regulation or the cap will also impact the other components of the EU climate policy architecture and the regulatory strategies employed. Finally, the EU ETS 1 implements the inclusion of international aviation and shipping in the EU's climate policy targets, ensuring the corresponding contributions to emission reductions.

Figure 3-1: Architecture of EU climate policy



Source: Oeko-Institut

- The second pillar of the EU's climate policy framework up to 2030 is the EU Effort Sharing Regulation (ESR, EU 2023e). Unlike the EU ETS 1 pillar, this regulation addresses, firstly, the individual Member States, which are responsible for ensuring that targets allocated to Member States (Art. 4 ESR) for emission sectors not covered by either the EU ETS 1 or the Land Use, Land-Use Change and Forestry Regulation (LULUCF Regulation, see below) (Art. 2 ESR) are achieved through the combined effect of EU-wide and national instruments. These EU-wide instruments also include the EU ETS 2, to be introduced from 2028, covering road transport and stationary combustion plants not regulated by the EU ETS 1.[1] In this respect, a key difference between the EU ETS 1 and the EU ETS 2 is that the interactions between the EU ETS 1 and the other commitment sectors do not apply to the EU ETS 2; consequently, the latter lacks the architectural function of the EU ETS 1 described above. Secondly, the ESR's target commitments are broken down into individual years and are reviewed accordingly. To a limited extent, there are flexibility options over time and between the commitments of the various Member States (Article 5 of the ESR), in relation to the EU ETS 1 (Article 6 of the ESR) and to the LULUCF sector (Article 7 of the ESR). Thirdly, the provisions of the ESR currently only run until 2030. Whether the basic approach of the ESR will be continued largely unchanged or whether there will be significant structural changes (restriction to emissions not covered by the EU ETS 1 or the EU ETS 2, the introduction of Member State obligations for overall emission targets, including emissions covered by the EU ETS 1, etc.) cannot be predicted at present, but is certainly relevant to certain design issues of the EU ETS 1 (expansion or reduction of the scope of regulation, etc.). Finally, it should be emphasised that the

[1] Unlike the EU ETS 1, which focuses on emissions from installations (a downstream approach), the EU ETS 2 regulates the placing on the market of, or trade in, fossil fuels (an upstream approach). Accordingly, the EU ETS 2 relies solely on the auctioning allocation method, and there is no free allocation of emission allowances.

legally enshrined caps of the EU ETS 1 and EU ETS 2 will, in the longer term, result in the agricultural sector becoming the dominant force in the ESR sector (Graichen et al. 2026).

- The third pillar of the EU's climate policy framework currently consists of the Regulation on Land Use, Land-Use Change and Forestry (LULUCF Regulation, EU 2023d). This Regulation sets out the contributions to target fulfillment, differentiated by individual Member State, towards the EU's net sink target in the area of land use, land-use change and forestry, amounting to 310 Mt CO_2eq (see above). The provisions of the LULUCF Regulation are aimed at target levels for 2030, but also allow for a range of comparatively complex flexibility options. The LULUCF Regulation is currently in force until 2030. Whether it will be continued in principle, incorporated into broader sink commitments (e.g. including technical sinks) or integrated into other regulatory frameworks is not yet clear and requires further clarification. There are significant areas of overlap with the EU ETS 1, particularly with a view to technical sinks; given this overlap, double-counting effects etc. must be avoided and consistency ensured.

This fundamental EU climate policy architecture is complemented by a governance system for the Energy Union and climate protection, regulated by the Governance Regulation (EU 2023b), which encompasses a wide range of reporting and review processes as well as various methodological provisions.

3.2. The EU ETS for the energy sector, energy-intensive industry, and air and maritime transport (EU ETS 1)

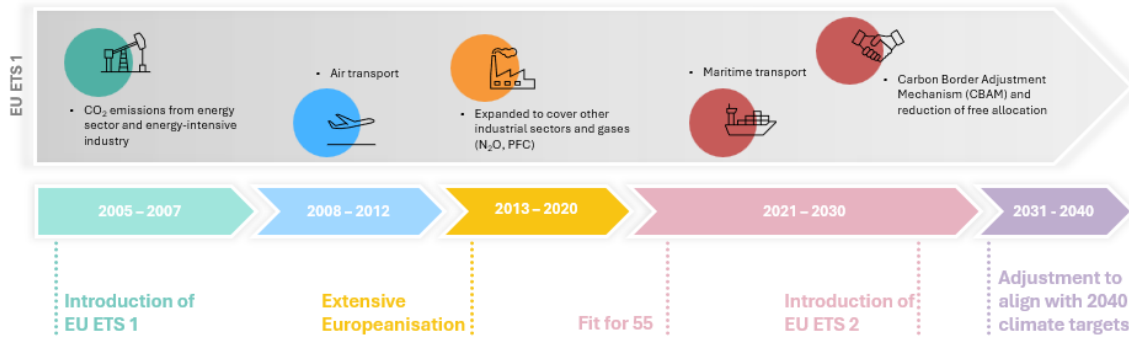
The EU ETS 1 was introduced in 2005 based on the EU Emissions Trading Directive (EU ETS Directive). Until the Chinese ETS was introduced, it was by far the largest emissions trading system in the world (ICAP 2025a; 2025b; IETA 2025; World Bank 2026).

The EU ETS 1 is a cap-and-trade system in which a total emissions cap is set and implemented through the issuance of emission allowances (European Union Allowances, EUAs). These allowances can be traded freely, allowing a market price to emerge for them. This pricing of GHG emissions generates price signals for cost-effective emission reductions. Plant operators are subject to the scheme, but all economic operators – i.e. not just those companies subject to the obligation to surrender allowances – can participate in trading.

The EU ETS is organised into commitment or trading periods. The first trading period ran from 2005 to 2007; the second from 2008 to 2012; the third from 2013 to 2020; and the fourth from 2021 to 2030. The scheme is set to continue in ten-year trading periods, with the fifth trading period scheduled to run from 2031 to 2040 and the sixth from 2041 to 2050. Trading periods from 2021 onwards will be divided into two five-year allocation periods, for which adjustments may be made, e.g. in the area of free allocation.

During the pilot phase (2005–2007), the EU ETS 1 covered only CO_2 emissions from the energy sector and energy-intensive industries. Almost 100 % of all EUAs placed on the market were allocated free of charge to installation operators (EEA 2025a). Since then, the system has continued to evolve; new sectors have been included, including aviation (2012) and maritime transport (2024), and the scope has been extended to cover other greenhouse gases (Figure 3-2). At the same time, the system's level of ambition has been, and continues to be, raised in line with the increasing ambition of the EU's climate targets.

Figure 3-2: Development of the EU ETS 1



Source: Oeko-Institut, based on Nissen et al. (2025)

The EU ETS 1 currently covers the following sectors, installations and GHG emissions:

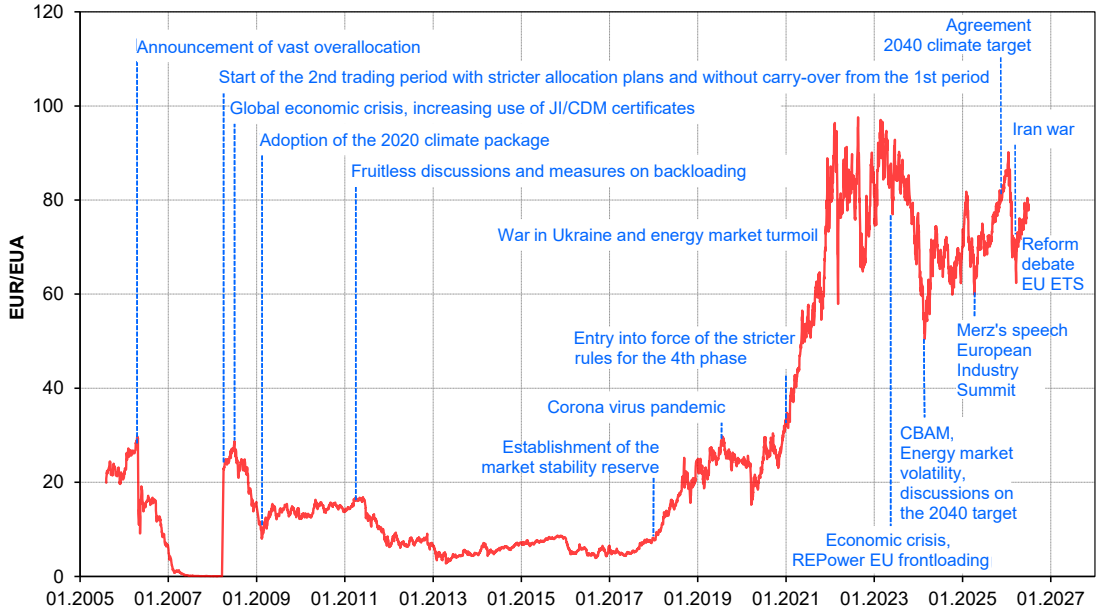
- CO_2 emissions from the electricity sector and from other combustion plants (in the energy sector or industry) with a thermal input of 20 MW or more;
- CO_2 emissions and, where relevant, emissions of nitrous oxide (N_2O) and perfluorocarbons (PFCs) from industrial sectors[2] ;
- CO_2 emissions from aviation for domestic flights and flights within the European Economic Area (EEA – i.e. the EU-27 plus Norway, Iceland and Liechtenstein), as well as flights to the United Kingdom with a take-off mass exceeding 5,700 kg;
- CO_2 emissions – and, from 2026, also methane (CH_4) and nitrous oxide (N_2O) emissions, from maritime transport for ships with a gross tonnage (GT) of 5,000 or more (based on the total enclosed volume of the ship).

Following EU enlargement, Bulgaria and Romania were integrated into the system in 2007, followed by Croatia in 2013. In 2008, the EEA states of Norway, Iceland and Liechtenstein joined the system. After leaving the EU, the United Kingdom exited the EU ETS in 2021 and now operates its own emissions trading system. However, power generation facilities in Northern Ireland remain within the EU ETS due to their close integration with the Republic of Ireland's electricity system. A linking agreement with Switzerland came into force in 2020.

The rules of the EU ETS 1 have become increasingly harmonised across Europe over time. While the caps and allocation rules were initially based on National Allocation Plans during the first two trading periods, individual Member States were able to exercise a certain degree of discretion in designing the EU ETS 1 (Ellerman et al. 2008; Ellerman et al. 2011). However, the European Commission applied increasingly restrictive EU-wide framework guidelines during the transition to the second trading period. From 2013 onwards, EU-wide regulations have governed cap setting, the allocation of emission allowances and auctioning procedures.

[2] The EU ETS Directive allows Member States the option of including smaller installations in the EU ETS via an opt-in mechanism. For some industrial sectors, different thresholds apply to the 20 MW thermal input requirement.

Figure 3-3: Trends in spot prices for EU ETS 1 emission allowances and key exogenous developments, events and reforms of the EU ETS 1



Source: Oeko-Institut

At the same time, the EU ETS 1 has been repeatedly adjusted in light of practical experience with the system, as well as in response to exogenous events (Figure 3-3). This relates both to the overallocation of emission allowances or certificates from international projects and to economic or political crises, as well as to the corresponding countermeasures and the adaptation of the EU ETS 1 in the context of the various increases in ambition within the EU's climate policy. However, the overview also shows that price trends in the EU ETS 1 have reacted significantly to political announcements or failed reform measures, some of which were short-term in nature, while others had longer-lasting effects on trading prices (in terms of price levels).

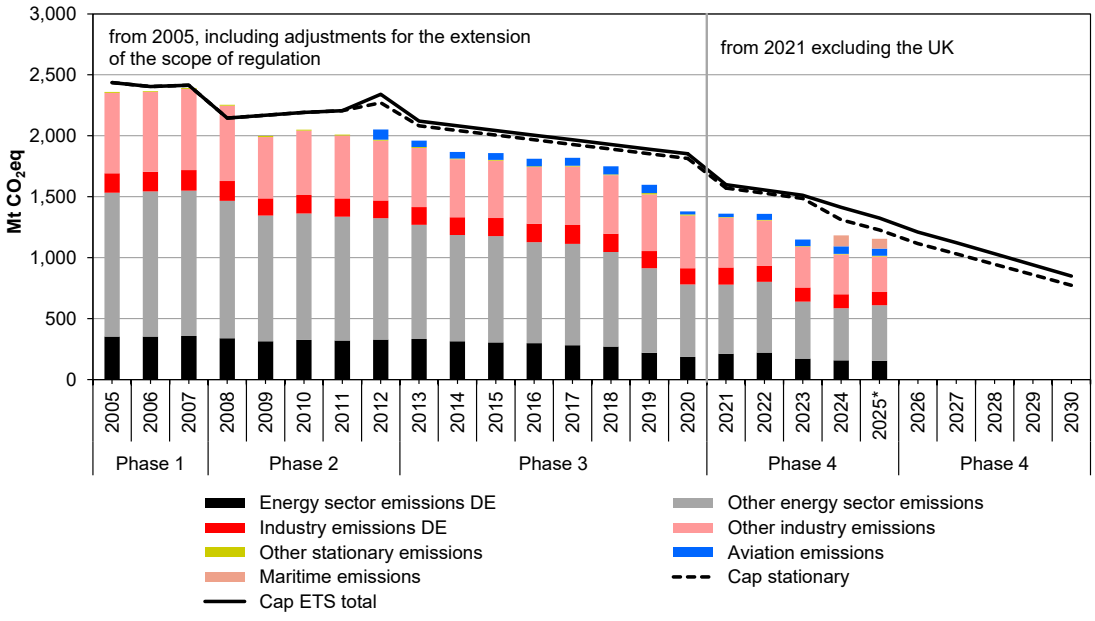
In view of the various internal and external challenges facing the EU ETS 1, as well as the regulatory adjustments planned on a regular basis (i.e. from trading period to trading period) but in some cases also prompted by specific circumstances (such as the MSR), it should be noted that the EU ETS 1 is an emissions trading system subject to frequent reviews and revisions. Learning processes and evidence-based adjustments have always played a major role in this system. Thanks to this approach, it has ultimately been possible – despite at times adverse external circumstances (various economic and energy market crises, etc.) and unforeseen developments (overallocation, a huge influx of low-quality project credits from the international market, etc.) – to establish a system that has been able to maintain a high level of trust. This applies first and foremost to investment decisions. However, trust was also ensured by the fact that the various changes came into effect predominantly with lead times that allowed problematic interference with the highly liquid futures markets for emission allowances – with time horizons of approx. three years – to be avoided.

The EU ETS 1, as a central pillar of the EU's climate architecture, covers a very large proportion of total greenhouse gas emissions. In 2005, it covered 44 % of gross emissions and 49 % of net emissions in the EU 27; by 2024, these shares had fallen to 37 % and 41 % respectively. For Germany, the EU ETS 1 covers a considerably higher proportion of national emissions. In 2005, 49 % of gross GHG emissions and 51 % of net emissions were generated within the scope of the EU ETS. By 2024, these shares had fallen to 41 % and 42 % respectively. This means that, for both the EU 27 and Germany, disproportionately large emission reductions were achieved within the scope of the EU ETS 1.

3.3. The emission-side quantitative architecture of the EU ETS 1 under current legislation

Since 2013, GHG emissions from the aforementioned sectors have been subject to an EU-wide cap. This cap is reduced annually by the Linear Reduction Factor (LRF) (see Article 9 of the EU ETS Directive). The current LRF is 4.3 %, and according to current legislation it is set to increase to 4.4 % from 2028. The LRFs were set on the basis of the EU's 2030 climate targets. However, the LRF will need to be adjusted as part of the forthcoming EU ETS 1 reform to reflect the EU's increased climate ambition with a view to the 2040 target (see chapter 5.2).

Figure 3-4: Cap and emissions trends in the EU ETS 1



Note: Data for 2025 and sectoral breakdown based on estimates by Oeko-Institut.
Source: Oeko-Institut

Figure 3-4 provides an overview showing that the largest proportion of emissions regulated by the EU ETS is by far attributable to the energy sector, particularly the electricity sector. In the inaugural year of the system (2005), 65 % of the emissions covered by EU ETS 1 were attributable to the energy sector, while 35 % were attributable to industry (based on the 2005 scope). By 2025, with the inclusion of aviation and shipping, the

energy sector accounted for 57 %, while industry accounted for 41 %. In 2025, aviation and shipping accounted for only around 3 % of the emissions regulated by EU ETS 1. In Germany, the energy sector accounted for around 69 % of total emissions from stationary installations in 2005, while industry accounted for 31 %. Over the subsequent 20 years, the share of the energy sector fell to 58 % while the share attributable to industrial installations rose to 42 %. For both the EU ETS 1 as a whole and Germany, the energy sector thus contributed a disproportionate share of emission reductions, particularly in the context of the decline in coal-fired power generation driven by policy and the market. Between 2005 and 2025, emissions from the energy sector covered by the EU ETS 1 fell by around 54 % in the EU 27 and by around 56 % in Germany. By contrast, industrial emissions fell by 48 % in the EU 27 and by around 32 % in Germany.

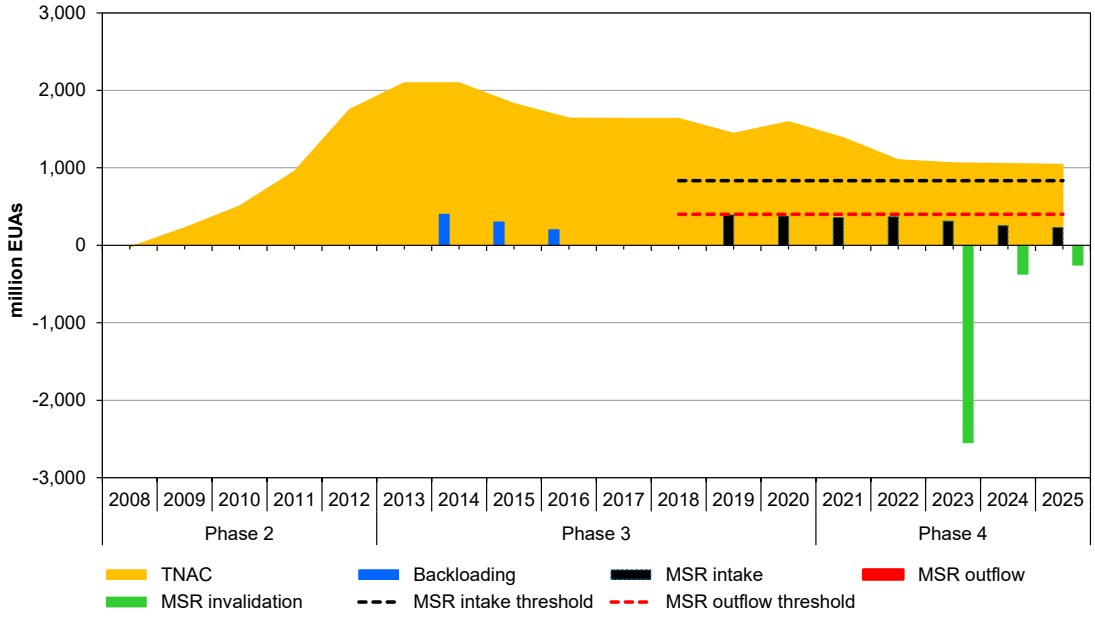
Against this backdrop, emission reductions in the industrial sector will play a new and considerably greater role in the years ahead, particularly following the phase-out of coal-fired power generation in the EU-27 and in Germany. This development is foreseeable for the coming years and is also being driven by emissions pricing under the EU ETS 1.

However, the overview provided in Figure 3-4 also shows that, over the past few decades, the maximum number of emission allowances placed on the market (the ‘cap’) has always exceeded the total number of regulated installations. This situation, combined with a significant influx of allowances from the Clean Development Mechanism (CDM) and Joint Implementation (JI) international mechanisms, caused emission allowance prices to fall sharply over a relatively long period (see Figure 3-3). Consequently, in 2015, a decision was taken to introduce a Market Stability Reserve (MSR) (EU 2024b), which came into effect in 2019. Regulated under the EU Emissions Trading Directive (Art. 1a of the EU ETS Directive) since 2024, the MSR aims to regulate market liquidity. The MSR acts as a price-stabilising instrument in EU ETS 1 by balancing supply and demand. Depending on market liquidity, it can absorb or release allowances. The MSR's trigger mechanism arises from a surplus situation in the ETS market, as determined by the Total Number of Allowances in Circulation (TNAC) parameter. If the TNAC exceeds 833 million allowances, the MSR withdraws allowances from the market by reducing the number to be auctioned accordingly. These allowances are then held by the MSR and are no longer available to the market. Under current legislation, they may also be permanently cancelled under certain conditions (see chapter 5.3 for details). This reduces supply and stabilises the price. Conversely, if the TNAC falls below 400 million, allowances are released into the market by increasing auction volumes to boost liquidity and stabilise prices. The trigger levels mentioned were derived from anticipated demand from providers of hedging products at the time of the MSR’s introduction, primarily in the context of the liberalised electricity market and hedging requirements for electricity futures contracts. Despite the significantly changed emissions situation in the electricity market, these trigger levels have not yet been adjusted.

The development of the TNAC, as well as the various MSR parameters, additions and cancellations, are shown in Figure 3-5. Since 2008, the TNAC has grown steadily, reaching a level of 2,098 million EUAs in 2013, which led to an oversupply of emission allowances on the market. Since 2019, the TNAC has consistently exceeded the MSR intake threshold of 833 million EUAs and has therefore been absorbing allowances (see Figure 3-5). As the TNAC has not yet fallen below the threshold of 400 million EUAs, the MSR has not yet released any allowances. Since 2023, all EUAs in the MSR up to the threshold of 400 million EUAs have been permanently removed from the market. In the first year of removal (2023), this led to a total write-down of 2,546 million EUAs.

In addition to the quantities of allowances not released onto the market due to the trigger levels described above, the quantities of allowances withheld from 2014 onwards as part of backloading (EC 2014) were also transferred to the MSR.

Figure 3-5: Trends in MSR parameters and volumes



Note: A total of 900 million EUAs were withheld (backloading) between 2014 and 2016; these were transferred to the MSR in 2019 and 2020.

Source: Oeko-Institut

In total, approx. 3,188 million EUAs were absorbed by the MSR (including the backloading volumes). Of these, approx. 3, 169 million EUAs have been permanently cancelled in the MSR since 2023 (see chapter 5.3.3).

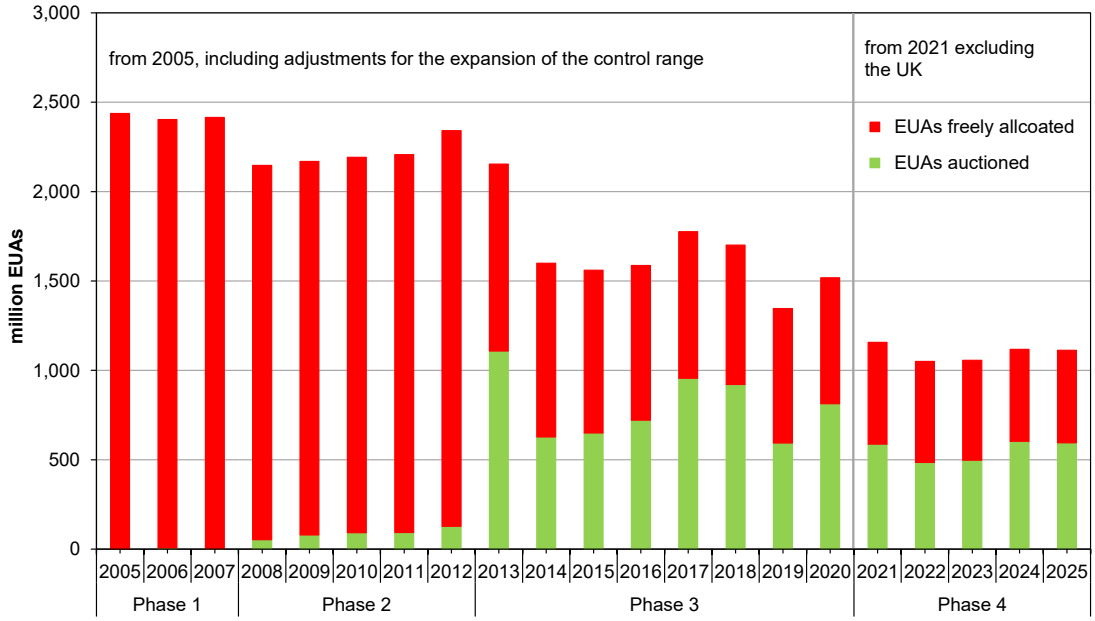
3.4. Free allocation in EU ETS 1

Since the start of the third trading period, and to an increasing extent, EU ETS 1 emission allowances have been introduced into the market through auctions. While in the first trading period almost 100 % and in the second trading period approx. 95 % of all emission allowances were allocated free of charge, by 2024 the share of free allocation of all emission allowances placed on the market stood at 46 % (Figure 3-6).

However, some industrial and energy-sector installations continue to receive a proportion of the emission allowances they require through free allocation. Under the EU ETS Directive, there are three mechanisms for the free allocation of emission allowances:

- Article 10a(1): allocation via benchmarks (BM) to mitigate carbon leakage risks;
- Article 10a(7): quantities of allowances set aside for free allocation to new installations (New Entrants Reserve – NER);
- Article 10(c): allowances for installations in the electricity sector, which may be issued by economically weaker Member States during a transitional period.

Figure 3-6: Trends in free allocation and auctions under EU ETS 1 (stationary sector)



Note: Auctioned EUAs in the respective years have been reduced by the backloading of emission allowances and the transfer of emission allowances to the MSR

Source: Oeko-Institut

The majority of allowances allocated free of charge serve to prevent carbon leakage risks (the relocation of emissions to regions without CO_2 pricing). Some of the industrial sectors that have so far been able to cover a large proportion of their allowances through free allocation have been included in the Carbon Border Adjustment Mechanism (CBAM hereafter)[3] since 2026. CBAM was introduced to replace free allocation as a carbon leakage mitigation tool in 2023. CBAM has been fully effective since the start of 2026. Free allocation in the selected sectors is being reduced from 2026 onwards (for details, see chapters 8.2 and 9.6).

The volume of free allocation for the relevant installations is determined on the basis of a benchmarking system. These benchmarks relate primarily to the production volume of specific products at the respective industrial installations. The starting point for determining these benchmarks is the average specific emission values of the top 10 % most efficient installations within the scope of EU ETS 1. These values, which are updated at regular intervals, are combined with maximum and minimum values for benchmark updating, along with other factors (for details, see chapter 9.3).

3.5. The revenue generated from auctions and its use

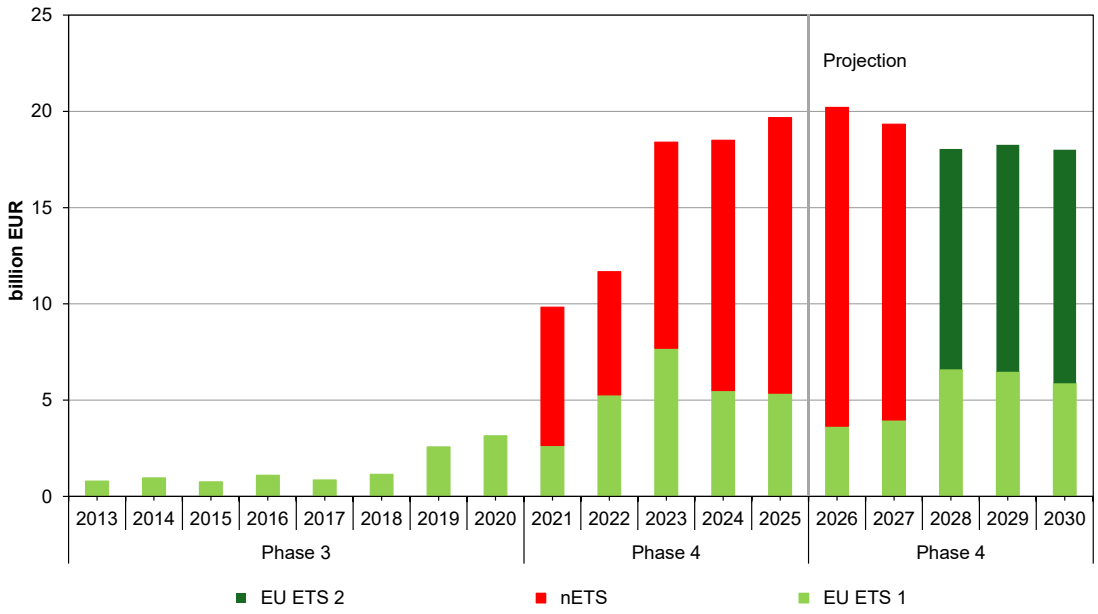
Revenue from the auctioning of emission allowances under the EU ETS 1, as well as revenue from the national fuel emissions trading system (nETS) in Germany and, in future, the EU ETS 2, represents a key source of funding. Figure 3-7 shows, first of all, the

[3] From 2026, CBAM covers products from the iron and steel, aluminium, cement, fertiliser, hydrogen and electricity sectors (EU 2025).

trend in revenue from carbon pricing schemes in Germany, with the actual figures achieved up to and including 2024. While auction revenues from the EU ETS 1 remained at around EUR 1 billion annually until 2018, the substantial rise in carbon prices in subsequent years led to a sharp rise in revenue. In 2023, auction revenues amounted to EUR 7.7 billion, and in 2024 to EUR 5.5 billion. Germany's national emissions trading system generated revenue of around EUR 13 billion in 2023 (German Emissions Trading Authority (DEHSt) in German Environment Agency 2025b). To date, the revenues from the various emissions trading systems have been channelled in full into Germany's Climate and Transformation Fund, although this basic principle is no longer to be fully adhered to in the draft budgets for 2027.

In total, this inflow amounted to just under EUR 20 billion in 2025. Over the coming years, revenue levels are expected to fall slightly due to rising allowance prices and a trend towards lower auction volumes resulting from cap reductions. Around two-thirds of fiscal revenue is expected to come from emissions trading systems outside the EU ETS 1.

Figure 3-7: Fiscal revenue from the EU ETS 1, the nETS and the EU ETS 2 for Germany



Note: For the EU ETS 1 and the EU ETS 2, the futures prices traded in June 2026 for the respective delivery years were used as a basis. For the nETS, the upper limit of the price corridor (65 €/t CO_2) was used for 2026 and 2027.

Source: DEHSt, Oeko-Institut

The total auction revenues from the EU ETS 1, excluding the quantities auctioned for the Modernisation Fund, are allocated, first of all, to individual Member States according to a specified formula (Article 10(2) of the EU ETS Directive):

- 90 % of the total revenues are allocated in proportion to the emissions regulated by the EU ETS 1 at the start of the scheme.
- A 10 % share is distributed among a total of 16 economically less developed Member States.

In addition, the auction revenues will be channelled into a number of specific funds, which can be used either to finance EU programmes or to make repayments to Member States for specific purposes:

- For the Modernisation Fund, 2 % of the total allowance volume will be auctioned between 2021 and 2030, with an additional 2.5 % of the total allowance volume to be auctioned between 2024 and 2030. The fund supports lower-income EU countries, particularly in Central and Eastern Europe, and, from 2024, also Greece, Portugal and Slovenia, in modernising their energy systems (Article 10(1) of the EU ETS Directive and EC 2024d).
- For the Innovation Fund, 345 million EUAs – which might otherwise have been allocated free of charge – and 80 million EUAs earmarked for auction will be auctioned off. In addition, the unused revenues from the auction of 300 million EUAs from the NER for the promotion of CCS and renewable energy demonstration projects, as well as 50 million EUAs from the MSR, will be allocated to the Innovation Fund (Article 10a(8) of the EU ETS Directive). Furthermore, the allowances that are no longer allocated free of charge as part of the introduction of CBAM will also be allocated to the Innovation Fund (Article 10a(1a) of the EU ETS Directive).
- For the Social Climate Fund (EP; Council 2023), 40 million EUAs, which would otherwise be allocated free of charge, and 10 million EUAs, which could otherwise be auctioned, will be made available (Article 10a(8b) of the EU ETS Directive).
- The EU's (temporary) Recovery and Resilience Facility (RRF) is a key implementation mechanism for the EU's NextGenerationEU programme, which was established in response to the Covid-19 pandemic and Russia's war of aggression against Ukraine (EC 2025e). The RRF's loans and grants total EUR 725 billion and are intended to support reforms and investments by EU Member States. As part of the EU's RePowerEU package, grants of up to EUR 20 billion have been made available through the Innovation Fund (60 %) and the continued sale of EU ETS 1 allowances (40 %) (EC 2025e).

The auctions and sale of EU ETS 1 emission allowances thus make a considerable financial contribution to the EU Member States. In some cases, these funds are channelled directly through various funds into climate policy measures or the transformation of the energy system; in others, the decision rests with the Member States. Since 2023, the EU Emissions Trading Directive has required Member States to use all auction revenues for the purposes of climate action (Art. 10(3) EU ETS Directive). However, to date, only some Member States have complied with this obligation (EEA 2025b).

4. Adjusting the scope of the EU ETS 1

4.1. Introductory remarks

The EU ETS 1 was deliberately designed as a pan-European instrument strongly linked to the single market and targeting specific sectors. Its scope gradually and cautiously expanded over time as more experience was gathered. In principle, the scope of the EU ETS 1 has proven its worth. International comparisons demonstrate that emissions trading systems primarily target the energy sector and emission-intensive industries (World Bank 2020; ICAP 2026b).

Nevertheless, the current scope of the EU ETS 1 should be reviewed on an ongoing basis. This concerns not only the integration of additional emission sectors and the possibility of an opt-out, but also the linking of emissions trading systems or the direct integration of different emissions trading systems.

All of these changes to the scope have significant economic and distributional implications, as well as important administrative and procedural aspects, and extend to implications for financial market regulation. Last but not least, the positioning of EU ETS 1 within the EU's overall climate policy framework and the associated policy aspects must be considered.

The overarching requirement for all matters relating to the scope of EU ETS 1 is that they must be consistent with the legally enshrined objective of achieving climate neutrality within the EU by 2050, as well as with the legally codified interim targets.

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4.2. Expansion of the scope of the EU ETS 1

Context

The scope of EU ETS 1 was primarily focused on large stationary emission sources, particularly during the introductory phase from 2005, but it was also driven by practical implementation considerations. The system was initially designed to cover easily measurable CO_2 emissions from large point sources. The uncertainties surrounding the quantification of emission volumes were lower in this regard, thereby minimising the risk to the functioning of the market in terms of 'real' emission reductions, as well as the risk associated with setting the cap. Furthermore, this approach allowed transaction costs to be kept low. In retrospect, this approach has also proved its worth, as experience from the first trading period showed that uncertainties or tolerances in determining emission volumes — particularly where reduction targets at cap level were very low — could quickly lead to the collapse of the market or prices for emission allowances.

However, the growing experience gained from implementing the EU ETS 1, along with the methodological developments carried out in this context, made it possible to incorporate additional emission sources from a technical perspective. Other quantity control systems were also established, such as the fuel-based national emissions trading

system in Germany and the planned EU ETS 2, which can address more diffuse emission sources or less standardised input materials.

Following the introduction phase, the scope of the EU ETS has continuously expanded. In the past, this has involved the following steps:

- Since 2012, the EU ETS 1 has also covered aviation, thereby expanding the scope currently by more than 60 Mt CO_2;
- In 2013, greenhouse gases other than CO_2 were included in the EU ETS for the first time, including N_2O emissions from certain chemical processes and PFC emissions from primary aluminium production. The cap adjustment in 2013 amounted to 107 Mt CO_2eq (EC 2010), and covered a number of additional industrial processes (e.g. process combustion), as well as non-CO_2 greenhouse gases.
- From 2024 onwards, maritime transport was gradually incorporated into the EU ETS 1, thereby integrating additional emissions of around 90 Mt CO_2eq.

Although some changes to the system's scope are relatively minor, they are nevertheless important in order to curb potential leakage effects. For example, the EU ETS 1 cap increased by 2.3 Mt CO_2 as of 1 January 2026 since the scope was extended to include methane and N_2O emissions from maritime transport. Although these emissions are currently insignificant, they could increase if there is greater reliance on liquefied natural gas and ammonia as fuels in the future. Capturing only CO_2 emissions and not other GHG emissions could create perverse incentives. Lower CO_2 emissions could be offset by increases in other GHG emissions. Therefore, including methane and N_2O emissions from maritime transport ensures that the right incentives for switching between different fuels are set via a uniform price signal.

The EU ETS Directive currently contains a number of preparatory measures to extend the scope of the EU ETS:

- For waste incineration plants with a thermal input exceeding 20 MW, a reporting obligation for CO_2 emissions was introduced on 1 January 2024 (see Annex 1 of the EU ETS Directive). From 1 January 2028, CO_2 emissions from waste incineration will be included in the EU ETS (Article 30(4)(c) of the EU ETS Directive).[4]
- A reporting obligation for the non-CO_2 effects of aviation came into force at the start of 2025. The European Commission is expected to present a legislative proposal for the inclusion of these non-CO_2 effects where appropriate in 2028 (Article 14(5) of the EU ETS Directive).

Waste incineration

Since the start of 2024, emissions from waste incineration in Germany have been covered by the national emissions trading system (nETS). In that year, these plants reported emissions of 13.1 Mt CO_2. According to current projections (Wehnemann et al. 2026), emissions from waste incineration are not expected to decrease significantly in the years ahead. As a result, the share of emissions from waste incineration in total emissions from

[4] Waste incineration produces CO_2 emissions; landfill also generates methane emissions. Therefore, it should be examined whether other waste treatment facilities and landfills, which generate methane and nitrous oxide emissions, should be included in the EU ETS to prevent incentives for the displacement of emissions into these otherwise unregulated sectors (Article 30(4)(c) of the EU ETS Directive).

the energy sector (where they are recorded in the greenhouse gas inventory system) will rise significantly, with waste incineration becoming the second-largest source of emissions after natural gas from 2030 onwards. Without appropriate integration into overarching emissions trading systems or the consistent pricing of waste incineration emissions, achieving the long-term emission reduction targets in the energy sector, and consequently in the German and EU economies as a whole, will be very difficult.

The risk of 'cross-sectoral leakage' is often cited as a counter-argument against including waste incineration in the EU ETS[1]. This refers to the concern that pricing waste incineration could lead to an increase in landfill or waste exports. However, recent analyses show that an increase in landfill is unlikely (Hogg 2026). In most Member States, the legal framework and existing landfill taxes severely restrict a return to landfill. However, if rising waste exports to non-EU countries were to become a real and observable problem, then, analogously to CBAM, the option of requiring CBAM certificates to be purchased for these exports could be examined in order to prevent corresponding carbon leakage.

Integrating waste incineration into the EU ETS would ultimately transfer responsibility for this sector from the Member States to a uniform EU-wide regulatory framework. This would also reduce the problematic incentive effects arising from differing waste incineration regulations across the various Member States.

While not solely due to the integration of waste incineration into the EU ETS 1, this integration will, in the long term, create a new focus and give rise to regulatory requirements regarding the treatment of technical net sinks, particularly for waste incineration plants equipped with CCS technologies that also process biogenic materials.

Aviation

In the aviation sector, a number of non-CO_2-related climate effects must be taken into account in addition to CO_2 emissions from the combustion of aviation fuels. The most significant effects in this regard stem from N_2O emissions and contrails. The magnitude of these non-CO_2 climate effects also depends on the location of the emissions (i.e. altitude and latitude) and the actual atmospheric conditions. In 2024, emissions from aviation covered by EU ETS 1 amounted to 64.1 Mt CO_2 (including Switzerland (Nissen et al. 2025)). A study for the Netherlands estimates multipliers of 3.2 for European destinations in 2030, rising to 5.9 by 2050 (Grebe and Raphaël 2023). For international flights, the multipliers are slightly higher. This illustrates that, in the long term, aviation could become the most significant sector within the scope of EU ETS 1, provided that greenhouse gas emissions from stationary installations are significantly reduced and aviation, with all its emissions and climate impacts, is included in the system.

Recommendation

In summary, it is recommended that the current approach should be consistently maintained. If individual sub-sectors, such as waste incineration, remain excluded from EU ETS 1, the GHG reduction targets will have to be met solely by installations that are already covered by the scope. This would not be efficient. Furthermore, delaying the inclusion of waste incineration could mean that substantial decarbonisation efforts would be required at a later stage.

The non-CO_2 effects of aviation should also be included in the mandatory scope of the EU ETS 1 as soon as possible, as it would make mitigation options more cost-effective.

4.3. Merger of the EU ETS 1 and EU ETS 2

Current situation: Emissions Trading System for buildings and road transport

The planned introduction of EU ETS 2 means that road transport and stationary combustion plants, which are not currently covered by EU ETS 1 (primarily, but not exclusively, buildings), are set to become part of an EU-wide emissions trading system in the near future. Due to concerns about additional costs for consumers, and to allow more time for preparation, the introduction has been postponed by one year, from 2027 to 2028. Once the EU ETS 2 is launched, there will therefore be two parallel emissions trading systems covering different sectors. In the long term, however, the aim is to have a single ETS covering all sectors. A clearly defined timetable has been set for the potential integration of the EU ETS 1 and EU ETS 2 systems, with the European Commission required to evaluate the feasibility of merging them by 31 October 2031 (Article 30i of the EU ETS Directive).

Impact: Varying abatement costs

Merging the emissions trading systems could have varying and, in some cases, conflicting effects on the sectors involved. For the ETS 1 sectors, there is a risk of increased cost pressure, since the consumer-orientated sectors of buildings and transport generally have different cost structures and are willing to pay significantly higher prices for emission allowances. A merger could therefore lead to a noticeable price shock for companies in the sectors incorporated under the EU ETS 1, particularly where there are significant price differences between the systems. Conversely, pressure on the ETS 2 sectors could ease if, as a result of the merger, relatively cheap allowances priced below the actual abatement costs within the scope of the EU ETS 1 become available. This could weaken the necessary incentives for transformation in certain sectors. The stability and predictability of pricing for the ETS 1 sectors could also decline. Price rises for fuel and heating attract significant political attention and could lead to short-term interventions, as demonstrated by political processes following Russia's attack on Ukraine, for example, or the postponement of the launch of the EU ETS 2.

At the same time, the merger would increase the total quantity of available allowances, which would, in principle, improve market liquidity. However, the actual effect depends largely on the design of EU ETS 2. If the supply of allowances is tight, no significant relief is to be expected even as a result of the merger.

Finally, it should be noted that within the scope of the future EU ETS 2, there are a very large number of additional climate and energy policy instruments in various EU Member States, particularly in the buildings and transport sectors. These instruments substantially influence abatement costs and may lead to considerable differences in the distribution of costs between Member States and sectors. Unlike the EU ETS 1, which was introduced in an environment that had few supplementary instruments — except for support for renewable electricity generation — the EU ETS 2 must consider significant ‘brownfield effects’ resulting from the existing climate and energy policy instruments.

Limitation: Lack of empirical data on EU ETS 2

The German Expert Commission on Energy Transition Monitoring has stated that the potential integration of EU ETS 1 and EU ETS 2 could create additional uncertainties for

investors. Furthermore, the differing marginal abatement costs in the two systems could present new challenges in terms of distributional effects and location decisions (EWK 2024). The expected increase in market liquidity resulting from the merger of the emissions trading systems is likely to be limited in the long term (Graichen et al. 2025). Instead, it is to be expected that the additional price pressure on the ETS 1 sectors will predominate. Notwithstanding these short-term effects, linking the two systems in the long term appears sensible in principle to increase the efficiency of emissions trading.

The timetable, the design of the systems and the resulting price levels are crucial to a successful merger. Currently, however, there is considerable uncertainty, particularly with a view to price developments in ETS 2. Against this background, ETS 2 should first be sufficiently established so that stable market mechanisms can develop and any necessary adjustments can be made. Only then can reliable forecasts be made, e.g. regarding the future design of the MSR 2 or price trends in the ETS 2 sectors.

Recommendation: Gradual merger of the systems

To limit the initial impact of a merger, it is advisable to take a step-by-step approach. Such a gradual approach could, for example, involve allowing only a limited quantity of allowances to be traded between the systems. Alternatively, the price difference between the systems could be capped for trading purposes. This would help to avoid sharp price spikes and allow market participants to be introduced to a common system gradually.

The options for a gradual merger of EU ETS 1 and EU ETS 2 could include:

- Minimum price difference (Graichen et al. 2025): A fixed minimum price difference ensures that trading between the systems only occurs in the event of a sharp rise in one of the systems, i.e. in the event of acute scarcity.
- Limited trading (Graichen et al. 2025): Restricting the number of allowances that can be traded between systems can mitigate the resulting impact on price levels in the ETS 1. In the long term, a pathway should be established for the gradual increase in the number of transferable allowances.
- Price alignment: Price corridors in both trading systems can help manage the price differential and avoid price shocks upon merger. However, narrow price corridors run counter to the effective operation of quantity control within the EU ETS (see chapter 5.3).
- Link via the MSR: In the event of a merger, the compatibility of the instruments of both systems must be reviewed; this includes the MSR. Merging this ‘buffer’ could facilitate an initial link between the two systems and reveal the varying degrees to which they rely on allowances in the MSR.

Finally, it is essential to consider the interactions between the different regulatory approaches of EU ETS 1 and EU ETS 2. While the EU ETS 1 obliges installation operators to surrender emission allowances (downstream regulation), and allows measures to prevent leakage to be implemented at installation level (e.g. free allocation of emission allowances), the EU ETS 2 obliges suppliers or end-user suppliers in the fossil fuel sector (upstream approach). With this 'point of regulation' approach, only the auction-based allocation method can be meaningfully implemented, while operator-specific measures to prevent carbon leakage are only possible at considerable administrative cost.

As the short-term liquidity effects of integration are negligible and a short-term merger with the EU ETS 2 entails considerable operational risks, a long-term, phased merger is the preferred approach. To this end, a suitable timetable must be developed, along with options for initial 'soft linking,' based on the framework set out in the EU Emissions Trading Directive (the European Commission's 2031 review report). In the long term, a joint cross-sectoral emissions trading system remains an efficient solution. However, there is currently a lack of robust, practical experience regarding the effects of the EU ETS 2 in the relevant sectors.

4.4. Linking emission trading systems

The EU ETS 1 covers the entire European Economic Area (EEA), not only the EU 27. In addition to the EU 27, the system also encompasses Norway, Iceland and Liechtenstein. Power plants in Northern Ireland are also included. As part of the accession process for new Member States to the EU, these countries would also be included in the EU ETS (this is particularly relevant for countries in the Balkans and Ukraine).

Beyond the full integration of new countries into the EU ETS 1, there is the possibility of linking different emissions trading systems. Such arrangements have primarily been implemented between North American emissions trading systems (CARB 2017), but are also becoming increasingly important for the EU ETS 1.

- A linking arrangement has been in place since early 2020 between the Swiss emissions trading system, which was launched in 2008 (ICAP 2025c) and the EU ETS 1 (EU 2024a; ICAP 2025c; DEHSt 2023).
- Following its withdrawal from the European Union, the UK also left the EU ETS 1 with effect from 1 January 2021, but has introduced its own emissions trading system (UK ETS), which shares many similarities with the EU ETS 1 but also has some differences (UBA 2025). Negotiations on linking the EU ETS 1 and the UK ETS began in 2025, with the link expected to be implemented in 2028/2029.

Under Article 30(5) of the ETS Directive, the European Commission must analyse, by 31 July 2026, how to link with other emissions trading systems. However, the Directive stipulates that this must not compromise the EU's long-term climate neutrality targets.

In principle, linking with other emissions trading systems is to be welcomed in the long term, as it creates a larger market in which marginal abatement costs can converge. This also reduces the risk of carbon leakage. Furthermore, in this context, CBAM would no longer be required for trade between the linked systems. This is likely to be a key incentive for other countries to seek links with the EU ETS.

However, linking emissions trading systems presents significant challenges. Existing linking projects in North America, experience gained from linking with Switzerland, and negotiations on the link between the EU ETS and the UK ETS highlight the need for careful consideration of the following key areas, some of which also depend on different linking options (World Bank 2020):

- comparable levels of ambition, including with regard to time horizons;
- comparable allocation approaches;
- compatible rules on the use of project-based credits or international carbon credits;

- compatible requirements for monitoring, reporting and verification (MRV);
- comparable implementation controls;
- comparable financial market regulations.

Naturally, the EU has only limited influence over the level of ambition and other design options within the linked systems. This could result in a loss of control, which might jeopardise the achievement of medium- and long-term climate policy targets, or lead to other unintended consequences (including with regard to competition issues). Therefore, it should always be possible to reverse the linking arrangement. Alternatively, partial linking approaches involving maximum net flow volumes or other limiting mechanisms are conceivable.

4.5. Exclusion of industrial sectors and opt-out provisions

In discussions surrounding the reform of the EU ETS 1, there have been several calls to exclude individual sectors or installations from its scope in order to avoid the costs arising from greenhouse gas pricing and to reduce competitive disadvantages (Hermann and Matthes 2026).

Such opt-out arrangements can only apply to individual sectors or installations unless the EU ETS 1 scheme is completely undermined or abandoned. An opt-out would inevitably lead, initially, to distortions (or distributional conflicts) that depend heavily on location- and market-specific conditions which are difficult to assess objectively and are therefore virtually unmanageable. Such effects are likely to extend to areas like material substitution. Furthermore, installations remaining within the EU ETS 1 scheme would, where applicable, be required to increase their emission reduction efforts over time. Measures already implemented towards transformative production processes would also be hugely devalued.

Given the central role of the EU ETS 1 in EU climate policy (see chapter 3.1), the question remains as to what obligations would apply to installations or sectors no longer covered by the EU ETS 1. Under the current framework, installations opting out of the EU ETS 1 would either fall under the climate protection responsibilities of the various Member States (ESR), or be subject to the EU ETS 2, which would create distortions that would be difficult to reconcile with the fundamental concept of the EU single market. Therefore, the intentions behind an opt-out approach could only be realised if accompanied by a fundamental change to the architecture of EU climate policy. For both fundamental and procedural reasons, this does not seem at all sensible or advisable.

The existing challenges within the EU ETS 1 should therefore be addressed or mitigated through the establishment of an appropriate policy mix. This will be described in more detail in the following chapters and will include LRF/MSR adjustments, resolving the benchmark issue (particularly for the chemicals industry), pursuing an evidence-based CBAM approach and supporting the ETS with appropriate supplementary instruments in areas such as CAPEX/OPEX support, infrastructure and lead markets.

5. Emissions cap and Market Stability Reserve

5.1. Introductory remarks

The cap on emissions allowances is of great importance to the functioning of the EU ETS 1. During the first two trading periods up to 2012, this cap was determined by the sum of the individual EU Member State caps, as set out in the National Allocation Plans. Since 2013, there has been an EU-wide cap that is reduced annually. This is laid down in Article 9 of the EU ETS Directive. The annual reduction is determined by a Linear Reduction Factor (LRF). In the third trading period (2013–2020), the linear reduction factor was 1.74 % relative to the baseline level of allowances for the period from 2008 to 2012. Over the years, the linear reduction factor has been adjusted regularly. Since the beginning of 2024, it has been set at 4.3 %, rising to 4.4 % from the beginning of 2027. The level of the LRF in the EU ETS 1 also depends on the overall EU-wide target and the contributions to emission reductions set for sectors outside the EU ETS 1 (see chapter 3.1). The European Commission produces impact assessments alongside legislative proposals to calculate the efficient allocation of reduction targets across sectors and, consequently, the necessary level of the cap reduction in EU ETS 1.

Under the current EU ETS Directive, the cap in EU ETS 1 would fall to zero by 2039 if the LRF of 4.4 % were to be maintained indefinitely. However, the latest impact assessment by the European Commission for the 2040 target shows that the cap could be reduced at a slightly slower pace to achieve this target. The impact assessment contains three different emissions scenarios, all of which lead to a climate-neutral EU by 2050 (EC 2024a). These scenarios are based on cost-optimised macroeconomic modelling and differ in their interim target for 2040. An additional variant examines the impact of declines in demand and behavioural changes, particularly with regard to transport and food consumption. All scenarios assume that the 2030 target will be met. The impact assessment shows the cost-effective distribution of sectoral emissions, but does not make assumptions about the policies and measures required to achieve these emission levels and their distribution. Based on the sectoral results, however, emissions can be allocated to existing policy instruments (Table 5-1). Including air and maritime transport within the current scope, the modelling indicates that between 200 and 285 Mt CO_2 may still be emitted under the EU ETS 1 in 2040.

The European Climate Law does not address the question of the use of international carbon credits. These could be particularly relevant for land use, land-use change, and forestry (LULUCF), as it is already uncertain whether this sector will meet the 2030 target. Looking ahead to 2040, climate risks will have increased significantly. At the same time, restructuring forests to make them more resilient to climate change will reduce their capacity to absorb carbon in the short to medium term. Against this background, the integration modelled in Table 5-1 – essentially an extrapolation of the 2030 target – appears very optimistic. However, the European Climate Law also stipulates that insufficient sequestration by natural sinks should not result in additional burdens being placed on other sectors. International carbon credits could serve as a safety reserve here, ensuring that the overarching 90 % target can still be achieved. Furthermore, discussions are currently underway on how international carbon credits, as a potential flexibility option, can support the achievement of national targets beyond 2030. Given this, the EU ETS 1 should not be calibrated to an overall target of 85 %, nor should the maximum 5 % allowance for international carbon credits be fully utilised, to ensure sufficient

international carbon credits remain available for other purposes (see also Schneider et al. 2026). Consequently, only some of the international carbon credits are taken into account. The emission caps and scenarios are calibrated below so that they are consistent with an 88 % reduction in emissions. This results in residual emissions of around 200 Mt CO_2eq for stationary installations in EU ETS 1 and around 46 Mt CO_2eq for international transport in 2040.

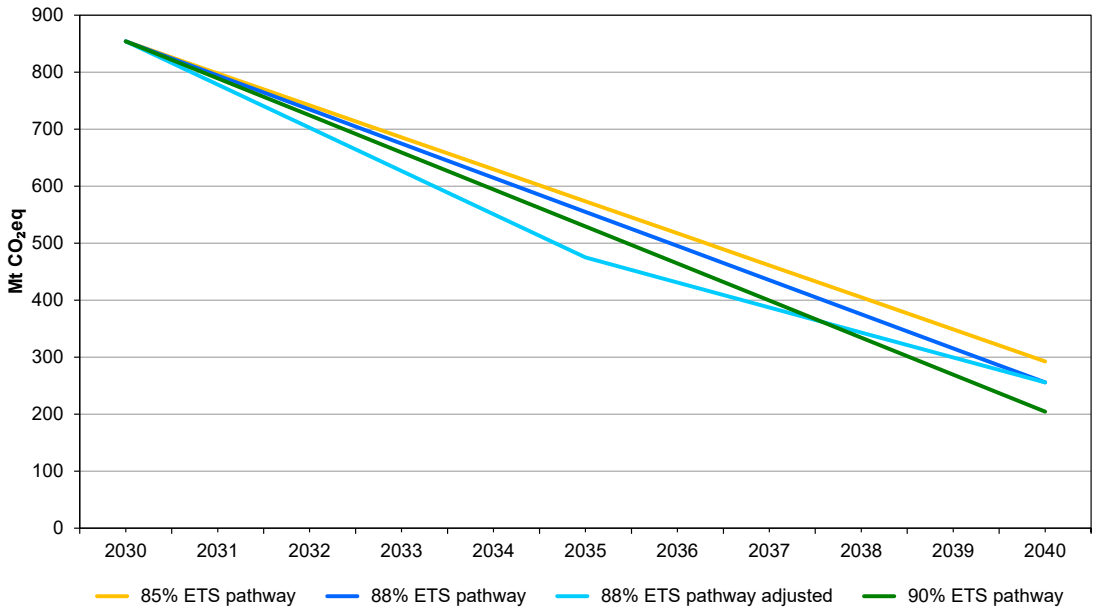
Table 5-1: Target trajectories in the EU climate policy architecture

	aligned with 2040 target of …					
	85% net domestic	**86% net domestic**	**87% net domestic**	**88% net domestic**	**89% net domestic**	**90% net domestic**
	2040 emissions/removals [Mt CO_2eq]					
ETS 1	**285**	**271**	**257**	**246**	**221**	**199**
stationary	*237*	*224*	*210*	*200*	*177*	*156*
aviation	*30*	*29*	*29*	*29*	*29*	*29*
shipping	*18*	*18*	*17*	*17*	*16*	*15*
ESR sectors	**751**	**732**	**713**	**697**	**671**	**646**
ETS 2	*321*	*310*	*300*	*292*	*279*	*266*
other	*430*	*421*	*413*	*406*	*392*	*380*
CDR	**-325**	**-339**	**-354**	**-365**	**-372**	**-379**
LULUCF	*-289*	*-298*	*-308*	*-316*	*-316*	*-317*
Industrial	*-36*	*-41*	*-45*	*-49*	*-56*	*-62*
Total domestic net emissions	**709**	**662**	**614**	**567**	**520**	**473**

Source: Oeko-Institut based on EC (2024a)

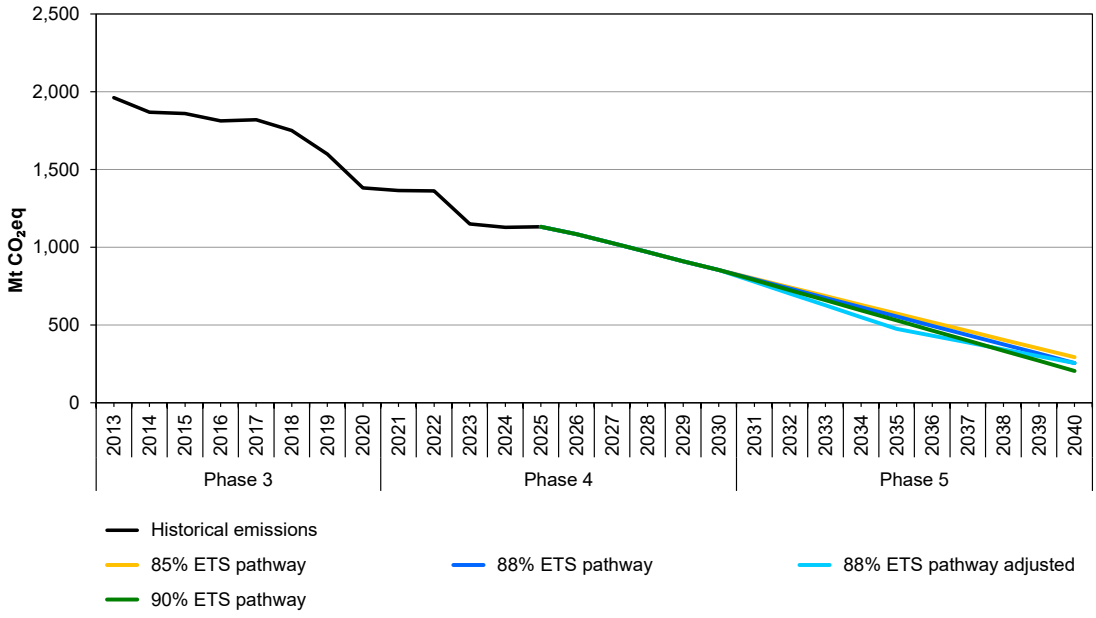
Figure 5-1 shows the emission scenarios that we have used for the EU ETS 1. All scenarios begin in 2030 with that year's cap. Emissions in 2040 depend on the assumed use of international carbon credits. The emission scenarios show the outcome of cost-effectively allocating residual emissions across the individual sectors in 2040. The two key emission trajectories are those which are compatible with a domestic emission reduction target of at least 88 %. The adjusted scenario takes into account the expectation of a faster reduction in emissions in the early years of the fifth trading period than in the second five-year period. This is due, among other things, to the large capacities of coal-fired power plants that will be phased out of the system by 2035 due to policy and market forces (ENTSO-E 2025). The cumulative emissions for the fifth trading period (2031–2040) amount to 4,920 Mt CO_2eq (90 % compatible emissions trajectory, linear), 5,176 Mt CO_2eq (88 % compatible emissions trajectory, linear), 4,776 Mt CO_2eq (88 % compatible emissions trajectory, convex), 5,403 Mt CO_2eq (85 % compatible emissions trajectory, linear).

Figure 5-1: Target-compatible emission scenarios 2030–2040



Source: Oeko-Institut based on EC (2024a) and ENTSO-E (2025)

Figure 5-2: Historical EU ETS emissions and emission scenarios 2013–2040



Source: Oeko-Institut based on EC (2024a) and ENTSO-E (2025)

5.2. Adjustment of the Linear Reduction Factor

Changing the cap is the most direct way of controlling the volume of emissions. The key control mechanism in this regard is the LRF, which determines the annual decrease of the cap. In the event of a structural discrepancy between the cap and emissions, a one-off adjustment could be made by 'rebasing' of the cap. This has been discussed in the past, but does not seem to be a relevant option for the period up to 2040.

The aim of the cap adjustment is to ensure that the ETS 1 market is provided with sufficient (primary) liquidity in the target scenario: with an emissions trajectory compatible with the 90 % target, there should be no significant need for intra-period or cross-period banking or intra-period borrowing. At the same time, the cap must be designed in such a way that the EU-wide reduction target is not jeopardised.

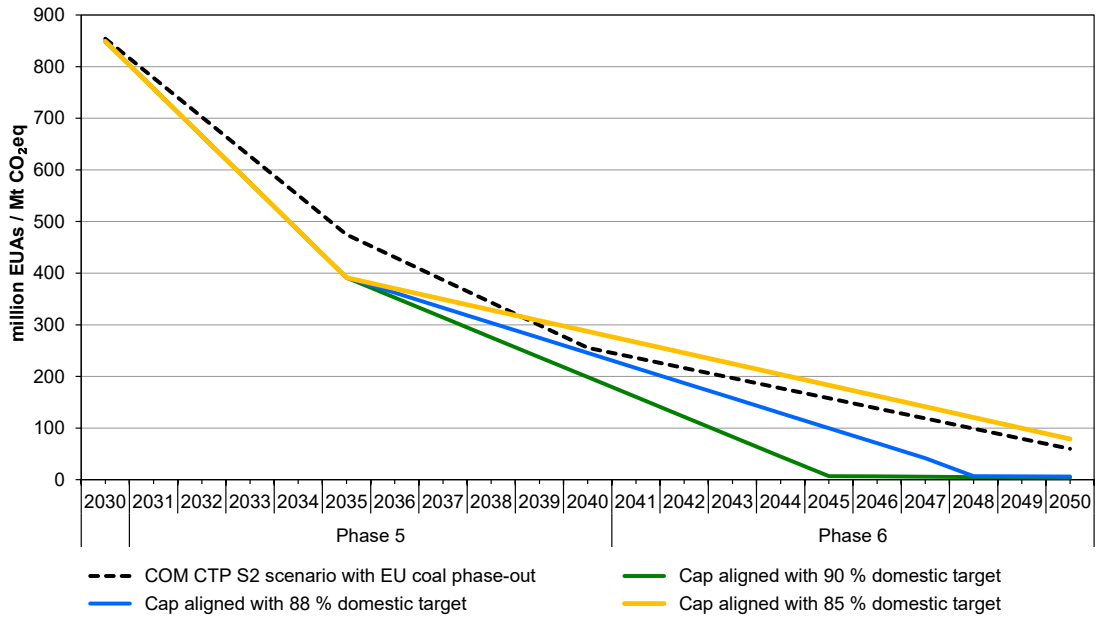
Any changes to the volume of allowances must occur solely through rule-based mechanisms (i.e. LRF and MSR, see below) and be decided with sufficient lead time. Market participants take the expected scarcity or cost of emission allowances into account when making long-term investment decisions. However, there is also a liquid futures market in the short term, with a time horizon of three to four years. Changes to the supply situation within this period can lead to market distortions. This applies in particular to interventions outside the regular framework. For example, the early auction of 37 million EUAs in 2023 noticeably affected the ETS price, despite not resulting in a change to the total volume (ESMA 2024).

To provide a comprehensive assessment of supply during the fifth trading period, it is necessary to consider the quantity of allowances that will still be available at the end of 2030, some of which will enter the market up to 2040. According to the current ETS rules, more than 1.4 billion EUAs will carry over into the fifth trading period. If the cancellations in the MSR are suspended in the short term, as proposed by the European Commission, a further 400 million EUAs could be added (chapter 5.3.3). These quantities are distributed across a market surplus, MSR quantities and remaining allowances in the New Entrants Reserve. It is not certain that all of these surplus quantities will enter the market. This depends on actual emissions trends, activity in the MSR and the use of the remaining allowances in the New Entrants Reserve, among other things. The European Commission plans to auction these primarily to finance an investment booster for the Industrial Decarbonisation Bank from 2030 to 2039 (chapter 5.3.3).

Given the high remaining quantities of allowances from the fourth trading period and the faster initial rate of expected emissions reduction during the first five years of the fifth trading period, the LRF could remain at 4.4 % until 2035 without noticeably affecting liquidity. This would also avoid the need for short-term market interventions and reduce the associated risks of price volatility. From 2036 onwards, the LRF could be reduced to 1.85 % (ETS 1 aligned to 90 %), 1.4 % (ETS 1 aligned to 88 %) or 1.0 % (ETS 1 aligned to 85 %). Figure 5-3 shows the corresponding cap trajectories alongside the central emissions scenario aligned to 88 %, taking into account the faster rate of emissions reduction expected in the early years. In the case of an LRF aligned to 85 %, the cap would remain above the emissions scenario up to 2050, thereby jeopardising achievement of the climate neutrality target. To meet the 2040 climate target, various values for adjusting the linear reduction factors and their starting points are conceivable, provided that the cumulative emission level remains the same. Regarding the starting points, however, it is also important to avoid interference in the liquid segment of the futures market. Even

a relatively short-term change to the linear reduction factor would result in significant price effects for periods for which a considerable volume of futures contracts has already been concluded on the basis of the current LRF. In order to meet the set targets without unduly restricting availability in subsequent years, the following analyses therefore also assume an LRF of between 1.4 % and 1.85 % after 2035. This would fall to zero between 2045 and 2048, except for small residual quantities from the aviation ETS. Between 2043 and 2046, the cap on residual industrial emissions would be 50–100 Mt CO_2eq.

Figure 5-3: Options for adjusting the LRF that are compatible with 90 %, 88 % and 85 % net climate targets for 2040



Note: This includes stationary installations as well as air and maritime transport.
Source: Oeko-Institut

5.3. Adjustments of the Market Stability Reserve

5.3.1. Background to the MSR

The EU ETS 1 was characterised by a substantial surplus of emission allowances during its early trading periods (chapter 3.2). This was due to various factors, including the economic and financial crisis from 2008 onwards and the high availability of international carbon credits. The resulting fall in the price of credits significantly reduced the steering effect of the system in climate policy terms. Against this background, the EU opted for a structural reform to achieve a better long-term balance between supply and demand in emissions trading – the introduction of the Market Stability Reserve (MSR).

The legal basis for the MSR was established by the EU MSR Decision in 2015. The MSR was set up in 2018 and began operation in 2019. The MSR was initially filled with 900 million EUAs, which had previously been withheld from auctions as part of the backloading process.

At the heart of the MSR is a rule-based, quantity-driven mechanism that automatically adjusts the auction volume of allowances. The key factor here is the total number of allowances in circulation (TNAC), which is calculated annually. The TNAC comprises the total quantity of allowances issued (auctions, free allocation) minus the total quantity of allowances used (allowances used to cover verified emissions, cancellations). On 28 May 2026, the current TNAC was published (EC 2026d). The total volume in circulation stood at 1.0 billion EUAs at the end of 2025. The EU ETS recorded its highest volume in circulation in 2013, at 2.1 billion EUAs.

Based on the TNAC, the MSR adjusts the auction volumes for subsequent years:

- If the TNAC exceeds an upper threshold (currently 833 million EUAs), a fixed percentage (currently 24 %) of the surplus is transferred to the MSR.[5]
- If the TNAC falls below the lower threshold (currently 400 million EUAs), allowances are returned to the market from the MSR (currently 100 million EUAs).

Thus, the MSR serves as a balancing mechanism, cushioning both surpluses and shortages, and limiting extreme price fluctuations, thereby eliminating the need for discretionary policy intervention in the market.

Since its introduction, the MSR has been adjusted and tightened on several occasions. Under Directive (EU) 2018/410, the rate at which allowances are transferred to the MSR was temporarily doubled from 12 % to 24 % of the surplus. As part of the Fit for 55 package, this increased rate was extended until 2030. It was also stipulated that allowances exceeding a threshold of 400 million EUAs would be permanently retired from the MSR. This effectively reduces the total volume of emission allowances in the EU ETS.

As part of the EU ETS reform, adjustments to the MSR are expected in order to ensure its effectiveness as a balancing instrument beyond 2030. It should be emphasised that the outcomes of potential reform options for the MSR depend substantially on the design of the LRF (chapter 5.2). As a general rule, the lower the ambition of the LRF, the less the MSR needs to contribute to the provision of additional allowances in situations of

[5] The buffer mechanism of the MSR applies in the transitional range between 833 and 1,096 million EUAs. This rule is intended to prevent even a minor exceedance of the upper threshold from leading to a disproportionate withdrawal of allowances.

scarcity, and the more likely it is that the MSR will continue to withhold allowances after 2030. Conversely, a more ambitious LRF increases the importance of the MSR as a stabilising element during periods of scarce allowance availability. Furthermore, actual emissions trends (Figure 5-1) also have a decisive influence on the extent to which supply and demand are balanced in the EU ETS.

To date, the central function of the MSR has been to remove excess emission allowances from the market that have built up to excessive levels. Over the course of the 2030s, releasing allowances from the MSR onto the market will become more important. In the long term, beyond 2040, the MSR could be developed further to integrate sink allowances into the EU ETS 1.

5.3.2. Revised calculation of the Total Number of Allowances in Circulation (TNAC)

Up to and including 2023, the TNAC was calculated solely based on the allowances from the stationary sector. From 2024 onwards, the demand from air and maritime transport will also be taken into account for the first time; however, this applies only to demand from 2024 onwards and not to historical demand from aviation (see chapter 3.2).

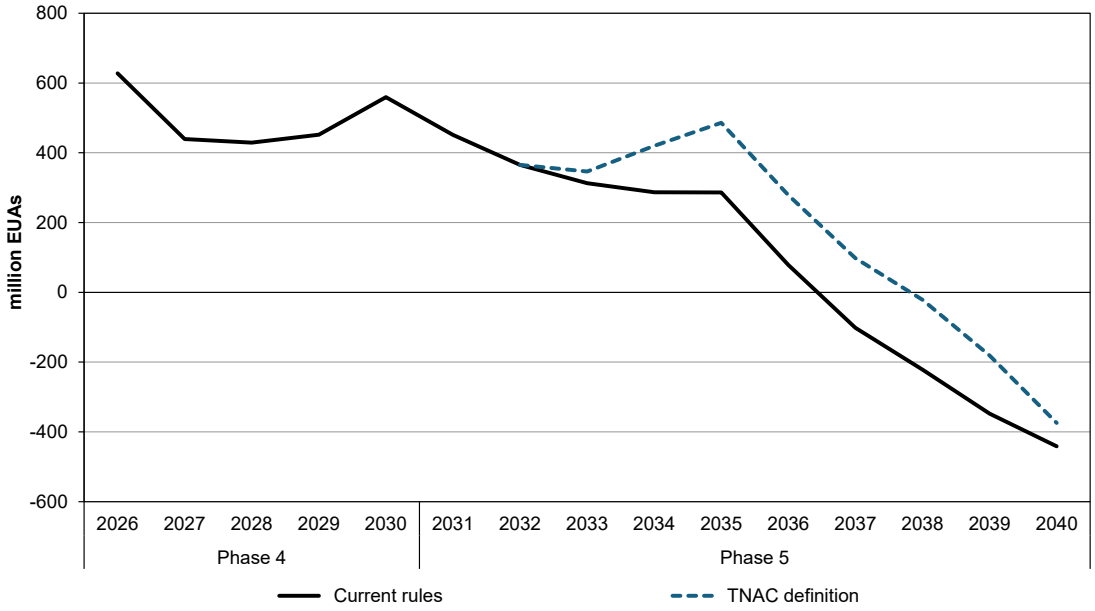
Box 5-1 TNAC visible to the market

In the following analyses, TNAC visible to the market (VtM) refers to the TNAC that is actually relevant from the perspective of market participants. It is adjusted for historical net demand from aviation and for the effects of ESR flexibility. By 2030, the difference between TNAC and $TNAC_{VtM}$ amounts to approx. 260 million EUAs.

The currently reported TNAC is 260 million EUAs higher than the TNAC actually available to the market (TNAC visible to the market – $TNAC_{VtM}$, Box 5-1). This comprises 190 million EUAs from the aviation sector's historical net demand up to and including 2023, as well as 70 million EUAs that Member States intend to use under ESR flexibility. Currently, not all eligible Member States intend to utilise their full total budget of 100 million EUAs, but they can still adjust this figure until 2027. Based on the ESR flexibility plans reported to date and using the current calculation methodology, the TNAC would be overestimated by approx. 260 million EUAs and by 290 million EUAs if the full ESR flexibility were utilised.

This may mean that the MSR does not respond appropriately to the actual market situation. In particular, the release of allowances into the market begins too late in the first half of the 2030s. Figure 5-4 illustrates this effect using the $TNAC_{VtM}$ trend. If the TNAC is calculated as before (current rules), the $TNAC_{VtM}$ will decline from 2032 onwards given the emissions trend shown. However, if the TNAC calculation is adjusted, the $TNAC_{VtM}$ will remain at around 400 million EUAs until 2035, after which it will decline due to depleted MSR reserves. If the TNAC calculation is adjusted (adjustment of the TNAC calculation), the $TNAC_{VtM}$ will hover at around 400 million EUAs up to 2035 and then decline because the MSR has been depleted.

Figure 5-4: Trend in TNAC visible to the market following adjustment of TNAC calculation



Assumptions: LRF of 4.4 % (unchanged), adjusted emissions scenario compatible with a domestic target of 88 % in 2040

Source: Oeko-Institut's MSR tool (see Graichen et al. 2025)

The correction to the TNAC calculation therefore means that, given the current emissions trajectory and with no change to the LRF, the $TNAC_{VtM}$ will remain in the lower range of the current threshold and well above zero until the mid-2030s.

5.3.3. Changes to cancellation rules for Market Stability Reserve

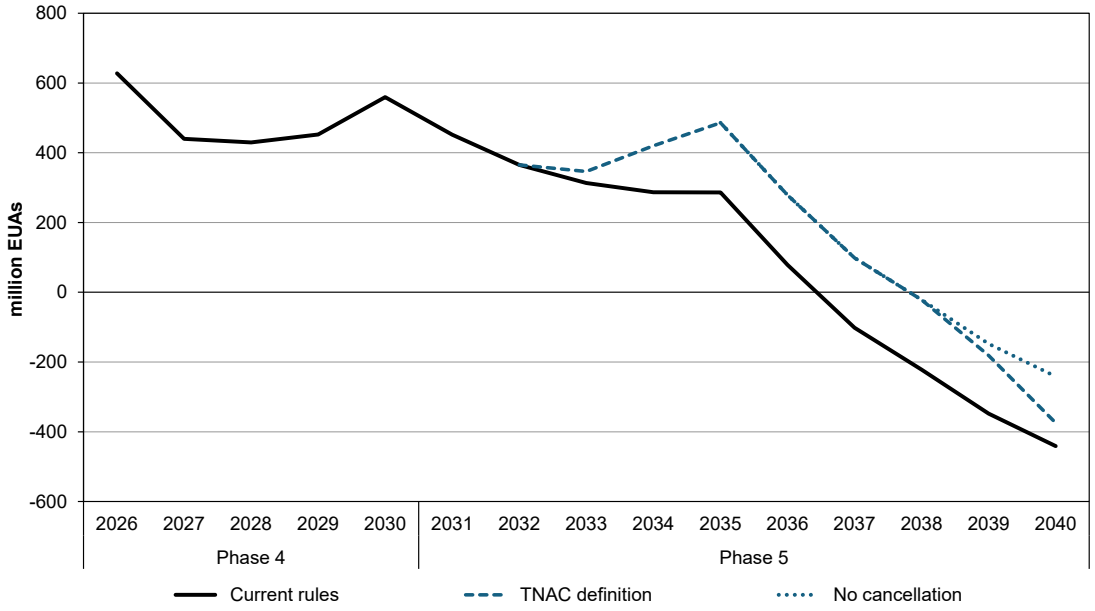
Since its introduction, the MSR has regularly withdrawn around 2.3 billion EUAs from the market. In addition, in 2019 and 2020, 900 million EUAs from backloading and a further 900 million EUAs from unallocated free allocation in the third trading period were transferred to the reserve. Conversely, 250 million EUAs were withdrawn from the MSR and transferred to the Innovation Fund and the New Entrants Reserve for the fourth trading period. In total, therefore, approx. 3.8 billion EUAs were transferred into the MSR, of which around 3.2 billion EUAs were cancelled.

Currently, the number of EUAs in the MSR is capped at 400 million. In early April 2026, the European Commission proposed that no further allowances should be removed from the MSR. As the MSR will continue to absorb allowances in the scenarios described here up to 2028, depending on the exact month from which cancellation is suspended, this would increase the number of allowances in the MSR in 2030 to between 420 and 600 million EUAs. Under the current rules, a further 200 million EUAs will be transferred from the NER to the MSR at the end of the fourth trading period (Box 5-2). This means that between 620 and 800 million EUAs will be available in the MSR at the start of the fifth trading period, without cancellations.

Box 5-2 Unused allowances in the New Entrants Reserve (NER)

At the start of the fourth trading period, 331.3 million EUAs were held in the NER.[6] The plan is for 200 million EUAs – provided they are not used within the NER – to be transferred to the MSR at the start of the fifth trading period. However, it is now clear that the allowances held in the NER are not only remaining unused, but that the reserve is also growing. This is because unallocated allowances, which were originally intended for allocation, are also flowing into the NER. Such non-allocations may result, for example, from capacity reductions at installations. For the period 2021–2025, this additional inflow is estimated at 171.5 million EUAs.[7] A further comparable volume of allowances is expected to be added in the years 2026–2030. In total, the NER would thus grow to around 674.3 million EUAs. Even after deducting the planned return of 200 million EUAs to the MSR, around 474.3 million EUAs would remain, meaning that the NER would still be well stocked.

Figure 5-5: Trend in TNAC visible to the market following an adjustment to TNAC calculation, and without cancellation of allowances in MSR from 2026 onwards



Assumptions: LRF of 4.4 % (unchanged), adjusted emissions scenario compatible with a domestic target of 88 % in 2040

Source: Oeko-Institut's MSR tool (see Graichen et al. 2025)

Figure 5-5 shows the trend in the $TNAC_{VtM}$ up to the year 2040, assuming that, in addition to the adjustment to the TNAC calculation, the cancellation of allowances from the MSR

6 https://climate.ec.europa.eu/news-other-reads/news/2025-carbon-market-report-eu-ets-lowers-power-sector-emissions-and-expands-maritime-transport-2025-12-03_en

7 https://climate.ec.europa.eu/news-other-reads/news/2025-carbon-market-report-eu-ets-lowers-power-sector-emissions-and-expands-maritime-transport-2025-12-03_en

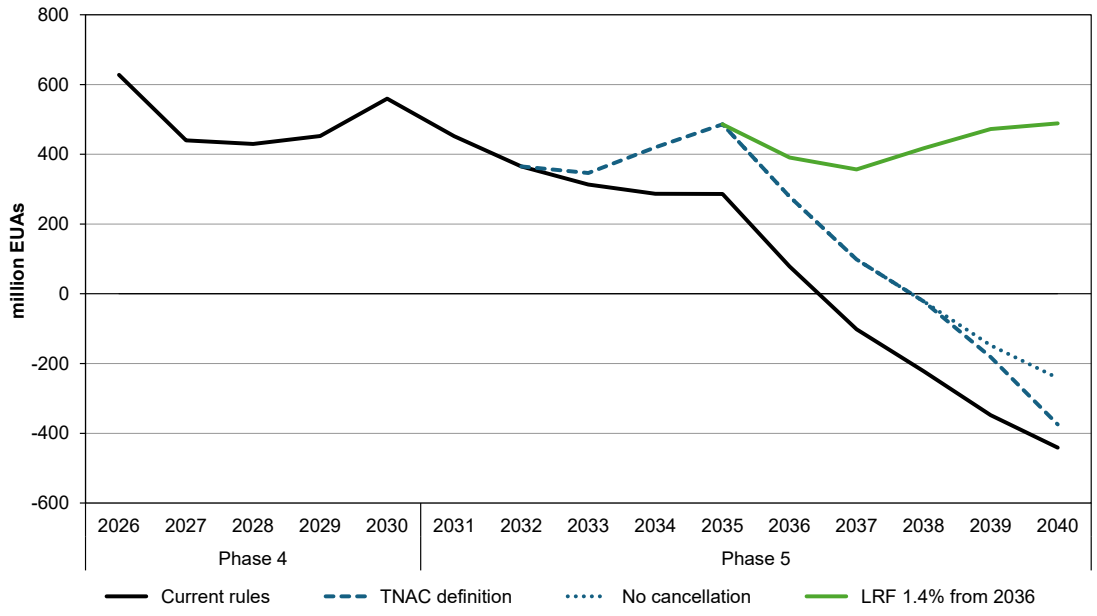
is suspended from January 2027. As the MSR would only return allowances to the market for the first time in 2033 under the given emissions scenario, and would not be exhausted until 2039, the decision not to cancel allowances from the MSR would only impact market supply from that point onwards. According to the scenario presented here, the MSR would not be empty until 2043, even though the $TNAC_{VtM}$ falls below zero many years earlier.

In addition to the transfer of unused allowances from the NER to the MSR, in accordance with current regulations, and the suspension of allowance cancellations in the MSR, further options that would increase the MSR are under discussion (see section 5.3.6).

5.3.4. Combining a revised LRF with adjustments to the MSR

As explained in chapter 5.3.1, the effectiveness of reform options for the MSR can only be properly evaluated alongside an adjustment to the LRF. Figure 5-6 considers this by combining an adjustment to the TNAC calculation with the abolition of allowance cancellation in the MSR and a target-compatible LRF of 1.4 % from 2036 onwards. The $TNAC_{VtM}$ is expected to be approx. 400 million EUAs during the fifth trading period.

Figure 5-6: Trend in the TNAC visible to the market following an adjustment to the TNAC calculation, excluding the cancellation of allowances in the MSR and with an LRF of 1.4 % from 2036



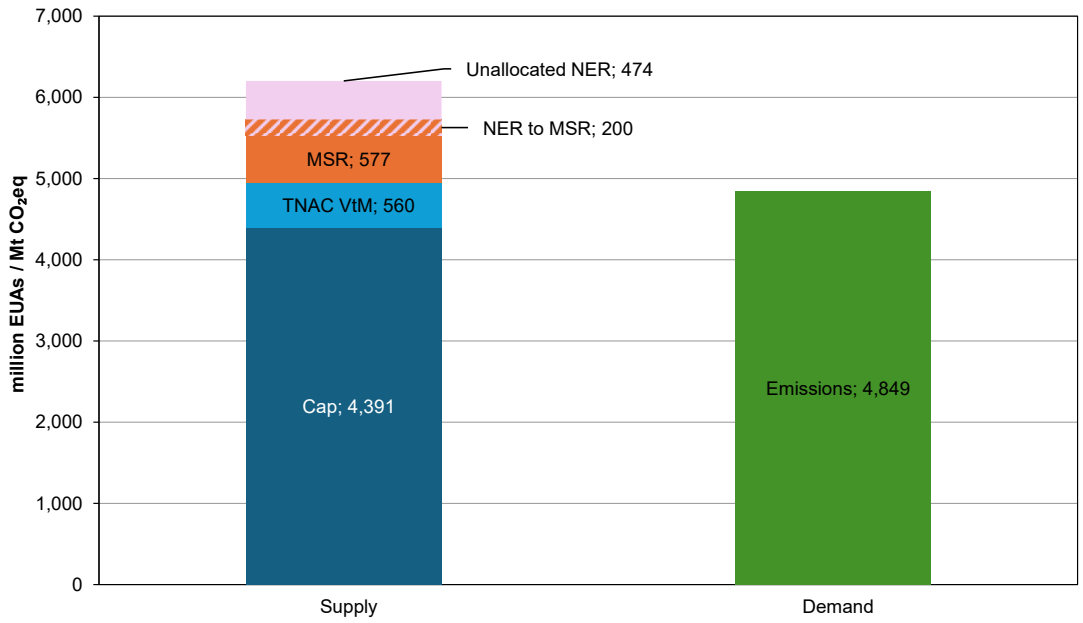
Assumptions: Adjusted emissions scenario compatible with a domestic target of 88 % in 2040
Source: Oeko-Institut's MSR tool (see Graichen et al. 2025)

Figure 5-7 shows a comparison of the supply of allowances and the expected emissions trajectory in a target-compatible scenario during the fifth trading period. The supply comprises both the allowances available in the fifth trading period under an LRF that is reduced to 1.4 % from 2036, and allowances carried over from the fourth trading period into the fifth. This includes 577 million EUAs held in the MSR, provided there are no further cancellations from January 2027 onwards, as well as an additional 200 million

EUAs from unused allowances in the NER. Added to this are around 560 million EUAs in surplus allowances carried over from the fourth to the fifth trading period, as well as an expected 474 million EUAs in unused allowances from the NER.

Overall, it is clear that the available supply significantly exceeds the target-compatible cumulative emissions for the fifth trading period. This shows that this combination of LRF and MSR adjustments provides a sufficient supply for a target-compatible emissions scenario in principle. However, it is crucial that the allowances enter the market at the right time. At the same time, it is evident that further measures to expand the supply would cause it to rise significantly beyond a target-compatible level. This carries the risk of emissions deviating from the intended target pathway, prices falling, and emissions trading failing to achieve the required steering effect to meet the 2040 target in the covered sectors.

Figure 5-7: EUA supply and demand based on the reform package, 2031–2040



Assumptions: Adjusted emissions scenario compatible with a domestic target of 88 % in 2040; LRF of 1.4 % from 2036, adjusted TNAC calculation, suspension of cancellation from January 2027

Source: Oeko-Institut's MSR tool (see Graichen et al. 2025)

The design of the LRF and the MSR, along with other potential sources of allowance supply, will influence market conditions well beyond 2040, as they affect the surplus of allowances and MSR holdings. In the current scenario, the allowance surplus at the start of the sixth trading period in 2041 is over 1.3 billion EUAs. This includes a surplus held by market participants of approximately 500 million EUAs, 400 million EUAs in the MSR and the remaining NER volume of approximately 500 million EUAs from the fourth trading period. However, the latter is currently under discussion as part of the planned Investment Booster of the proposed Industrial Decarbonisation Bank (see chapters 5.3.5 and 10).

Compared with these 1.3 billion EUAs that could carry over from the fifth to the sixth trading period, the cumulative emissions in the sixth trading period, amount to 1.5 billion tonnes of CO_2eq. This is according to the European Commission's S2 scenario, which aims to achieve an 88 % reduction in emissions by 2040 and is compatible with climate neutrality by 2050 (see chapter 5.2). It is clear that the allowances carried over from the fifth to the sixth trading period – even without taking into account the cap in the sixth trading period – are at the level of the cumulative emissions compatible with the targets.

5.3.5. Auctions of remaining NER allowances to finance the Industrial Decarbonisation Bank's Investment Booster

In the context of the forthcoming reform of the ETS, EU Commission President Ursula von der Leyen has announced several initiatives specifically designed to boost investment in industrial decarbonisation. At the heart of this is the planned ETS Investment Booster of around EUR 30 billion, which is to be financed through the sale of emission allowances. The aim is to provide additional funding for climate-friendly technologies and to support industrial companies in their transition.

In addition, as part of the Clean Industrial Deal, the Commission is pursuing the establishment of an Industrial Decarbonisation Bank, through which investments of around EUR 100 billion are to be mobilised. This is intended to serve as a central financing instrument for the transformation of industry and to support projects that enable emissions reductions while simultaneously strengthening the competitiveness of European industry. Both initiatives are to be funded primarily from ETS revenues and underscore the political priority of making greater use of ETS revenues for decarbonisation.

It remains unclear exactly how the funds from the auctioning of allowances are to be made available. Depending on the scheme's design, releasing additional quantities of allowances onto the market in the short term — for example, through the auctioning of unused allowances from the NER — could cause the CO_2 price to fall. This could undermine the profitability of companies that have already made substantial investments in decarbonisation measures. Furthermore, a lower price level would mean that more allowances would have to be auctioned to achieve the same funding target, exacerbating market distortions further. Auction volumes should not be adjusted within the three- to four-year time horizon of the liquid futures market, as unexpected additional auctions during this period could increase price volatility and weaken the ETS's price signal.

The European Securities and Markets Authority (ESMA 2024) notes that bringing forward auctions under the REPowerEU plan, specifically the auction of 35 million EUAs in 2023, had a noticeable impact on the ETS price. Against this backdrop, the short-term introduction of several hundred million additional allowances into a comparatively smaller market could have unpredictable and potentially significant consequences for market equilibrium.

In this context, currently considering auctioning the remaining allowances from the NER over the duration of the fifth trading period, rather than in the short term. While this approach could help to distribute additional market volumes over time, it raises the question of whether the relevant auctions would require revenue frontloading in order to generate revenue early on (see chapter 10).

In the modelled scenario, for example, the auctioning of 400 million EUAs from the NER surplus over the period of 2030 to 2039 means that the MSR will not distribute any

allowances in the fifth trading period and its distribution function is, in effect, replaced by the additional auctioned quantities. The trend in the $TNAC_{VtM}$ largely corresponds to the pattern shown in Figure 5-6. At the end of the fifth trading period, the MSR's holdings are around 400 million EUAs higher, as no allocations need to be made from the reserve and the additional market demand is instead met by the auctioned NER volumes.

5.3.6. Replenishment of the Market Stability Reserve

In combination with an adjusted LRF and a reformed TNAC formula, suspending the cancellation mechanism in the MSR is sufficient to ensure liquidity in the 2030s and probably beyond, provided that emissions trends remain consistent with the targets (chapter 5.3.4). The MSR can also meet the requirements extending beyond the long-term perspective (i.e. after 2040) for residual industrial emissions covered by EU ETS 1 that are unavoidable, provided it holds sufficient quantities of emission allowances.

Several options are conceivable for providing these quantities, which are currently estimated to be in the range of 50 to 100 Mt CO_2eq.

Firstly, unused allowances from the NER could be transferred to the MSR. While this would provide a significant volume of approx. 400 million EUAs, it would only be available for a one-off injection and would no longer be available to finance the Investment Booster (see chapter 5.3.5).

Secondly, from a long-term perspective, it makes sense to further develop the MSR with a replenishment mechanism for sink allowances. This option would also enable longer-term and repeated – e.g. annual – replenishment of the MSR and is not currently subject to any regulatory restrictions. The relevant removal credits would then be purchased and converted within the MSR into EU ETS 1 emission allowances. The MSR would then also function as a gateway for removal credits. Given the challenges associated with the direct use of removal credits as a compliance instrument, the approach via the MSR would be the preferred option.

In theory, a third option would be to integrate international allowances into the EU ETS 1 via the MSR as a gateway. The European Commission would then purchase international allowances, e.g. using funds from auction revenues.[8] Corresponding quantities of regular emission allowances would then be held in the MSR. However, the overarching framework of EU climate policy also applies to the channelling of international carbon credits via the MSR. This framework provides for only limited use of international carbon credits to meet the 2040 target and no use at all for the 2050 target (chapter 3.1).

Centralised allocation and release of sinks (Option 2) and international allowances (Option 3), where applicable, via the MSR would establish it as a gateway through which relevant quality requirements, quantity controls and phased integration into the ETS and overarching climate policy architecture can be implemented.

[8] With a view to the use of allowances, a distinction must be made between two levels. Under the EU ETS 1, only EUAs would be used. As part of the EU's commitment under the Paris Agreement, the EU would then use the Article 6 credits it has purchased.

5.4. Conclusion and recommendations

The analysis shows that the reform of the cap and the Market Stability Reserve (MSR) can only be considered in conjunction with one another to ensure an ETS design that is simultaneously compatible with policy objectives, promotes investment and stabilises the market. If the reform is not coordinated, there is a risk that a structural surplus of allowances will arise once again. This is particularly the case if changes to the cap, the MSR or additional supply sources – such as through the auctioning of remaining NER allowances – are not consistently coordinated with one another.

Under the current rules, the cap in EU ETS 1 will fall to zero by 2039. An adjustment to the cap is to be expected in light of the new 2040 target. However, the analysis shows that adjusting the LRF too early would entail considerable risks to the achievement of the target. Taking into account the significant expected reductions in the electricity sector in the first half of the 2030s, followed by a slowdown in the rate of reduction, it is assumed here that the LRF will initially remain at 4.4 % until 2035. From 2036 onwards, it will then be reduced to a value compatible with the 2040 target, falling within the range of 1.4 % to 1.85 %. An LRF within this range would provide the market with sufficient primary liquidity in the medium term without undermining the long-term reduction target.

The analysis also makes it clear that, even with emission trajectories compatible with the target, considerable quantities of allowances will be carried over from the fourth to the fifth trading period. This means there is no fundamental shortage of allowances; rather, the key issue is ensuring that the allowances enter the market at the appropriate time. Against this background, an adjustment to the TNAC calculation is particularly necessary. The current calculation does not consider historical air traffic demand or ESR flexibility. A change to the TNAC calculation will enable the MSR to respond more effectively to situations of surplus and scarcity. In this context, it is also recommended that the MSR's volume triggers be reviewed as part of the reform and, in future, be adjusted to a falling level of the cap, rather than permanently maintaining rigid thresholds.

At the same time, the analysis shows that any additional measures aimed at increasing supply should be treated with caution. This is particularly relevant for potential auctions of residual NER allowances intended to finance the planned Investment Booster or the Industrial Decarbonisation Bank. Such measures pose a considerable risk to price formation and investment signals. Therefore, additional auction volumes should not be introduced into the liquid futures market either in the short term or in the years ahead. In the modelled scenario, auctioning 400 million EUAs from remaining NER allowances over the period of 2030 and 2039 would effectively replace the MSR's distribution function. This highlights the importance of systematically considering the interactions between different supply sources.

Possible flexibility options such as the inclusion of removal credits (see chapter 7) could increase the supply further and must be considered in reform discussions from the outset, along with their interactions with the cap and MSR.

6. Price management

6.1. Introductory remarks

Allowance prices in an emissions trading system are, by their very nature, volatile. In the EU ETS 1, this volatility depends on fundamental factors, such as the supply and demand situation, as well as more situational factors. Fundamental factors include short-term oversupply in the market (as was the case in the years up to 2018), the energy market environment (e.g. regarding coal-gas price differentials as a marginal abatement option), the contributions of other instruments to emission reductions, long-term target adjustments in the EU ETS 1, as well as other, more short-term factors such as economic developments. Furthermore, technological developments (particularly with a view to price-setting marginal avoidance options) are of paramount importance, especially for long-term time horizons. Situational and, above all, short-term price determinants include the activities of financial market participants as well as market information and rumours. Figure 3-3 illustrates this using the example of historical price trends.

Although short-term price volatility is almost impossible to predict, a number of market participants regularly disclose their price expectations. Table 6-1 shows the trend in such analyst estimates from a regularly surveyed panel, as well as those for the World Energy Outlook (WEO), which is published by the International Energy Agency (IEA). The overview shows that analyst estimates for the outlook over the next few years have changed considerably in the last three years.

While, in 2023, price levels of (nominal) EUR 140 to EUR 155 per EUA were expected for 2030, price expectations for subsequent years were initially revised downwards slightly, i.e. to the range of EUR 120 to EUR 130 per EUA. From 2026 onwards, the forecasts for 2030 fell to levels of approx. 100 EUR/EUA, but continue to show an upward trend over time and for the period from 2031 onwards. These trends were initially driven by price developments in the natural gas and hard coal markets, but were subsequently influenced by what appear to be revised expectations regarding the future development of the EU ETS 1 and also the longer-term economic outlook.

The WEO projections initially highlight the vast influence of long-term climate policy ambition levels on the long-term price assumptions. For a development pathway in line with the commitment to climate neutrality by 2050, prices of approx. 150 EUR/t CO_2 (in real 2024 prices) are expected in the mid-2030s, rising to over 200 EUR/t CO_2 in the longer term. In nominal terms, the corresponding prices would be approx.190 EUR/t CO_2 and around 350 EUR/t CO_2 respectively. While these price levels depend heavily on the policy mix parameters and the scope of the ETS, they illustrate that substantially rising price levels are to be expected in the future. However, the range of conceivable developments resulting from a variety of factors is also very broad.

This poses, therefore, various challenges to the further development of the EU ETS. Firstly, the system should be designed so that it robustly reflects dynamics in the energy sector and, where applicable, the economic environment in prices. Secondly, a mechanism must be established to manage the price effects of shifts in supply and demand, ensuring sufficient robustness in prices and price trends for investment projects.

Table 6-1: Analyst estimates for future allowance price levels

a) Carbon Pulse Panel (median values)

Survey	Analysts	Next quarter	2023	2024	2025	2026	2027	2028	2029	2030	2031	
			EUR/EUA									cps*
30.01.2023	11	80.00	84.00	94.90	97.20	114.50	-	-	-	140.00	-	
02.05.2023	16	87.00	87.50	99.67	102.00	119.50	-	-	-	153.00	-	9.3%
03.08.2023	15	85.30	-	95.96	100.64	119.50	126.30	-	-	155.00	-	1.3%
16.10.2023	15	82.15	-	94.75	106.30	123.55	-	-	-	155.00	-	0.0%
23.01.2024	14	68.50	-	71.00	84.00	104.00	113.00	120.00	127.00	140.00	-	-9.7%
17.04.2024	14	60.50	-	63.95	72.75	94.20	114.85	123.80	130.00	137.50	-	-1.8%
22.07.2024	14	68.95	-	67.12	76.55	91.50	105.00	115.00	127.00	145.00	-	5.5%
14.10.2024	13	64.90	-	-	75.00	81.30	104.00	113.00	125.00	134.90	-	-7.0%
30.01.2025	14	72.75	-	-	74.25	89.07	104.50	112.20	122.40	134.80	-	-0.1%
01.05.2025	13	68.00	-	-	71.85	86.87	102.00	112.04	121.50	122.00	-	-9.5%
10.07.2025	14	73.00	-	-	-	86.50	99.50	112.00	117.00	137.00	-	12.3%
07.10.2025	15	76.05	-	-	-	88.00	104.00	113.50	123.55	135.20	-	-1.3%
15.04.2026	14	74.15	-	-	-	77.75	91.00	92.40	103.50	106.00	117.50	-21.6%
EEX Futures**			-	-	-	74.16	76.71	79.33	82.20	85.29	88.79	

Notes: * cps – compared with the previous survey. – ** Average values for futures contracts in the month of the last survey.

b) Projections from World Energy Outlook

WEO	2030/2035*			2040			2050		
	Stated Policies	Advanced Pledges**	Net zero	Stated Policies	Advanced Pledges**	Net zero	Stated Policies	Advanced Pledges**	Net zero
	EUR (2024)/t CO_2								
2017	-	-	-	48.87	142.53	142.53	-	-	-
2018	-	-	-	42.24	137.53	137.53	-	-	-
2019	-	-	-	39.64	129.05	129.05	-	-	-
2020	-	-	-	49.55	133.39	133.39	-	-	-
2021	59.78	110.37	119.56	68.98	156.35	188.54	82.78	183.95	229.93
2022	77.95	116.93	121.26	84.88	151.57	177.55	97.87	173.22	216.53
2023	110.90	124.77	129.39	119.22	161.73	189.46	124.77	184.84	231.05
2024	125.93	138.95	156.32	129.40	151.98	178.04	137.22	173.69	217.12
2025	73.69	-	152.47	73.69	-	173.64	133.83	-	211.76

Notes: * From 2024 onwards, base year 2035. – ** Up to 2020: Sustainable Development Scenario; from 2021 onwards: Advanced Pledges Scenario.

Sources: Carbon Pulse, International Energy Agency

Thirdly, a decision must be made at an early stage as to whether future marginal abatement options should be realised solely through the EU ETS 1 or, where appropriate, through additional instruments as well. This is particularly important for the period after 2035, when the previously dominant marginal abatement option of switching from coal to gas in electricity generation will become less significant due to the EU-wide phase-out of coal-fired power generation. The latter set of issues is addressed in chapter 11.

6.2. Cost Containment Reserve and price control via the MSR

For several years, discussions in the literature on the EU ETS 1 have focused on how the system can respond more effectively to sharp price increases, since high price volatility can negatively affect the certainty of investment planning for decarbonisation (Cludius et al. 2022).

In addition to the volume-based MSR mechanism (chapter 5.3), which is triggered via the TNAC and defined thresholds, the EU ETS 1 already has a price-based stabilisation instrument in place under Article 29a of the ETS Directive: If the EUA price exceeds 2.4 times the average price of the preceding two years for six consecutive months, 75 million EUAs are released from the MSR into the market. Prior to the Fit for 55 revision, Article 29a was not rule-based but rather linked to a decision by the Climate Change Committee as to whether the price rise was fundamentally justifiable. Furthermore, the Linear Reduction Factor was reduced from 3 to 2.4.

The report underpinning the 2021 MSR review (EC 2021d), discusses further options for developing Article 29a that would speed up the response time. These include:

- shortening the observation period to three months (as in Article 30h of the EU ETS 2) or observing non-consecutive months;
- a further reduction of the LRF to less than 2.4 – at current price levels, the current factor corresponds to a price increase of 180–190 EUR/t CO_2; and
- the introduction of an absolute price threshold above which allowances are distributed. A similar provision exists within the MSR2 of the EU ETS 2, with a price threshold of 45 EUR $_{2020}$/t CO_2. However, this is not a hard price cap, as only limited quantities are distributed even if the price is significantly above this threshold.

In principle, the effectiveness of a price-based intervention also depends on the MSR's simultaneous behaviour via its volume trigger. The design of Article 29a and its interaction with the MSR have long been subjects of controversy (Gerlagh et al. 2022; Willner and Perino 2022). In this context, Perino (2024) and Willner and Perino (2022) propose developing the volume and price control mechanisms of EU ETS 1 further. They advocate a rule-based form of price cap that is known in advance, which would effectively resemble a Cost Containment Reserve (CCR). This could release additional allowances into the market automatically, or at least predictably, in the event of sharp price fluctuations.

The basic concept of a CCR differs from that of the MSR. The MSR is a volume-based instrument that responds to the total number of allowances in circulation (TNAC), thus primarily targeting excess or insufficient liquidity in the market. By contrast, a CCR would operate on a price-based basis and explicitly aim to limit very high prices or high price volatility. Borghesi et al. (2023) highlight the tension between the MSR and the CCR if they were to be integrated into EU ETS 1 simultaneously, noting this would lead to inconsistencies in how the mechanisms function. Therefore, retaining the MSR as a stability mechanism is not considered to be compatible with controlling supply volumes via a mechanism triggered by EUA prices.

The same applies to introducing a strong price trigger within the MSR. Firstly, the trigger would be pro-cyclical, releasing additional allowances in response to high prices and thus jeopardising the climate target. Secondly, it would undermine the fundamentally rule-based volume control of the EU ETS 1, opening up scope for political discretion which could severely – and thus unacceptably – undermine the system's credibility.

In the broader context and in light of the current design of the EU ETS 1 and the underlying motivations for the functioning of the overall system, the measures described above – the introduction of a Cost Containment Reserve or price triggers for the MSR – do not

appear to be appropriate, particularly with a view to the current and future functions of the MSR in its present form.

6.3. Price corridors

Pricing in the EU ETS 1 is determined by various factors, including the parameters of the LRF and MSR, economic trends, and the behaviour of speculators. The price is therefore volatile and reflects the current and expected market situation. Compared to a fixed price, such as that set by a CO_2 tax or, until 2025, by the German Fuel Emissions Trading Act (BEHG), reduced predictability is a significant disadvantage. Although the future CO_2 price can be projected in companies' investment calculations, it cannot be predicted with certainty. The same applies to developments in international energy markets and energy-adjacent commodities, which have considerably influenced carbon prices (e.g. the coal-to-gas switch) to date and will continue to do so in the future (e.g. CCS). This makes long-term investments in climate protection more challenging, as payback periods of ten years or more are common. A reform proposal by Pietzcker et al. (2021) that has been discussed repeatedly addresses this planning uncertainty by setting a dynamic upper and lower limit for the ETS price, thereby stabilising price expectations. This would help to stabilise market prices and enhance the predictability of investment decisions made by companies.

At the same time, such a price corridor as suggested by Pietzcker et al. (2021) would limit the influence of the aforementioned factors – resulting in a number of consequences. For example, if parameter settings for the LRF, MSR, CBAM, benchmarks or free allocation are adjusted (as in the forthcoming revision of the EU ETS), the upper and lower price limits would also need to be adjusted. This would necessitate a very precise evaluation of the effects of the interactions between all the changes. Adjusting the corridor too sharply or too gently would trigger effects of its own on the price and market participants' expectations, thereby distorting the response to changing market processes intended by the price-setting mechanism. This applies even at the initial setting stage: cyclical or structural developments (e.g. technological advances or changes in the international fuel market) cannot be fully anticipated at the time of setting. If the price reaches the upper limit of the corridor, this indicates a situation of scarcity. At the same time, a higher price would make measures to reduce emissions more attractive. Without an effective price signal, therefore, the very steering effects intended by the cap-and-trade system would be curtailed.

Given the potential for error in setting the corridor limits and the restriction on market dynamics, price corridors do not seem to be an effective way of increasing planning certainty within the EU ETS. This is because it would create a fundamental tension between price and quantity certainty. Although the cap can be calibrated against the politically agreed GHG reduction targets, implementing a price cap could cause the system to overshoot or undershoot its targets. This would effectively require the cap to be relaxed or tightened, for example through targeted adjustments to the auction volume or MSR parameters. This would jeopardise the system's environmental accuracy. For this reason, it is preferable to retain volume control via the cap as the key target parameter and use the interaction of LRF and MSR, as described above, for fine-tuning.

7. Making compliance more flexible

7.1. Introductory remarks

The issues discussed in the following sections focus on whether allowances from other regulatory areas, such as the international arena or carbon sink policy, can be used as an alternative to EU ETS 1 allowances for demonstrating compliance with EU ETS 1 obligations (i.e. as a compliance instrument). However, this does not address the question of whether allowances from the international arena (primarily the various mechanisms under Article 6 of the Paris Agreement) or sink policy can be used in EU climate policy in principle. This question has been conclusively answered by the overarching legal framework of the European Climate Law; in addition, it is not part of the forthcoming review and revision processes for the EU ETS 1. Domestic emissions reductions form the legal basis for meeting the 2050 climate target. For the 2040 interim target, with a likely ramp-up beginning in 2035, international allowances may contribute up to five percentage points towards the target relative to the 1990 baseline. As EU targets are defined as net targets (i.e. including contributions from carbon sinks), including contributions from sinks to the overall targets is permissible but subject to separate targets and implementation instruments (see chapter 3.1).

The question of whether these approaches are economically and (geo-)politically sound is highly contentious across various academic disciplines and in the political sphere. However, this debate is not the focus of the present study. The sole issue at stake is whether the direct use of international emissions or emission reduction allowances, or international or EU carbon removal credits, should be permitted as a compliance instrument to fulfil the obligation to surrender allowances. Using such allowances as compliance instruments effectively increases the total volume of permitted emissions, i.e. indirectly expanding the cap of the EU ETS 1. This is particularly worth emphasising given that contributions from sinks or international allowances are already taken into account when setting the EU ETS 1 cap (see chapter 5.2).

Therefore, the use of international carbon credits, internationally transferred mitigation outcomes and removal credits as compliance instruments under EU ETS 1 must be harmonised with the overarching regulatory framework of EU climate policy. While the contribution of EU sinks towards meeting climate targets after 2030 is not limited in principle, the total number of international allowances that can be used is clearly capped, meaning that they cannot be used as a compliance instrument under EU ETS 1. This would necessitate the introduction of detailed rules to specify how and at what point in the system this limit is to be enforced. The same applies to issues of responsibility and, ultimately, liability with a view to the quality of allowances used outside the scope of the EU ETS 1.

7.2. International carbon credits

Starting point

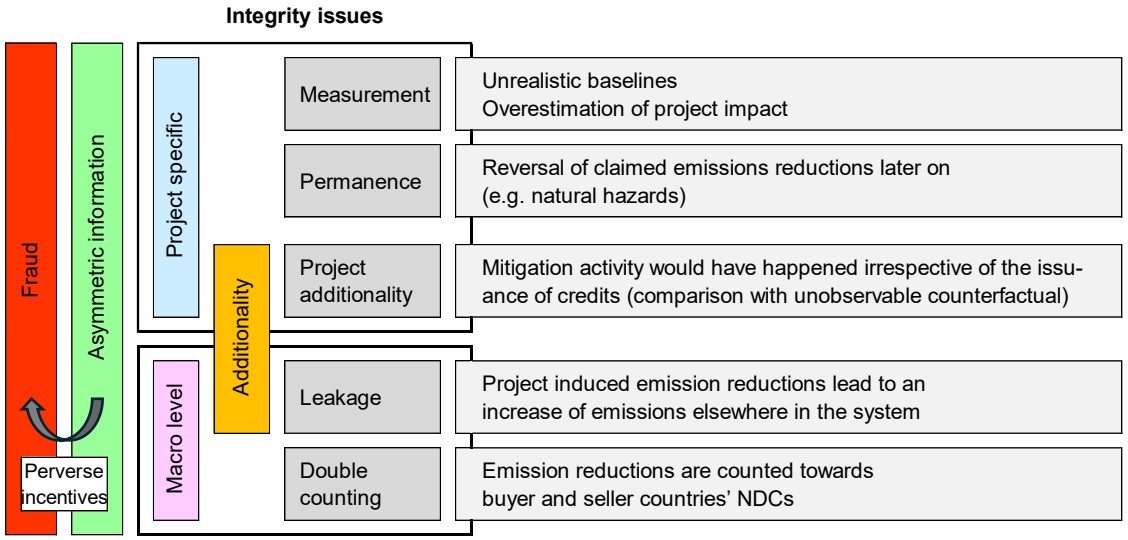
The fundamental objective of using international carbon credits, internationally transferred mitigation outcomes and removal credits under Article 6 of the Paris Agreement is essentially to achieve efficiency gains at a global level and the resulting cost savings: Emission reductions are to be achieved where the marginal abatement costs are lowest, which could significantly improve the global cost-effectiveness of climate protection, at

least from a static perspective. It is also intended that Article 6 contributes to the transformation of the selling country, help finance adaptation measures and increase global mitigation efforts (Schneider et al. 2026). The mechanism thus goes well beyond mere offsetting, as was the case, for example, under the Kyoto Protocol with the CDM. Given the sometimes problematic experiences gathered with previous instruments (CDM, JI), it remains unclear whether the credits generated thereby correspond to actual and additional emission reductions and at what prices high-quality credits will be traded.

Challenges

However, beyond an abstract or narrative discussion, implementing international projects also entails risks, some of which are structural in nature and therefore cannot be avoided or mitigated by simple administrative measures (Fuchs et al. 2026). Figure 7-1 provides an overview of these risks, without the intention of discussing or categorising them further.

Figure 7-1: A taxonomy of the risks of international carbon credits



Source: Based on Fuchs et al. (2026)

This risk overview is based not only on theoretical considerations and assessments, but also on practical experience of using international allowances as a compliance instrument in various emissions trading systems. In the context of EU ETS 1, the large volume of CDM and JI credits of highly questionable quality, particularly during the second period, vastly distorted price formation in the EU ETS 1. A similar situation arose in the context of the German greenhouse gas quota model for the fuel sector, introduced in 2009, which extended to cases of gross fraud (Deutscher Bundestag 2024c; 2024d). This also led to a huge decrease in the price of GHG quota certificates.

Cames et al. (2016) found that three-quarters of all CDM credits were not additional and failed to deliver the promised reductions. Therefore, one metric tonne of CO_2 'reduced' by a CDM project did not necessarily correspond to one metric tonne of CO_2 reduced domestically. In some cases, the mechanism created perverse incentives to emit more. For instance, companies increased the production of the greenhouse gas HCFC-22 to capture and destroy its by-product, HFC-23, and sell CDM credits. Consequently, prices

in the EU ETS 1 plummeted from 2009 onwards, severely eroding the incentives for emissions reductions in the EU (Hermann and Matthes 2012).

The price of GHG allowances fell from around EUR 400/t CO_2 in 2022 to below EUR 100/t CO_2 following imports of biodiesel suspected of being involved in fraud, and above all, fraudulent Upstream Emission Reduction (UER) projects in China. The volume of these fraudulent schemes amounted to EUR 4.5 billion (Deutscher Bundestag 2024a).

Although the use of 'high-quality' international carbon credits is encouraged politically, it is unclear which authorities, methods and procedures can ensure this quality, especially if the credits are to be used as a compliance instrument at a decentralised level. This is particularly pertinent to the methods developed and made binding within the consensus-orientated context of the United Nations. Experience gathered with such methodological specifications under Article 6 of the Paris Agreement (Box 7-1) underscores this point.

Box 7-1 Recent examples of Article 6 projects

To date, two methods for utilising Article 6.4 of the Paris Agreement have been officially recognised. These methods comprise emission reductions through the use of landfill gas (AMM-001) and reductions in N_2O emissions in nitric acid production (AMM-002). The methods were approved in October 2025 and May 2026 respectively for a period of five years. Emission reductions recognised under Article 6.4 are considered permanent reductions and are classified as ‘not subject to the risk of reversal’ (UNFCCC 2025; 2026).

The basic principles of both methods are not new and are based on methods that were already recognised under the CDM.

The UNFCCC has published detailed papers on these two mechanism methodologies. They describe in detail which emission reductions can be credited under the respective method, how additionality must be demonstrated, how reference emissions are to be calculated, how the displacement of emissions is to be prevented, and how the double counting of emission reductions is to be avoided.

The AMM-001 method for the utilisation of landfill gas, for example, covers the combustion of landfill gas for electricity or heat generation, as well as its injection into the natural gas grid. Emissions are reduced either through methane destruction or by substituting greenhouse gas-intensive electricity generation (UNFCCC 2025). The methodology document does not contain any direct benchmark values, as these depend on various project-specific factors (e.g. landfill size, waste composition, electricity mix, etc.). Landfill gas utilisation has been standard practice in Germany for many years. Support for landfill gas utilisation was introduced as early as 2000 under the EEG. The mitigation costs are low; this is not a transformative technology.

Method AMM-002 for reducing N_2O emissions during nitric acid production covers the introduction, recommissioning and improvement of measures to prevent nitrous oxide emissions during nitric acid production. For installations with new or recommissioned abatement technology, a benchmark is set at 1.06 t CO_2eq / t HNO_3. For installations that already have an abatement system and are merely upgrading it, a lower value of

0.16 t CO_2eq /t HNO_3 applies.[9] In the EU, a benchmark of 0.151 t CO_2eq / t HNO_3 is envisaged for the EU ETS 1 for the period 2026 to 2030 (EC 2026b; UNFCCC 2026). This figure is considerably lower than the higher benchmark value set out in the methodology under Article 6.4. This difference carries the risk of exacerbating the risk of carbon leakage, particularly in the European chemicals industry, as new competing installations abroad, in particular, receive seven times as many credits under Article 6 as they would under free allocation in EU ETS 1.

Conclusion and recommendation

In light of experience gathered to date, emission reductions from non-European projects and schemes should not be integrated into the EU Emissions Trading System as compliance instruments. While the 'centralised' use of such emission allowances does not eliminate the fundamental risks associated with the use of international carbon credits when setting the cap for EU ETS 1, it does facilitate targeted quality control and the rapid implementation of corrective measures. Furthermore, it helps to avoid further procedural complexities within EU ETS 1 by removing the need for additional control, limitation and liability provisions at company level.

7.3. Removal credits

Introduction and basic options

The EU ETS Directive stipulates that the European Commission must submit a report and, where appropriate, a proposal on the inclusion of negative emissions by 30 July 2026 (Article 30(5) of the EU ETS Directive). In some quarters, this is interpreted as the inclusion of carbon removal credits in the form of offsets. Similar arrangements have been adopted in the New Zealand Emissions Trading Scheme (NZ ETS), where forest owners can generate credits for afforestation and must surrender corresponding credits when the forest is harvested (ICAP 2024). The regulations in the NZ ETS already highlight a key challenge in the emissions-based assessment of sinks. Two components must be taken into account in this regard: emissions can be sequestered, but they can also be released again. Both aspects must be considered.

However, the (current) wording in the EU ETS Directive regarding negative emissions is relatively open-ended. Negative emissions can be accounted for in many different ways. Three distinct options should be distinguished:

1. Direct eligibility of carbon removal credits as compliance instruments.
2. Indirect consideration through the financing of carbon removal projects using auction revenues, or the purchase of carbon removal credits with auction revenues (including innovation funds).
3. Extension of the scope of the EU Emissions Trading Directive to include the sequestration and release of biogenic emissions (this would then be implemented via an emission factor greater than zero for biogenic CO_2 emissions).

[9] The benchmarks were converted using a GWP of 265 kg CO_2 / kg N_2O. In the AMM-002 method, the benchmarks are given in kg N_2O/t HNO_3 and amount to 3.99 kg N_2O/t HNO_3 and 0.6 kg N_2O/t HNO_3 respectively.

One limitation to bear in mind is that, under Section 4(5)(b) of the European Climate Law, only 'domestic permanent removals' are to be accounted for under the EU ETS (Regulation (EU) 2026/667 2026). This makes it clear that, for temporary carbon sequestration, incentive schemes other than inclusion in the EU ETS must be found.

In addition, care must be taken to ensure that, when utilising carbon removals within the framework of the EU's climate policy architecture – whatever form the future carbon removal and sink targets or obligations may take – double counting is ruled out.

Differences between technical and natural sinks

When considering negative emissions, it is important to distinguish between technical sinks (BioCCS and DACCS) and natural sinks (e.g. forests and agricultural land). In BioCCS, biogenic CO_2 is captured from combustion (biomass power plants) or process-related emissions (e.g. biogas processing or ethanol production) and then stored. DACCS involves the direct removal of CO_2 from the atmosphere for subsequent storage. Compared with natural sinks, the challenges associated with these technical sinks are less significant:

- Technical sinks are generally characterised by the permanent storage of CO_2 (BioCCS and DACCS).[10] The amount of CO_2 stored in technical sinks can be accurately determined. In contrast, natural sinks are generally temporary and quantifications are subject to high levels of uncertainty.
- For a complete inventory, all emissions resulting from the operation of the plant must be included. In addition to direct emissions from capture, transport and storage, this also includes potential leakage over the plant's lifetime. For example, substantial emissions can occur in the upstream chain of biogas production, such as the use of mineral fertilisers and the operation of agricultural machinery. One option would be to account for these emissions using discount factors.

Facilities for permanently storing CO_2 are still only in the pilot stage, and the costs per tonne of CO_2 stored are significantly higher than the ETS price (Mendelevitch et al. 2026). Therefore, specialised funding instruments are essential in any case to ensure that the projects can be implemented (see chapter 11.5.5).

Challenges relating to natural sinks

With a view to natural sinks (e.g. afforestation, soil carbon sequestration), four key problems stand in the way of their direct inclusion in the EU Emissions Trading System:

- As a rule, this only involves temporary carbon sequestration. The harvesting of forests or natural disturbances such as forest fires, storms and bark beetle infestations can very quickly release the sequestered carbon again. Climate change is causing such disturbances to become more frequent and intense. However, if plant operators were permitted to offset their fossil fuel emissions using temporary carbon removal units, these would need to be replaced regularly over centuries. Since it is highly unlikely that plant operators would fulfil these obligations over such long periods, it is not

[10] Although biochar can sequester carbon over a longer period (including in the soil), it does not achieve a comparable level of permanent storage to that of CCS. Biochar projects shall therefore be treated as natural sinks in the following.

advisable to permit temporary carbon removal units directly within the EU Emissions Trading System.

- Many sink projects exhibit only limited additionality, and there is the problem of carbon leakage. For example, if large areas of arable land in Germany were to be afforested, this could lead to an increased demand for arable land elsewhere, such as in the Amazon region, which could accelerate deforestation there (see the relevant debate on biofuels, e.g. Valin et al. (2015). From a global perspective, emissions could even rise as a result of the afforestation of arable land in Germany.
- Compared with the very high monitoring standards in EU ETS 1 for the emission sources included to date, the uncertainties in quantifying carbon sequestration in natural sinks are significantly greater and can only be reduced to a limited extent, even with improved methods.
- There are specific targets within the LULUCF sector – and, in the future within the more broadly defined carbon sinks and removals sector, which must be achieved alongside the emission reduction targets under EU ETS 1 and EU ETS 2, so simply 'offsetting' emissions from the EU ETS is not an effective approach. Furthermore, ‘emissions deterrence’ should be avoided. This effect occurs when the price in EU ETS 1 is driven down by cheap offset credits from natural sinks, thereby reducing the incentive for emissions reductions in the EU ETS sectors (WPKS 2023).

In focus: biomass in the EU ETS and the zero emission factor

The role of natural sinks in EU emissions trading is also linked to the emission factor used for biomass in emissions monitoring. In the past, an emission factor of zero was set for the combustion of biomass in EU ETS 1. Following the revision of the EU ETS Directive at the start of 2023, conditions were introduced to specify when this zero emission factor may be applied. Article 14 of the ETS Directive governs monitoring. It refers to the sustainability requirements for biomass under RED III. Biomass can only be reported with a CO_2 emission factor of zero if a GHG emission saving of at least 70 % is achieved compared with a reference process for fossil fuels. Originally, these regulations applied only to biofuels, but have now been extended to include solid biomass as well. The 70 % rule is based on a life-cycle assessment approach.

Essentially, the issue regarding the zero emission factor for biomass centres on who should bear the cost of restoring the carbon sink function. After all, if a forest is cleared without being replanted, applying a zero emission factor would not make sense. It should also be noted that emissions from the combustion of wood are recorded as emissions in national greenhouse gas inventories. This is determined by balancing carbon sequestration and release by forests in the inventory under CRF Sector 4 (LULUCF). To avoid double-counting, biogenic emissions are not recorded in the energy sectors. Only there does an emission factor of zero apply to biogenic emissions in the inventory. Therefore, the previous application of an emission factor of zero for solid biomass in emissions trading cannot be derived from inventory regulations. Rather, regulations that take both sequestration and release into account are appropriate. This applies to both carbon releases and carbon sequestration. However, this presents a methodological challenge that goes beyond the current EU ETS 1 system boundaries: allowances would generally have to be surrendered for the release of biogenic emissions, while offset allowances could be issued for sequestration. Such a change is, however, methodologically very complex and raises many questions, e.g. how to account for decentralised biomass use and whether and to what extent the cap would need to be adjusted. This option is

therefore included here for the sake of completeness, but would only be feasible in the long term.

Conclusion and recommendation

In the case of permanent technical sinks, direct inclusion in the EU ETS via an offset system would be possible (e.g. under Article 24a of the EU ETS Directive). However, this does not apply to natural sinks. Given the challenges described, natural sinks should only be linked indirectly – if at all – to the EU ETS 1. Auction revenues could be used to finance the purchase of carbon removal credits. Through such purchase programmes, a defined target (a negative cap) for natural sinks could be implemented (the 'separate cap' option in Edenhofer et al. (2023)). This would be implemented by a government body that would essentially have two tasks:

- Firstly, it would be necessary to regularly purchase sink allowances, for which additional EUAs could be made available in some cases (gateway and conversion body). Chapter 6.2 sets out that these emission allowances from the EU ETS 1 should be transferred to the MSR. The gateway should therefore be designed in such a way that the targets in the LULUCF sector – or the broader carbon removal credits to be introduced in future – are achieved.
- Secondly, it would be the responsibility of the government body to regularly replace temporary sink certificates.

In principle, it should be noted that the inclusion of sinks should be indirect and not direct through their use as a compliance instrument (see chapter 7.2). Indirect inclusion – for example, through the setting of a cap within the context of the overall EU climate policy architecture or, where appropriate, through the replenishment of the MSR with regard to industrial residual emissions – can make a significant contribution to reducing the complexity of the system (in terms of temporariness/permanence, limited additionality/carbon leakage, quantification uncertainty, liability issues, etc.) and to avoid other problematic effects.

8. Border adjustment mechanisms

8.1. Introductory remarks

The EU ETS 1 operates within an international context characterised by the absence of carbon pricing in many non-EU countries, or by significant differences in effective carbon pricing. For the various emissions trading systems internationally, the range of nominal prices extended from approx. 10 US$/t CO_2eq (China's national ETS) to just under 100 US$/t CO_2eq (EU ETS 1), with four distinct price bands currently evident. Some systems generate prices of between 10 and 15 US$/t CO_2eq (e.g. Chinese national and provincial schemes, South Korea and US East Coast states); others generate prices in the range of 20 to 30 US$/t CO_2eq (New Zealand, California/Quebec); and others generate prices of between 60 and 80 US$/t CO_2eq (other North American schemes and the UK); the EU ETS 1 has the highest price levels of up to 100 US$/t CO_2eq (ICAP 2026a). The reasons for these differences vary widely and include the level of ambition, the scope of application, the available emission reduction options, market liquidity and exchange rate policies, particularly with regard to China. Furthermore, the aforementioned price differences do not take into account the fact that the various systems adopt very different approaches to free allocation, which is highly relevant to the competitive landscape. The spectrum ranges from almost entirely free allocation (China) to auctioning shares of 90–100 % (US East Coast).

These price differences, combined with the rise in price levels over time, give rise to the challenge of carbon leakage for industries in the EU and in the countries covered by the EU ETS 1 that face international competition – and certainly also in the UK. Carbon leakage does not, therefore, arise initially from the relocation of production[11] outside the scope of the EU ETS 1, but only when such relocations result in higher emissions in an international context. In this respect, the debate on carbon leakage and carbon leakage protection instruments must be clearly distinguished from location-related issues in a general sense, which arise, for example, from the perspective of resilience or trade policy (including distortions caused by exchange rate policies). This may well give rise to the need to safeguard business locations for reasons that lie beyond the carbon leakage problem; however, carbon leakage protection instruments are not designed to address these issues and can, at best, make only a partial contribution.

To date, the free allocation of emission allowances has served as the primary mechanism for carbon leakage protection for European industry. From 2026, this is to be gradually replaced by CBAM, which will apply to imports of selected goods. One reason for this (partial) transition of carbon leakage protection to a different instrument is that the incentives for emissions reductions remain limited in the context of free allowance allocation, and the incentive effects of the carbon price should be expanded (Recital 11 of the CBAM Regulation). This applies in particular to the incentives created via the EU ETS regarding optimal consumption levels and product innovations – that is, the emission reduction levers operating within the overall system beyond the optimisation of individual installations (see chapter 9.1). However, the functionality of carbon leakage prevention in the area of exports of European goods has not yet been established.

[11] In this context, relocation refers less to the physical relocation of production facilities and more to the decline in production within the EU (which is particularly evident statistically in the energy-intensive industrial sector) in favour of increased imports of energy- and emission-intensive (intermediate) products.

Beyond preventing carbon leakage, CBAM is not, for the time being, an instrument for securing the location of industrial production in Europe. However, it does create a tension between protection against carbon leakage and support for the industrial transition towards climate neutrality in Europe, particularly with regard to the import of intermediate goods from regions with a larger and cheaper supply of renewable energy.

Against this background, this chapter also discusses alternatives or complementary measures to CBAM, such as the Clean Industry Contribution applied to basic materials and general tariff policy.

8.2. Carbon Border Adjustment Mechanism

Overview

The Carbon Border Adjustment Mechanism (CBAM), which came into effect in early October 2023 with a reporting and implementation phase. It has been in force as a compliance mechanism since early January 2026. The primary aim of CBAM is to prevent the risk of production being relocated to countries not covered by the EU ETS, which would result in additional greenhouse gas emissions abroad. While preventing this carbon leakage within a global economic framework characterised by (hugely) varying levels of effective greenhouse gas pricing is CBAM's primary objective, the scheme also pursues secondary objectives. These include, first and foremost, the creation of incentives for introducing greenhouse gas pricing instruments and other transformation mechanisms (policy diffusion), as well as supporting industrial transformation in other countries.

The legal basis of CBAM is the CBAM Regulation, which was adopted in May 2023 and has since undergone various revisions. Based on this Regulation, a large number of legal acts have been adopted, covering the entire CBAM process chain. These range from rules on reporting, monitoring, verification and accreditation, to country-specific standard values for emission factors.[12] Additionally, provisions have been introduced to implement initial system simplifications based on experience gained during CBAM's reporting ramp-up phase. These primarily relate to new de minimis thresholds, exempting importers of fewer than 50 tonnes of CBAM goods annually from the reporting obligation. Furthermore, CBAM levies will first become due in 2027, and simplified calculation methods have been introduced for emissions from pre-production (CBAM Regulation of 8 October 2025). The debate surrounding the system’s administrative burden remains evident, and it is important to continue exploring the potential for simplifying and streamlining the system. However, particularly in light of experience gained during the ramp-up of similar processes in the context of the EU ETS, it should be noted that higher implementation costs are primarily incurred during the respective system's introductory phase and also take the form of one-off expenses to a significant extent. Once the system has stabilised, transaction costs will almost certainly remain within reasonable limits.

Some of the necessary legislative acts, such as those concerning the rules on offsetting national carbon pricing schemes, are currently being drafted or are subject to consultation.[13] The European Commission has also made numerous guidance documents and

[12] https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism/cbam-legislation-and-guidance_en

[13] https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism/cbam-legislation-and-guidance_en

tools available to assist with the implementation of CBAM obligations. Responsibility for implementing CBAM in Germany lies with the German Emissions Trading Authority (DEHSt) within the German Environment Agency.

Table 8-1: Goods covered by CBAM by category

Aggregated goods category	Number of goods included	Sector	Emissions included
Electricity	1	Electricity	CO_2 (indirect & direct)
Calcined clay	1	Cement	CO_2 (indirect & direct)
Cement clinker	1	Cement	CO2 (indirect & direct)
Cement	3	Cement	CO_2 (indirect & direct)
Hihg-alumina cement	1	Cement	CO_2 (indirect & direct)
Nitric acid	1	Fertilisers	CO_2 (indirect & direct) and N_2O
Ammonia	2	Fertilisers	CO_2 (indirect & direct)
Compound fertilisers	20	Fertilisers	CO_2 (indirect & direct) and N_2O
Urea	4	Fertilisers	CO_2 (indirect & direct) and N_2O
Sintered ore	1	Iron and steel	CO_2 (direct)
Pig iron	7	Iron and steel	CO_2 (direct)
Ferromanganese	3	Iron and steel	CO_2 (direct)
Ferrochrome	5	Iron and steel	CO_2 (direct)
Ferronickel	1	Iron and steel	CO_2 (direct)
Direct-reduced iron (DRI)	2	Iron and steel	CO_2 (direct)
Iron or steel products	421	Iron and steel	CO_2 (direct)
Crude steel	38	Iron and steel	CO_2 (direct)
Aluminium in primary form	5	Aluminium	CO_2 (direct) and PFC
Aluminium products	53	Aluminium	CO_2 (direct) and PFC
Hydrogen	1	Chemicals	CO_2 (direct)
Total	571		

Sources: Annex 1 of the CBAM Regulation, Oeko-Institut

As outlined in the CBAM Regulation, under the new system, importers will be required to purchase CBAM certificates. These certificates will need to be purchased to pay an amount equivalent to the cost of EU ETS emission allowances. The cost will be calculated on the basis of the estimated greenhouse gas emissions associated with the production of the imported goods. The current CBAM Regulation sets out different system boundaries for determining the emissions attributable to the (imported) goods covered by CBAM. To date, direct emissions have predominantly been captured (the carbon intensity of the electricity used in production is usually not included); indirect emissions are also taken into account only for certain goods (cement and fertilisers) (Table 8-1). The obligation to purchase CBAM certificates is reduced if carbon pricing mechanisms come into effect in the countries of origin for the production of the relevant goods. The goods already covered by CBAM currently represent an import value of around EUR 100 billion (CEU 2026).

From 2028, CBAM is to be extended to a further 180 goods. This extension covers downstream products with a high iron, steel and aluminium content; however, some key products (such as passenger cars) are not included among the newly added goods (Table 8-2). The goods newly included within the scope of CBAM currently have an import value of around EUR 55 billion (CEU 2026). At a later stage, a review will be carried out to determine whether CBAM can or should be expanded further. This concerns both the inclusion of further goods and the consideration of (additional) indirect emissions.

Table 8-2: EC proposal to expand the range of goods covered by CBAM from 2028, arranged by category

Aggregated goods category	Number of goods included	Sector	Emissions included
Assembled metal products	34	Industrial machinery and machine tools	CO_2 and PFC
	39	Vehicles and chassis	CO_2 and PFC
	28	Metal products and manufacturing	CO_2 and PFC
	21	Vehicle components and systems	CO_2 and PFC
	18	Household appliances and consumer goods	CO_2 and PFC
	17	Construction and lifting equipment	CO_2 and PFC
	7	Engines, drives and power generators	CO_2 and PFC
	6	Electrical and electronic components	CO_2 and PFC
	5	Medical, laboratory and safety equipment	CO_2 and PFC
	5	Agricultural and gardening equipment	CO_2 and PFC
Total	180		

Note: The inclusion of PFCs (perfluorocarbons) applies only to goods containing aluminium.
Source: CEU (2026) and EC (2025c)

Since the transition phase began in 2023, importers have been required to report on the grey emissions of imported CBAM goods. They may use either default values or actual emission figures for this purpose. The CBAM's regular phase commenced in January 2026, introducing the requirement to surrender CBAM certificates. However, a number of important questions regarding the design and further development of the system remain unresolved.

These questions relate to how the system can be circumvented or made ineffective in achieving its intended outcomes, and how existing gaps in its effectiveness can be closed. Firstly, the issues of 'resource shuffling' and 'downstreaming' of value chains are relevant. Secondly, crediting greenhouse gas pricing schemes in countries of origin that are designed and structured very differently presents a complex challenge. Thirdly, solutions must be found for treating exports from EU ETS Member States. In principle, there are potential solutions for all these areas. However, it should be noted that certain solutions may create tensions with the various objectives of CBAM (preventing carbon leakage, supporting transformation abroad, and contributing to policy diffusion) or other strategic objectives of the European Union (restructuring Europe's industrial base through the import of climate-friendly intermediate goods or industrial resilience policy). It is therefore necessary to make strategic policy decisions and to develop the mechanism systematically based on empirical evidence that improves over time. In addition, we need a conceptual framework to enable continuous learning, review and revision processes that avoid disruption. In this respect, CBAM follows the basic approach of the EU ETS. The latter is organised into periods, enabling precise learning and revision processes on the basis of regular reviews. This approach has been implemented over the past 20 years.

Resource shuffling

Resource shuffling describes the increased export of low-emission goods into the scope of the EU ETS without any reduction in the total emissions associated with the manufacture of the respective products in the countries of origin. In this process, low-emission products are specifically supplied to the EU market, while more emission-intensive

products remain domestically or are exported to countries with weaker climate regulations. As a result, greenhouse gas emissions in the exporting countries remain unchanged, thereby undermining the effectiveness of CBAM.

Resource shuffling can manifest itself in various ways. For example, it can involve:

- the redirection of trade flows, whereby existing low-emission production facilities redirect their output for exports to the EU, or new, non-additional low-emission production facilities are used for exports to the EU without decommissioning old, less efficient production facilities with a higher emission intensity; and
- increasing the proportion of scrap. The export of products to the EU that contain a higher proportion of scrap or recycled materials in their production, thereby reducing a product's grey emissions.

Resource shuffling poses a potential threat to the effectiveness of CBAM. If low-carbon products can easily be diverted to meet demand for CBAM goods in the EU, companies in third countries may either offer their products at lower prices than European competitors, since they can operate without CO_2 costs and drive EU manufacturers out of the market; or they may sell their products at higher prices, generating unexpected windfall profits. In both cases, the competitiveness of European companies would be weakened without any reduction in global emissions. Conversely, emissions may even rise if production capacity is relocated to regions with less ambitious climate targets (carbon leakage).

This could undoubtedly jeopardise the effectiveness of the CBAM's safeguards against carbon leakage. The possible countermeasures involve different approaches and have different implications. In an initial proposal to mitigate this risk, the Commission is to be permitted to classify certain combinations of country of origin and goods as posing a 'high risk of carbon leakage' (EC 2025c). Importers of these goods would then have to prove that no 'resource shuffling' has occurred; otherwise, the use of actual emission values (at installation level) could be restricted. These options entail a high level of administrative burden by their very nature if they are to be fully effective. Another option would be to base CBAM, either as a matter of principle or subject to certain conditions, on company-specific, country-specific or, where appropriate, global standard values for product-specific emissions. However, this approach would run counter to the objective that CBAM should also incentivise industrial transformation in the countries of origin. At the same time, it could undermine the strategy of pursuing industrial transformation in the EU through imports of green intermediate products (hydrogen, ammonia and green sponge iron) into Europe. The introduction of additionality certificates is also under discussion, although this would raise the typical challenge of determining adequate and manageable baselines. Concrete regulatory proposals for addressing resource shuffling are not yet available, but are expected shortly and are urgently needed.

Downstreaming of value chains

CBAM initially applies to particularly emission-intensive products from basic material goods and the initial stages of further processing. As the number of subsequent processing stages increases, the complexity of CBAM coverage rises, and there is a risk that incentives will arise to extend the further processing of emission-intensive goods to a stage that is no longer covered by CBAM, particularly where such further processing can be carried out with relatively little effort. It is against this backdrop that, for example,

the expansion of the range of goods subject to CBAM from the start of January 2028 should be understood. There is no doubt that this process will (have to) continue; striking a balance between effective protection against carbon leakage and limiting complexity – or ensuring that the system is as easy to administer as possible – requires the collection of as much empirical evidence as possible.

Crediting of GHG pricing instruments

To avoid placing an additional financial burden on companies under CBAM, importers can reduce the number of CBAM certificates they are required to purchase if they can demonstrate that a carbon price has already been paid during the production process in the country of origin (Article 9 of the CBAM Regulation). It is of central importance to establish transparent, robust and effective criteria as the comparability of carbon prices between third countries and the EU presents significant conceptual and administrative challenges. Following a fact-finding exercise (EC 2026g), the European Commission launched a consultation process in May 2026 on a corresponding draft regulation (EC 2026e). The draft document contains comprehensive and highly nuanced provisions on a wide range of topics, from the fundamental eligibility of various greenhouse gas pricing approaches to the valuation of free allowances, exemptions and refunds. It makes clear that there are diverse and numerous areas of tension that must be taken into account with regard to the consideration of greenhouse gas pricing systems in producer countries, ranging from ensuring adequate reflection of pricing systems in the international context and preventing misuse to maintaining manageability of the system. The draft addresses these multifaceted issues and proposes pragmatic approaches from the current largely theoretical perspective. At the same time, the draft allows initial conclusions to be drawn regarding the European Commission's preferred approach in similar policy areas. For example, it recognises the flexible mechanisms of the Paris Agreement on Climate Change (UNFCCC 2016; Art. 6 PA) without imposing additional requirements beyond those under the UNFCCC.

Exports

Although CBAM aims to ensure equivalent carbon prices for imports and domestic products within the single market, this protection does not extend to exports by European manufacturers to countries outside the scope of the EU ETS. For sectors covered by CBAM, this may result in a competitive disadvantage, as the introduction of the mechanism is intended to phase out the free allocation of allowances under the EU ETS at a relatively rapid pace.

However, the absence of an 'export solution' is not an inadvertent omission; it reflects the difficulty of implementing such a solution that maintains free allocation for sectors considered at risk of carbon leakage while ensuring compliance with WTO rules.

There are various options and areas of tension here, ranging from the targeted allocation of free allowances to ETS installations – with all the challenges involved in attributing exports to emitting installations that may belong to different companies – to financial compensation or support payments, with all the associated challenges of the resulting incentives for plant operation.

As part of the CBAM review, the European Commission is expected to present a proposal in the summer of 2026 on how the export issue should be addressed in the long

term. In December 2025, the Commission put forward a model for a transitional solution for the years 2026–2028 (EC 2025d). According to this model, a Temporary Decarbonisation Fund is to be established. Financed by 25 % of CBAM revenues, this fund would provide temporary financial support to European companies that commit to ambitious decarbonisation measures.

Sectors

The effectiveness of CBAM, both actual and potential, varies depending on the sector covered and its specific competitive situation. For example, in the **cement** industry, CBAM could help to curb competition from imports in northern European countries, given the high transport costs. In the Mediterranean region, where there are non-EU neighbours such as Turkey, it is important to address potential circumvention scenarios through regulation. While this also applies to import competition in **steel** production to a certain extent, a quarter of German steel companies' exports go to countries outside the EU. This means resolving the export issue is highly relevant to steel companies. To prevent relocation risks from being shifted to downstream sectors, these sectors should be involved to a greater extent than has been the case to date. Initially, the scope of CBAM in the **chemicals** industry is limited to ammonia production. The remaining German ammonia production faces extremely high levels of competition, particularly from European competitors, meaning that CBAM can do little to remedy the situation in this regard. Competitiveness could only be restored by reducing existing price differences. This is particularly true with a view to green ammonia, given that production and transport costs are lower than for green hydrogen, and there is believed to be high import potentials in this sector.

8.3. Climate contribution on basic materials

Current situation: insufficient support for the carbon price

As described in the chapter 8.2, there are currently considerable challenges relating to CBAM. There has also been no adequate protection against carbon leakage for these sectors to date. Furthermore, from an industry perspective, the current accompanying instruments (chapter 11) have not been sufficient to incentivise and finance the conversion of numerous production processes.

To address these issues, an additional excise option is under discussion – a climate contribution referred to as the Clean Industry Contribution (CIC). This would be based on the basic material content of some final products and passed on to the final consumers. Depending on how it is designed and integrated into the existing policy framework, the measure will have different impacts on the two issues described above.

Climate contribution added to final product price to finance the energy transition

In the case of the Clean Industry Contribution, the producers and importers of basic materials must pay a climate contribution, which can be passed on along the value chain and is waived when goods are exported outside the EU (Neuhoff et al. 2025). The amount of the contribution is based on the final product’s basic materials content and is aligned with the benchmark for the basic materials within the framework of free allocation under the EU ETS, in order to avoid cumbersome verification procedures and minimise the administrative burden. This allows the carbon footprint of the basic materials in the

final product to be derived and priced in a simplified manner. The CIC would apply to all basic materials, regardless of whether they are produced conventionally or in a climate-friendly manner.

Meanwhile, new proposals from industry also envisage adding a climate contribution to the final product price. In the chemicals industry, for example, a climate contribution paid by final consumers is under discussion, with the revenues being used to finance transformation projects within the industry itself. In principle, this sector-specific instrument could also be applied to other basic materials. Unlike the CIC, this climate contribution would not be based on the carbon content, but rather the sector's investment needs and the difference in cost between conventional and climate-friendly production methods for the basic materials in question.

Table 8-3: Different options for designing climate contributions

	Option of 2021 CBAM Proposal: Clean Industry Contribution (CIC)	Proposal of chemicals industry: Sector-specific climate contribution on basic materials
Objective	**Introducing a climate contribution on certain basic materials**	
	...as a transitional solution while continuing free allocation (in CBAM sectors) until CBAM provides sufficient **protection against carbon leakage.**	…as a permanent **financing instrument** for additional funds to finance transformation projects in the specific sector.
Method	**Irrespective of whether basic materials are produced in conventional or climate-friendly way**	
	… producers or importers of (processed) basic materials are obliged to pay a fixed contribution.	… an additional duty is levied **on all final products** for which the basic materials have been processed.
Amount of duty	**Amount of climate contribution depends on carbon content of final product**	
	… and the applicable benchmarks of EU ETS 1 and EUA prices to price in the **carbon content.**	… and is determined **independently of the carbon content** in order to provide funds for promoting the transformation of specific sectors.

Source: IW Cologne, Neuhoff et al. (2025)

The aim is to generate sufficient revenue to finance transformation projects in industry (CAPEX and OPEX). It remains unclear whether the current carbon price should be deducted from the difference in costs between conventional and climate-friendly methods of production.

Limitation: Short-term revenue without long-term prospects

Currently, CBAM faces challenges that jeopardise its effectiveness as a carbon leakage protection mechanism. Further refinements are required to ensure effective protection, particularly to mitigate the risk of circumvention and introduce a long-term compensation mechanism for European producers exporting affected goods. In the absence of a CBAM that is sufficiently effective, it makes sense to either continue free allocation or decrease the rate at which it is phased out. For example, in sectors where there is a high risk of circumvention, the CBAM factor could be frozen at the 2028 level for up to five years from 2029.

In this context, the Clean Industry Contribution is a useful way of supplementing the EU ETS on a temporary basis. However, it does not constitute a direct alternative to CBAM or carbon pricing as a whole, since it neither effectively protects against carbon leakage nor creates direct incentives for transformation. Applying standardised climate contributions to basic materials, regardless of the manufacturing process, primarily leads to a blanket increase in product prices and generates additional revenue. In the case of the CIC, it achieves carbon pricing on the demand side by raising prices for final consumers. Other design options, by contrast, envisage an approach whereby the climate contribution is based on transformation costs rather than implicit carbon content (see Table 8-3). In this case, the climate contribution does not directly influence the production process via price incentives. Its main effect is to generate additional revenue that can be used to fund transformation projects. If the level of the contribution reflects concurrent costs of sector-specific transformation, it could also increase as the transformation progresses, as is currently being discussed in the chemicals industry. However, it is not based on the carbon content, but rather on production costs, which initially rise as the transformation progresses. Even if the contribution were based on carbon intensity, it would still need to be adjusted regularly and could increase in line with an increasing carbon price. To maximise the impact of a climate contribution, revenue frontloading could be considered (see chapter 10). This would enable revenue to be channelled early and specifically into transforming the affected industries, supporting the transition and mitigating the impact of any long-term increase in the climate contribution resulting from rising transformation costs. This would also enable preparations to be made for a gradual reduction in free allocation without placing an excessive short-term burden on the affected companies.

Various options are also available for structuring the timing of collecting the climate contribution on basic materials within the value chain. While the concept of the CIC makes the producers of the basic materials subject to the financial obligation, with costs subsequently passed on along the value chain, current proposals envisage a direct climate contribution added to the price of the final product, covering the additional costs of climate-neutral basic materials or the transformation costs.

A direct climate contribution added to the final product price has the advantage that imported goods can easily be accounted for in this way, and there is no need to create exemptions for exported basic materials. From the perspective of industry representatives, there is also the advantage that the additionally incurred costs are also passed on directly to final consumers at their actual level. However, if the excise duty is applied at the start of the value chain, the additional costs could be factored into the calculations of downstream companies and subject to corresponding mark-ups. This can lead to the original cost increase caused by the climate contribution accumulating along the value chain. Consequently, final consumers may face a higher burden if the contribution is applied at the level of basic materials production, even though both options generate the same revenue to finance the transition.

If such an instrument were extended across sectors and covered many or all basic materials industries, it could lead to noticeable price mark-ups for final products and, consequently, a potential loss of acceptance. Even within industry, acceptance could decline between individual segments if the climate contribution were applied only to selected basic materials or if its rate varied by sector without an objective benchmark, such as carbon content. This would result in significant differences in sector-specific funding, and the climate contribution required to finance transformation in individual sectors would

increase the price of a wide range of final products, potentially affecting their sales, given that these products incorporate other basic materials.

Recommendation: Aligning with a long-term strategy for the policy instrument mix

Depending on its design, adding a climate contribution to basic materials complements the continuation of free allocation and can therefore usefully supplement the EU ETS 1. Above all, it generates additional revenue for the funding of transformation projects. This addresses the problem that, while the current EU ETS 1 provides incentives to reduce specific emissions, it has so far failed to create a sufficient basis for investment in emission-intensive industries. Furthermore, a direct surcharge on final products ensures that the additional costs of climate-friendly production of basic materials and the necessary transformation are passed on directly to the final consumers, and that the surcharge applied to the final consumer price does not increase further along the value chain.

At the same time, the measure does nothing to address the ongoing challenge of effectively implementing CBAM without undermining the international competitiveness of European companies. There is uncertainty, however, as to the duration for which the instrument will be introduced, particularly if it is only in place alongside free allocation, which is set to decrease in the long term. Accordingly, it is essential to consider the duration of the measure – for example, introducing it in parallel with a five-year freeze on the CBAM factor for the relevant sectors – as well as the potential administrative burden of this temporary measure.

In any case, should an additional politically mandated surcharge be introduced, consumer acceptance of the measure is likely to be low. In the event of a long-term introduction of the Clean Industry Contribution – irrespective of the future course of free allocation – final consumers can be expected to face a permanently higher cost burden. This is because both the carbon costs factored into prices and the additional surcharge will increase the price of final products. In this scenario, acceptance – and thus the political feasibility – of the instrument is likely to be more severely affected than in the case of a temporary introduction, complementary to the carbon cost burden on the basic materials industry. If the surcharge on basic materials is based on the cost differential between conventional and climate-friendly production rather than on the carbon price, the carbon costs should be factored into this price differential in order to reflect the actual additional costs within the framework of the EU ETS 1 and to reduce the cost burden on final consumers.

8.4. General tariff policy

The German and European industrial model is facing unprecedented challenges in the form of aggressive US tariff policy, systemic competition distortions caused by China, and pressure to transform climate policy. While CBAM addresses the problem of carbon leakage induced by European carbon pricing, reformed countervailing duties can offset non-climate-related distortions of competition. CBAM and general tariff policy address different regulatory levels and should therefore be tailored to their specific objectives. Due to its tariff-like nature, CBAM overlaps with and comes into tension with the EU's general trade policy, particularly the anti-dumping and anti-subsidy instruments, as well as the ongoing debate about 'Buy European' preferences and local content requirements in the Industrial Accelerator Act.

The EU ETS 1 threatens to exacerbate existing competitive disadvantages, particularly in energy-intensive sectors, as rising CO_2 costs increase the production costs of European companies relative to their non-European competitors. These cost increases coincide with pre-existing, non-climate-related distortions of competition, necessitating a nuanced response in terms of tariff policy.

This is particularly evident in the case of China: companies there benefit not only from the absence of, or lower, carbon costs, but also from extensive state subsidies across the entire value chain, as well as from a substantially undervalued currency. Consequently, many German industrial firms find themselves competing against Chinese rivals with price advantages of over 30 %. While it is difficult to quantify precisely, a considerable proportion of these price advantages is likely to be due to distortions of competition within the Chinese economic system, which is not transparent.

Matthes (2026) proposes countervailing duties which, unlike CBAM, are not linked to carbon costs but to verifiable subsidies and dumping practices. While CBAM helps to close the climate-specific cost gap, at least within the European single market, countervailing duties are intended to address the additional, subsidy-induced distortions of competition. To this end, the existing anti-dumping and anti-subsidy instruments are to be reformed in two key respects. Firstly, they are to be applied in a less product-specific and more cross-sectoral manner. Secondly, the systematic undervaluation of the Chinese currency is to be included as a subsidy element in the calculation of countervailing duties.

The advantage of such targeted tariff measures lies in the fact that they combat specific distortions of competition in accordance with WTO rules and, unlike local content requirements, do not fundamentally isolate the European single market from non-European competitors and trading partners. At the same time, trade and tariff policy instruments should not be exploited as a substitute for urgently needed domestic structural reforms. Reducing bureaucracy, lowering electricity and labour costs, and pursuing a location policy that promotes competition must be pursued as a separate reform agenda.

Tariff policy and CBAM are not alternatives within the context of the EU ETS 1, but rather complementary instruments at different regulatory levels. Their shared rationale is to establish a level playing field, not to create protectionist safe havens. This distinction remains the crucial regulatory guiding principle for a coherent European trade and climate policy.

9. Free allocation

9.1. Introductory remarks and overview

The free allocation of emission allowances in the EU ETS 1 is one of the most complex regulatory areas of the scheme.

In Germany, the first two trading phases of the EU ETS were characterised primarily by free allocation based on historical emissions, combined with periodically updated allocation decisions for existing and new installations. This allocation system created huge distortions to the incentive effects of the EU ETS, which largely prevented the efficient abatement of emissions (see the 'pyramid of distortions' in Table 9-1) and led to considerable free-riding effects, particularly in the electricity sector (see Matthes and Neuhoff 2007).

Therefore, with the third trading period, the transition was completed to both an EU-wide cap and the auctioning of emission allowances as the primary allocation method. Free allocation was retained only for installations where the carbon leakage issue was deemed relevant, specifically for most installations outside the energy sector. Free allocation is explicitly defined as a transitional option (Article 10a of the EU ETS Directive). In the electricity sector in particular, EU ETS allowances have since been allocated almost entirely through auctions.

The procedure for free allocation has switched to a benchmarking approach. In many cases, the transition to product-specific benchmarks has eliminated a large proportion of price distortions and incentivised comparatively comprehensive emissions reductions at installation level.

Free allocation under this benchmarking system is determined by a number of factors, as detailed in chapter 9.2.

Free allocation is based on a system of product-specific emissions benchmarks, which are currently updated every five years. In the future, however, new approaches may be adopted for these updates (see chapter 9.3). In this context, it is also important to note that a distinction will continue to be made, for some sectors, not only between products, but also between manufacturing processes. This applies to the different production routes for crude steel, for example, or to more complex industrial processes, for which fallback benchmarks relating to heat generation or fuel consumption are applied.

However, the benchmarks are just one factor in determining the free allocation. The first relevant factor is the cross-sectoral correction factor (CSCF), which harmonises the overall level of free allocation with the development of the cap (see chapter 9.5). The introduction of CBAM is reflected in the CBAM factor (see chapter 9.6).

Significant interactions continue to exist between the benchmarks and their updating, as well as with the other determinants of free allocation (chapter 9.7). These must be taken into account when assessing different reform options with a view to free allocation.

Table 9-1: Options for the allocation of emission allowances and distortions of the price signal (pyramid of distortions)

CO_2 price signal creates incentives for …				Optimal level		Optimal intensity	
				Demand/ Product innovation	Production	CO_2 emissions	Energy consumption
Incentivized optimization is …				system-wide		plant-specific	
Distortion of CO_2 price signal = loss of economic efficiency = higher allowance prices in future but, where applicable, prevents carbon leakage and associated efficiency losses				Price signal for optimal production at optimal demand levels	Price signal for optimal production without demand changes	Price signal for optimal CO_2 emission intensity at plant level	Price signal for optimal energy efficiency at plant level
Auctioning				X*	X	X	X
Free allocation	based on historical emissions			(X)	X	X	X
	Benchmarking	capacity	Updating & new entrant allocation	(X)	(X)	X	X
		poduct-specific		O	(X)	X	X
		product- and technology-specific		O	O	(X)	X
		product-, technology- and input-/fuel-specific		O	O	O	X
	based on historical emissions			O	O	O	O

X - ensured. (X) - ensured in general, but also depends on other factors. X* - ensured in general, if no carbon leakage can be assumed. O - not ensured.

Source: Oeko-Institut, based on Matthes and Neuhoff (2007)

Free allocation is updated regularly at specific intervals (predominantly for five-year periods at present) in line with production levels (updating of the allocation). The main reason for this is to avoid 'decommissioning premiums,' i.e. to prevent carbon leakage. Accordingly, no allowances are to be issued for installations that are not in use or have already been decommissioned. In addition, there is a free allocation for new installations to prevent distortions of competition between existing and new installations. Consequently, however, this leads to distortions in the carbon price signal (see Table 9-1). This means that the current system, with product-specific allocation based on carbon intensity, provides undistorted incentives. However, the appropriate approaches to optimal consumption or product innovation cannot emerge in this context because the updating process – via the respective renewed allocation for the various allocation periods[14] and any ex-post adjustments made beyond this – prevents the carbon price from being fully factored into product prices.[15]

[14] From an economic perspective, where allowances are reallocated every five years, the question arises as to whether it may be advantageous to reduce production (and monetise the allowances that are no longer required) if this reduction in production is offset by a correspondingly decreased free allocation of allowances in the next allocation period. At a discount rate of 5 %, the effective carbon price influencing production decisions is distorted by 23 % over a five-year period, and by 61 % at a discount rate of 10 %.

[15] In principle, activity rates are set on the basis of past reference periods. However, if the activity rate in a given year differs by more than 15 % from the rolling two-year average, the free allocation is adjusted upwards or downwards (Article 10a(20) of the EU ETS Directive). Any allowances released in this way are transferred to the New Entrants Reserve, while any additionally required allowances are taken from it.

Free allocation is updated regularly at specific intervals (currently mainly for five-year periods) in line with production levels. The main reason for this is to avoid 'decommissioning premiums' (i.e. to prevent carbon leakage). Accordingly, no allowances are issued for installations that are not in use or have been decommissioned. Additionally, free allocations are provided for new installations to prevent competition distortions between existing and new installations. Consequently, however, this leads to distortions in the carbon price signal (see Table 9-1). Therefore, the current system, which is based on product-specific allocation according to carbon intensity, provides undistorted incentives. However, the correct approaches to optimal consumption or product innovation cannot emerge in this area because the updating process – via the respective renewed allocation for the various allocation periods and any ex-post adjustments made beyond this – prevents the carbon price from being fully factored into product prices.

Finally, it should be noted that the analyses presented here initially focus on the free allocation of emission allowances for the period from 2031 onwards. However, the European Commission's recently published decision on the benchmarks for the 2026–2030 allocation period also suggests that, in the context of the current reform processes, changes to the benchmark updates could become possible with retroactive effect for this period. Nevertheless, the analyses, reform options and conclusions presented here, initially for the period from 2031 onwards, can also be applied, structurally and largely unchanged, to the current allocation period.

9.2. Basic approach to free allocation in EU ETS 1

Currently, free allocation is determined using the formula shown below, based on a range of different factors:

$$A = HAL \times BM \times CLF \times CSCF \times CBAMF$$

The free allocation (A) for the allocation period (currently 5 years at a time, i.e. 2026–2030, 2031–2035, etc.) is derived from the production level (historical activity level, or HAL, as defined in Article 10a(2) of the EU ETS Directive) during the relevant base period (2014–2018 for the 2021–2025 allocation period, 2019 to 2023 for 2026–2030 and, provisionally, 2024–2028 for 2031–2035, etc., Article 15(7) of the EU Free Allocation Regulation[16], EC 2024b), the relevant benchmark (BM, see chapter 9.3), the carbon leakage factor (CLF, Article 10a(6) of the EU ETS Directive), the cross-sectoral correction factor (CSCF, Article 10a(5) of the EU ETS Directive, see chapter 9.5) and the CBAM factor (CBAMF, Article 10a(1a) of the EU ETS Directive, see chapter 9.6).

The benchmarks, the CSCF and the CBAMF, along with the corresponding adjustment options, are discussed in more detail in the following sections. The CLF is not covered further here. For products from sectors where there is a significant risk of carbon leakage, a CLF of 100 % is applied (Article 16(4) of the EU Carbon Border Adjustment Mechanism Regulation). The majority of industrial sectors are covered by the relevant EU carbon leakage list.

[16] Where annual activity rates deviate by more than 15 %, corrections may be made (see above).

9.3. Adjustment of benchmarks

9.3.1. Introduction and general methodology

Since 2013, free allocation under the EU ETS has been based on 54 benchmarks, 52 of which relate to product-specific output and two of which are input-based fallback benchmarks for heat or fuel use. The fallback benchmarks are intended to cover products and processes that are too complex to apply product benchmarks to, or in the case of the fallback benchmark for heat, to cover purely heat generation processes.[17]

The benchmark concept implemented in the EU ETS is based on an analysis of the top 10 % of installations in the various installation groups (hereinafter referred to as the respective installation fleets for the production of a specific benchmark product) in 2007–2008. These benchmarks were derived from the average emission intensity of the top 10 % of installations for each product group during this period and were used in 2011 for the free allocation of allowances for the 2013–2020 trading period (EC 2021c).

Figure 9-1 shows the distribution of emission intensities across the various installations for the 52 installation groups, compared with the respective mean value for all installations in the relevant product group in 2016–2017. Typically, the emission intensities of 70 % to 80 % of the installations in each product group were below the average for all installations in that group. For the remaining 20 % to 30 % of installations, the specific emissions per unit of product were in some cases several times higher than the respective averages.

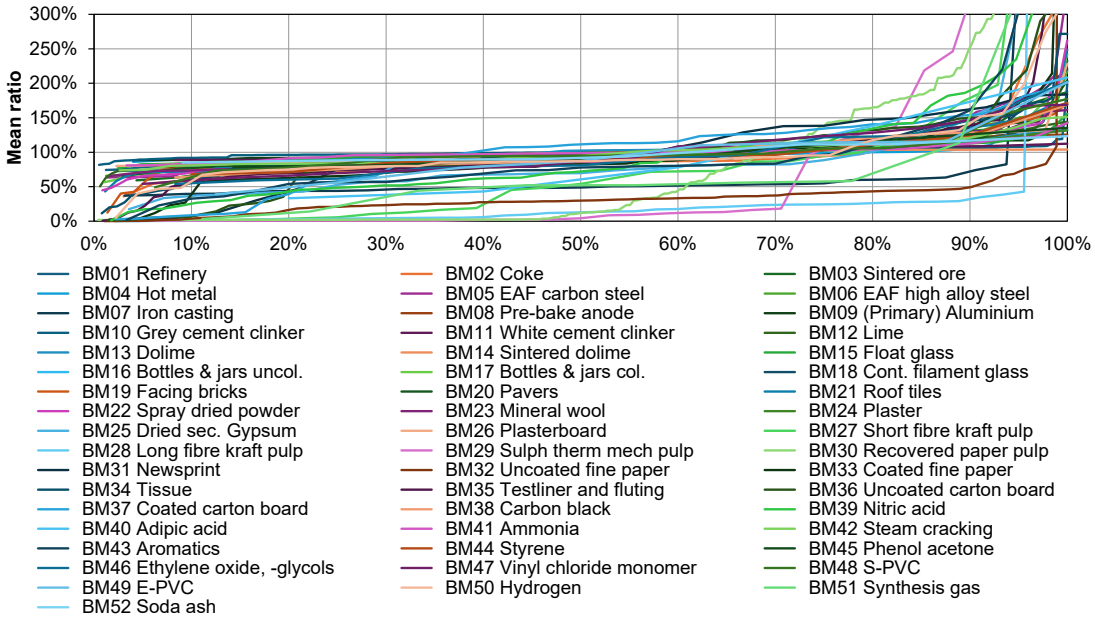
In the weighted average for all plants in 2016–2017, the emission intensity of the top 10 % of plants was around 68 % of the average, with the overall range extending from 0 % to 94 %. If the five highest and five lowest values are excluded, the range is 5 % to 84 %. However, this wide range is also due to the plant groups, which represent only comparatively low emission levels. For the plant groups with the 10 largest emission contributions (which account for approx. 85 % of the emissions covered by the various product benchmarks), the range is considerably narrower, with values ranging from 51 % to 89 %. For the installations with the largest emissions contribution (crude steel – BM04), the emissions intensity of the top 10 % of installations stands at around 89 % of that of the entire installation base. The particularly low emissions intensity values for the top 10 % of installations are typically found in the paper industry (where there is, in some cases, a high proportion of biomass utilisation).

As the trading periods progress, free allocation is updated for sub-periods of five years (allocation periods), with the benchmarks being lowered in each instance.

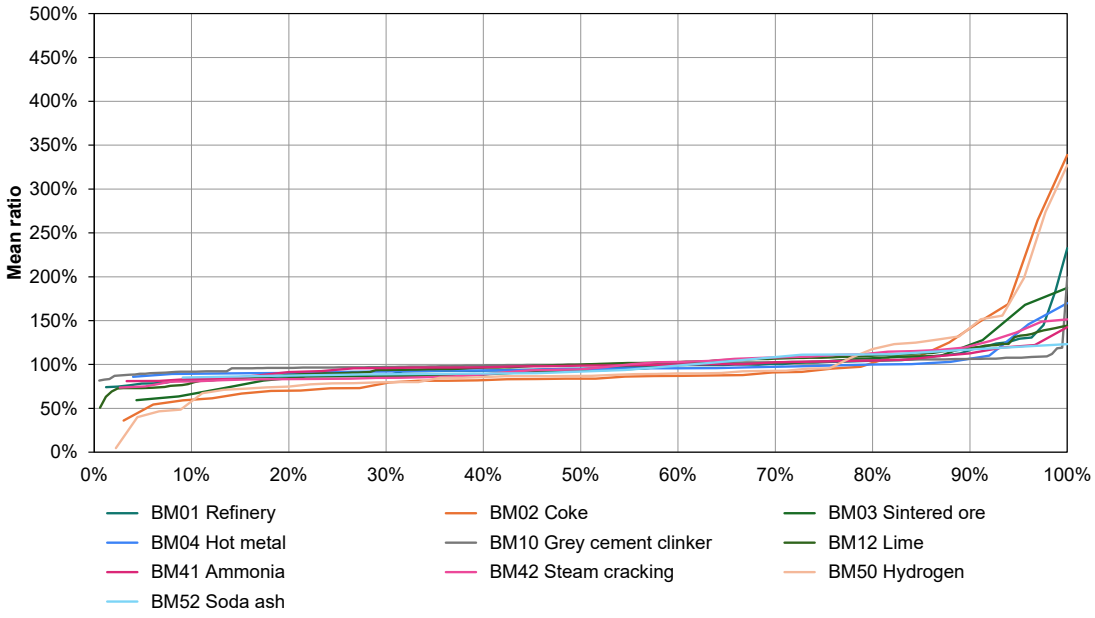
[17] Furthermore, in a small sub-sector, free allocation is still based on historical emissions, specifically for process emissions not covered by benchmarks. For these emissions, installations receive free allocations amounting to 97 % of the corresponding historical emissions until the end of 2027 and 91 % from 2028 onwards (Article 16(2e) of the EU Free Allocation Regulation).

Figure 9-1: Distribution of specific emission values for the various plant groups

a) All installation groups



b) Installation groups with the 10 highest GHG emissions



Sources: European Commission, Oeko-Institut

This regular adjustment of the benchmarks currently takes place every five years on the basis of a complex procedure:

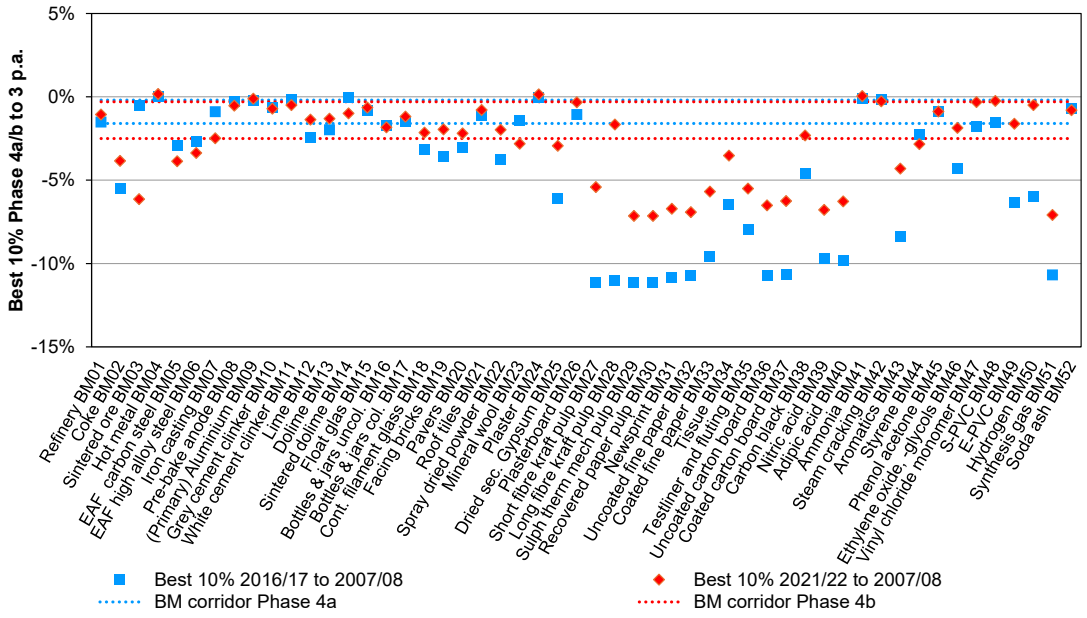
- As a general rule, the emission intensities of the top 10 % of installations within each installation group are determined. For the 2026–2030 allocation period, the relevant analyses are carried out based on the years 2021 and 2022.
- A linear reduction factor is derived from the ratio between the value determined in this way and the baseline values for the 2013–2020 trading period (using data from the reference period of 2007–2008).
- However, where this linear reduction factor is less than or equal to 0.2 % per annum or greater than or equal to 1.6 % per annum, the two aforementioned corridor values were used as the basis for the benchmark update for the 2021–2025 allocation period (Article 10a of the EU ETS Directive). For the 2026–2030 allocation period, the minimum and maximum values are increased to 0.3 % and 2.5 % per annum respectively.
- Multiplying the base values by the linear reduction factor over 15 or 20 years (the allocation periods of 2021–2025 and 2026–2030 respectively) then yields the respective benchmark for the relevant allocation period.

Figure 9-2 shows the outcome of this procedure.[18] Typically, the improvements in specific emissions from 2007–2008 to 2021–2022 are below the annual average values for the period up to 2016–2017. This means that the reduction in specific emissions from 2016–2017 to 2021–2022 is significantly lower than the values for the period from 2007–2008 to 2016–2017, resulting in smaller improvements in specific emission levels over the entire period.

For a whole range of product benchmarks (typically for product-specific installation groups with lower emission contributions), the annual reduction factors lie well below the corridor of 0.2 % to 1.6 % or 0.3 % to 2.5 %, respectively, meaning that the upper corridor values apply. Overall, the method for determining benchmarks is therefore fundamentally based on the concept of the top 10 % of installations; in reality, however, the corridor values apply to a great many benchmarks, albeit for more benchmarks in the 2021–2025 allocation period than in the 2026–2030 period.

[18] For the 2026–2030 allocation period, the values used were the specific emissions of the top 10 % of installations and the proposed benchmarks, as set out in the European Commission's draft consultation document (EC 2026b).

Figure 9-2: Comparison of annual changes in emission intensities for the top 10 % of installations in each installation group with product benchmarks



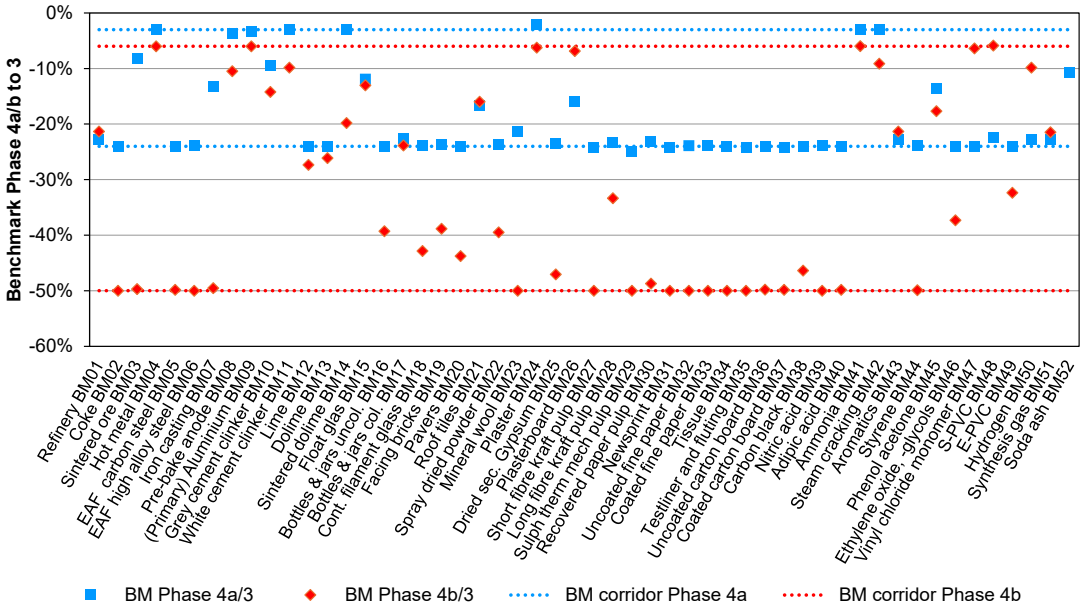
Sources: European Commission, Oeko-Institut

The application of linear reduction factors to the benchmarks leads, over the 15- and 20-year periods (the 2021–2025 and 2026–2030 allocation periods respectively), to reductions in individual benchmarks that are in some cases substantial (Figure 9-3).

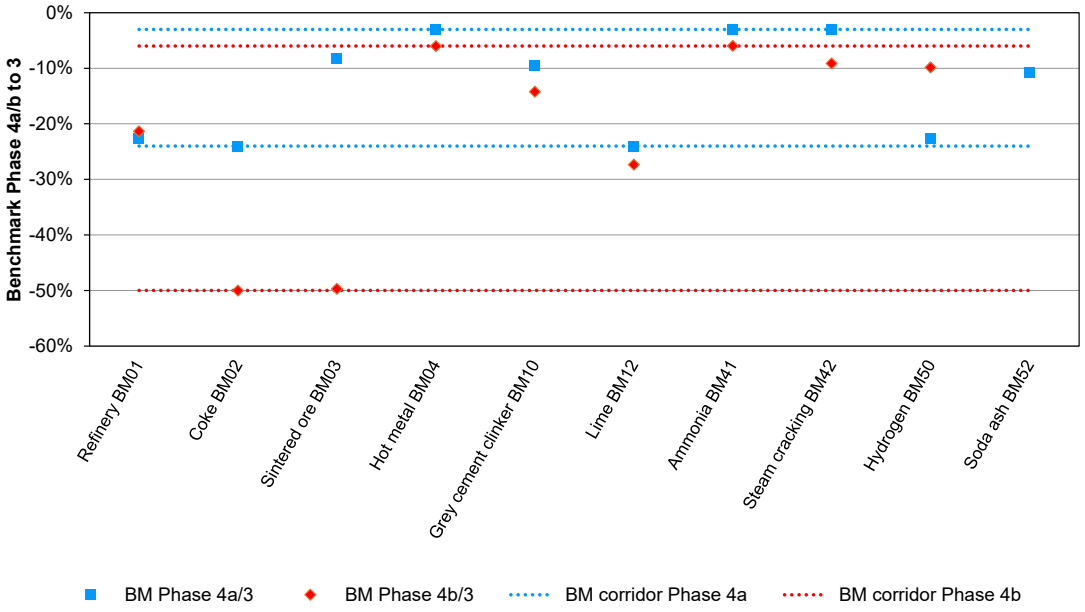
For some installation categories, this results in a reduction in the benchmarks (and thus also in a key determinant of the level of free allocation) of between 3 % and 6 % (2021–2025 and 2026–2030 respectively), and for others of up to 24 % and 50 % respectively. The concept of updating benchmarks via linear adjustment factors thus leads, on the one hand, to a considerable reduction in free allocation and, on the other hand, to considerable distributional effects between the installation groups involved in the production of the various benchmark products. This applies in particular to the production of products for which transformative technologies are used in the top 10 % of installations, while the corresponding modernisation cycles have not yet begun for the remainder of the installation fleet. In extreme cases, such a surge in modernisation among the top 10 % of installations between two allocation periods can mean that the upper corridor value for the benchmark adjustment takes effect immediately rather than the lower corridor value.

Figure 9-3: Decrease in benchmark values for the 2021-2025 and 2026-2030 allocation periods compared with the 2013-2020 baseline values

a) All product benchmarks



b) Product benchmarks for the installation groups with the 10 highest GHG emissions



Sources: European Commission, Oeko-Institut

Within the overall system of free allocation, the benchmark updates thus contribute to reducing the overall cut in free allocation; however, this reduction is also achieved through the application of the CSCF. In contrast to the CSCF, which operates uniformly across all installation groups (and beyond), the benchmark update under the currently

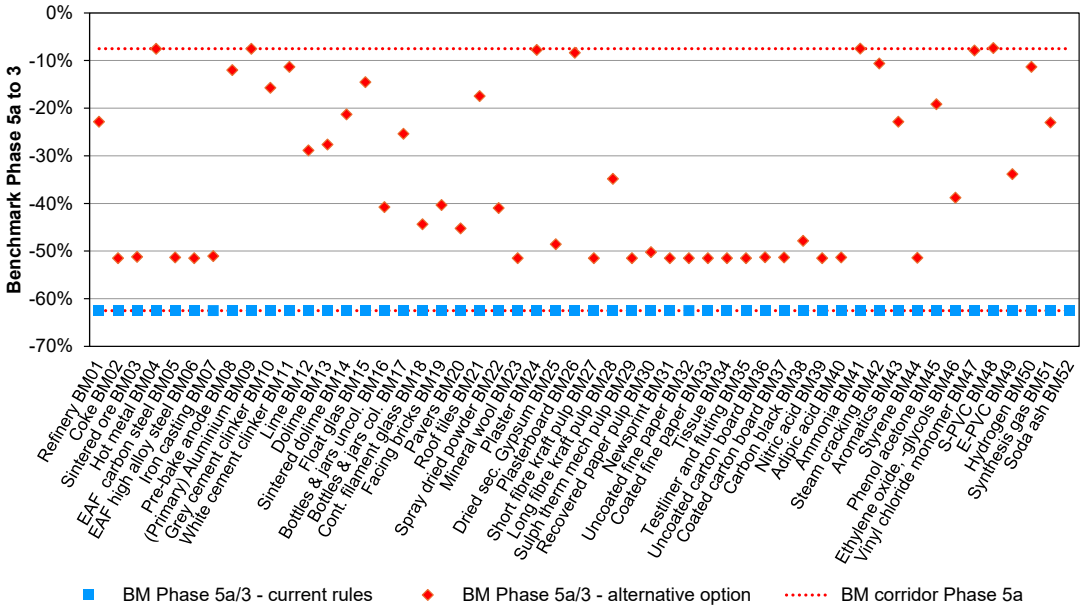
applicable procedure, however, leads to significant distributional effects (further amplified by the CSCF) between the various industrial sectors and may, in some cases – particularly with regard to the allocation periods from 2031 onwards – result in significant step changes. Such a situation could arise, for example, if, within the steel industry, a significant proportion of blast furnaces were to be replaced by direct reduction plants initially fuelled by natural gas, which are also classified under product group 4 (hot metal benchmark). Compared with the blast furnace route, these plants achieve specific emission reductions of up to two-thirds. Therefore, if these plants were to dominate the top 10 % of installations, the hot-metal benchmark would jump from the lower to the upper corridor value in the following allocation periods, based on the regulations currently in force. For the 2031–2035 allocation period, the benchmark would thus be reduced not by 7.5 % but by 62.5 %. Taking into account the CSCF (see chapter 9.5) and, where applicable, CBAM (see chapter 9.6), the decrease in free allocation would be even more considerable.

Against this background, the following options for action arise, each with their respective advantages and disadvantages:

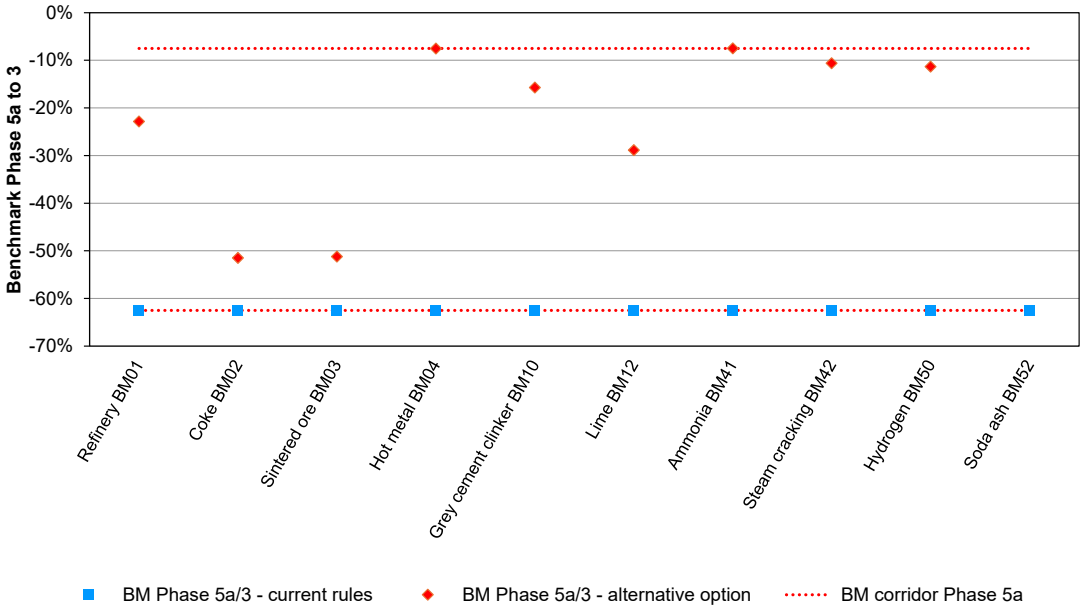
- If no changes were made, these roll-over effects – which would continue to intensify over time – would persist, thereby maintaining clear disadvantages within the overall system of free allocation. However, this would not entail any changes to the regulatory framework, and the CSCF could be lower than under the other options.
- Reform option 1: The benchmarks could be updated, based on the baseline values for the 2013–2020 trading period (or the 2007/2008 reference years), using a uniform and low adjustment rate (e.g. 0.3 % annually). This would largely limit cross-sectoral distortions and the procedure would be straightforward to implement. However, the benchmarks for allocation periods from 2031 onwards would then, in some cases, be significantly higher than the values for the 2026–2030 allocation period, and the CSCF would have to be correspondingly higher.
- Reform option 2: The benchmarks could be updated, based on the benchmark values for the 2026–2030 allocation period, using a uniform and low adjustment rate (e.g. 0.3 % per annum). This would limit cross-sectoral distortions to the extent that had arisen up to the 2021–2025 allocation period, and this approach would also be straightforward to implement. The benchmarks for allocation periods from 2031 onwards would consistently be lower than those for the preceding allocation periods, and the CSCF would not need to be adjusted quite as significantly as in the previous option.
- Reform option 3: All other adjustment options (using adjustment factors calculated differently from the lower corridor values of the currently applicable regulatory framework used in the two options above) could lead to a considerable administrative burden and unintended implications.

Figure 9-4: Example reduction in benchmark values for 2031–2035 allocation period compared with 2013–2020 baseline values under current legislation and proposed alternative option

(a) All product benchmarks



b) Product benchmarks for the installation groups with the 10 highest GHG emissions



Sources: European Commission, Oeko-Institut

Against this background, with a view to limiting cross-sectoral distortion effects caused by the benchmark design, the administrative burden, the consistency of trends over time and the effects on the CSCF (and its distributional effects), the option of carrying forward the benchmark values used for the 2026–2030 allocation period under current legislation, using the current lower corridor value from 2031 at the latest, or even for the current 2026–2030 allocation period, appears to be the recommended course of action.

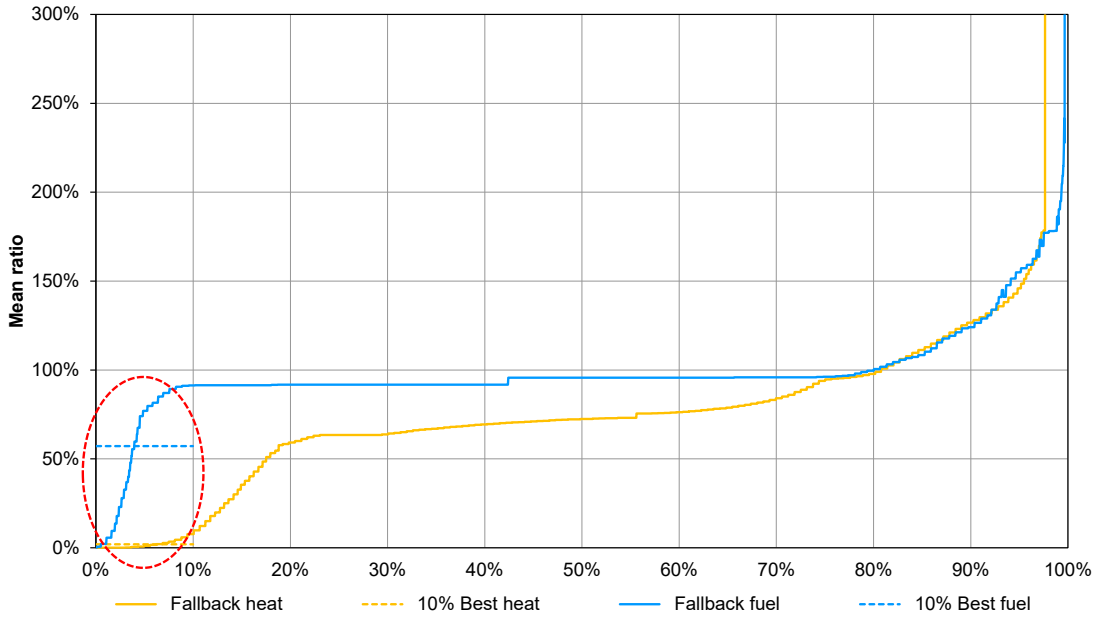
Figure 9-4 shows the results of a model calculation that illustrates the aforementioned effects (i.e. the emission reductions of the top 10 % of installations lead to the application of the upper corridor values for the benchmark adjustment), as well as the alternative option proposed here for updating the benchmark. Although the aforementioned update is speculative given the current legal situation and represents an extreme scenario, the effects are clear. Notably, for installation groups with high CO_2 emissions, the updated benchmark would provide significant relief and a more predictable allocation situation with regard to uncertainties surrounding the top 10 % of installations in each group. For the vast majority of plant groups with the highest emissions, differences in benchmark values range from 40 % to 55 %.

9.3.2. The specific problem of fallback benchmarks

For all installations that cannot be assigned to specific product benchmarks, so-called fallback benchmarks are applied for free allocation. If the heat quantities used for the respective process can be measured, free allocation is based on a heat benchmark. If such measurement is not possible, free allocation is determined on the basis of a fuel benchmark. The starting point for the heat and fuel benchmarks applied in the 2013–2020 trading period was not an analysis of the respective plant fleets with regard to the top 10 % of plants, but a simple estimation method. The use of natural gas was defined as the standard for the fuel benchmark (emission factor 56 t CO_2/TJ), while the heat benchmark was based on the assumption of a heating system with an efficiency of 90 %, corresponding to specific emissions of 62 t CO_2/TJ.

Particularly with regard to the heat benchmark, it should be noted that the range of installations covered by the allocation based on the heat benchmark is very broad. It ranges from district heating generation plants (36 % of the emissions covered by the heat benchmark in 2016/2017), through industrial plants not at risk of carbon leakage (29 %), to the use of process heat in sectors classified as being at risk of carbon leakage (35 %). For installations with allocations based on the fuel benchmark, district heating generation plays no role; here, the vast majority (just under 80 %) is accounted for by installations classified as at risk of carbon leakage, and only around one-fifth by installations without such a classification.

Figure 9-5: Benchmarking curve for fallback benchmarks



Sources: European Commission, Oeko-Institut

Comparing these figures with the actual composition of the real plant fleet highlights the problematic (distributional) effects arising from these baseline assumptions and the extrapolation methodology used. As a large proportion of district heating is generated using highly efficient CHP plants and (in some parts of Europe) also using biomass, the actual emission figures – particularly for the best-performing plants – are significantly lower than the above-mentioned baseline figures for 2013–2020, on which the projection is based. Figure 9-5 illustrates this using the plant stock as at 2016/2017. The average specific emissions for the top 10 % of plants, for which allocation was based on the heat benchmark, stood at just 1.6 t CO_2/TJ, i.e. at a level 97 % below the benchmark value for the third trading or allocation period. Consequently, the heat benchmark for the first allocation period of the fourth trading period (2021–2025) was set at the upper limit of the corridor, and this will also continue for the second allocation period. This huge reduction in the free benchmark allocation – driven primarily by the district heating sector – consequently also affects allocations in the industrial sector, where production processes and products are more complex (including in the chemicals industry). The distribution for the fuel benchmark is somewhat less drastic, but here too the structural curve shown at Figure 9-5 indicates that low-carbon fuels are found almost exclusively amongst the top 10 % of installations, while the structural curve remains virtually flat in the range from 10 % to 80 %.

The calculation methods used for the fallback benchmarks are therefore based partly on artefacts (ideal-typical baseline metrics), partly on the aggregation of very different sectors, and partly on specific conditions relating to the top 10 % of installations. Overall, they lead to significant distortions, particularly to the detriment of complex installations classified as having carbon leakage. This has also been recognised by the European Commission (recital 16 of the EU Benchmarking Regulation, EC 2026a). The decision taken in June 2026 on the benchmarks for the period 2026 to 2030 therefore also announces a proposal by the European Commission to increase the fallback benchmarks.

This increase is to be implemented at very short notice and will apply as early as the period 2026 to 2030.

Nevertheless, it should be borne in mind that, while identical benchmark levels have so far applied to the various areas of application of the fallback benchmarks, different values are applied here with regard to the carbon leakage factors in the allocation formula (see chapter 9.1) (Article 16(3) of the EU Free Allocation Regulation):

- For installations classified as carbon leakage installations, the carbon leakage factor is consistently 100 %.
- For district heating installations, the carbon leakage factor remains constant at 30 % from 2021 to 2030.
- For the remaining areas of application of the fallback benchmarks – that is, in industrial sectors without a carbon leakage classification – the carbon leakage factor is 30 % until 2026 and then decreases linearly to zero by 2030.
- For district heating systems in Bulgaria, the Czech Republic, Latvia and Poland, there are specific national regulations that allow for a higher level of free allocation for district heating (Annex VIII of the EU Free Allocation Regulation).

The results of the development of the fallback benchmarks to date are summarised in Table 9-2. The table also shows the quantities that will ultimately be allocated free of charge, taking into account the carbon leakage factors.

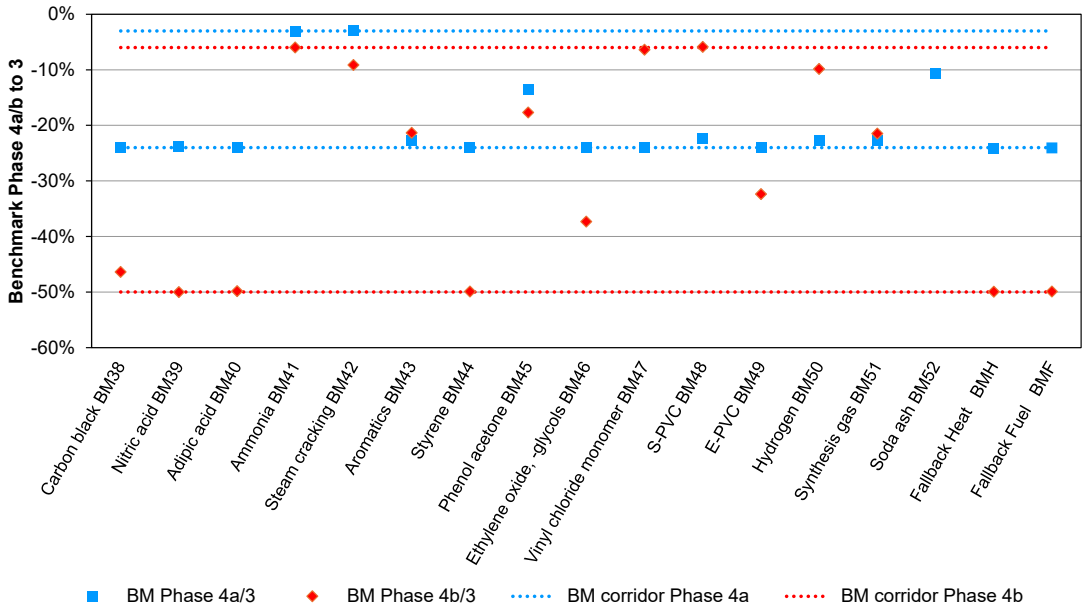
Table 9-2: Development of fallback benchmarks to date

	Benchmark			Allocation
	2013-2020	2021-2025	2026-2030	2021
	t CO_2 /TJ	t CO_2 /TJ	t CO_2 /TJ	million EUAs
Heat carbon leakage	62.3	47.3	31.2	59.3
Heat non-carbon leakage	62.3	47.3	31.2	4.3
District heating	62.3	47.3	31.2	16.2
Fuel carbon leakage	56.1	42.6	28.1	33.5
Fuel non-carbon leakage	56.1	42.6	28.1	2.7

Sources: European Commission, Oeko-Institut

As free allocation based on the fallback benchmarks is of particular significance for complex products and production processes in the chemicals industry, Figure 9-6 shows the development of the adjustment factors for the first and second allocation periods of the fourth trading period, covering both the product benchmarks in the chemicals industry and the two fallback benchmarks.

Figure 9-6: Adjustment factors for product-specific benchmarks in the chemicals industry and the fallback benchmarks



Sources: European Commission, Oeko-Institut

With a few exceptions (notably nitric acid and adipic acid production, where there are highly effective and cost-efficient or widely implemented abatement options for N_2O) and, above all, for the installation groups with very high emissions (steam cracking, ammonia and hydrogen production), the benchmark adjustment for the second allocation phase of the fourth trading period is 10 % or less. For allocation via the two fallback benchmarks, this results in a 50 % reduction in the benchmarks. This asymmetry – and the associated distributional effects – appear hardly justifiable, particularly in the longer term (where the differences continue to grow).

By analogy with the product benchmarks, the various options for updating the fallback benchmarks can be described and assessed as follows.

- Without any changes, these distorting effects would persist and would continue to increase over time. For installations classified as having carbon leakage, this would result in ever-increasing disadvantages within the overall system of free allocation. However, this would not entail any changes to the regulatory framework, and the CSCF could be smaller than under the other options.
- Reform option 1: The fallback benchmarks could be updated for applications relating to carbon leakage classification, based on the baseline values from the 2013–2020 trading period (or the reference to natural gas or natural gas used in typical heating plants), using a uniform and low adjustment rate (e.g. 0.3 % annually). This would largely limit the discrepancies between the product benchmark and the fallback benchmark, and the procedure would be straightforward to implement. However, the benchmarks for allocation periods from 2031 onwards would then, in some cases, be significantly higher than the values for the 2026–2030 allocation period, and the CSCF would have to be set correspondingly higher.

- Reform option 2: The fallback benchmarks could be updated, based on the benchmark values for the 2021–2025 allocation period, using a uniform and low adjustment rate (e.g. 0.3 % per annum). Distortions would thus be limited to the extent that had arisen up to the respective allocation period, and this approach would also be straightforward to implement. The CSCF would not need to be adjusted quite as significantly as in the previous option.
- Reform option 3: All other adjustment variants (using adjustment factors calculated differently from the lower corridor values of the currently applicable regulatory framework used in the two options above) could lead to a considerable administrative burden and unintended implications.

In view of the limitation of distortionary effects through the benchmark design, the procedural burden, the consistency of development over time, the effects on the CSCF (and its distributional impacts), and consistency with the adjustments proposed for the product benchmarks, Reform Option 2 is recommended. It is therefore recommended that, based on the benchmark for the 2021–2026 allocation period, an update be carried out using the current lower corridor value from 2026 onwards, thereby already anticipating or implementing the increase in the fallback benchmarks announced by the European Commission. The result of this extrapolation is shown in Table 9-3. This arrangement will then apply in particular to sectors at risk of carbon leakage. For district heating systems and installations not classified as being at risk of carbon leakage, free allocation is to be phased out as before (via the carbon leakage factor as outlined above).

Table 9-3: Proposal for further development of fallback benchmark for heat from 2026

	t CO_2/TJ	g CO_2/kWh	as % of the inital level
Current benchmarks			
2013-2020	62.3	224.3	100%
2021-2025	47.3	170.5	76%
2026-2030	31.2	112.1	50%
Proposal			
2026-2030	46.4	167.1	75%
2031-2035	45.5	163.7	73.0%
2036-2040	44.5	160.4	71.5%
2041-2045	43.6	157.0	70.0%
2046-2050	42.7	153.6	68.5%

Note: In addition, the carbon leakage factor will be applied. For district heating and heat generation in sectors not included on the carbon leakage list, free allocation will phase out on a linear basis.

Source: Oeko-Institut

9.4. Conclusion: The development of provisional allocation quantities

Based on the existing rules for updating the benchmarks in chapter 9.3 and taking CBAM into account (chapter 9.6), the trend in the provisional free allocation shown in Figure 9-7 emerges, including a comparison with the projection based on the currently valid approach to updating the benchmarks.

Following the end of free allocation for electricity generation at the start of the third trading period in 2013, free allocation for industry and other heat generation within the scope of the EU ETS stood at approx. 870 million EUAs in 2013. By 2025, this had fallen by over 40 % to approx. 500 million EUAs. This is primarily attributable to the decline in industrial production, as the benchmark values for the first allocation phase of the fourth trading period were reduced by only around 15 % on a weighted average basis compared to the third trading period (which had a range of 3 % to 24 %).

A further and relatively steady decline in free allocation is also expected from 2026 onwards. This trend is attributable, on the one hand, to the continuous reduction in production benchmarks by up to 2.5 % per year, and, on the other hand, to the highly probable decline in production, particularly in energy- and emissions-intensive sectors.[19]

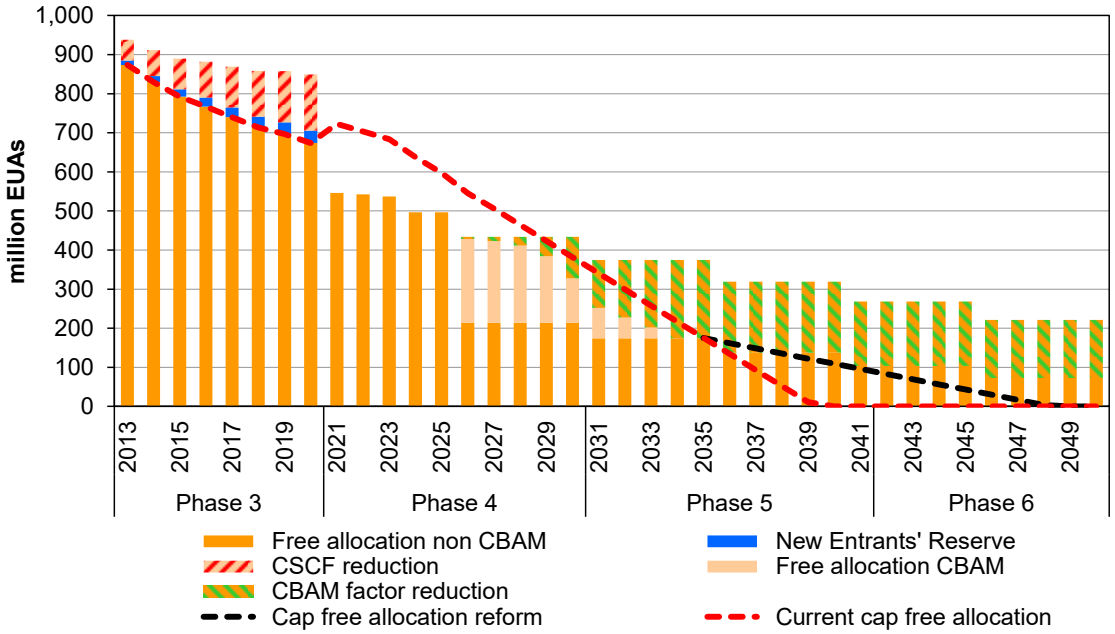
Figure 9-7 also shows the proportion of the provisional allocation quantities going to installations producing goods that are (currently) covered by CBAM. Until the fourth trading period, free allocation is still split roughly equally, with installations producing CBAM goods receiving around half. However, from the mid-2030s onwards, the proportion going to installations producing CBAM goods is projected to rise to around 60 % – and subsequently up to 67 % – if the current rules on benchmark updating are maintained. Subject to an adjustment to the benchmark update (as described in the preceding chapters), the provisional free allocation would continue to be split equally between installations producing CBAM goods and the remaining installations. From the perspective of the provisional allocation, a modified benchmark adjustment would initially benefit primarily installations that do not produce CBAM goods. For all installations, however, there would be greater predictability in terms of future allocation quantities, as the benchmark adjustments would no longer depend on the performance of the top 10 % of installations – a factor that is difficult for any individual installation to assess.

However, the overview also illustrates that focusing solely on the provisional allocation – i.e. the benchmarks – is insufficient. As the CSCF plays no role in the fourth trading period, very significant adjustments will have to be made via the CSCF from 2031 onwards (see chapter 9.5). In addition to this adjustment to free allocation, the application of the CBAM factor also plays a key role (see chapters 9.5 and 9.6).

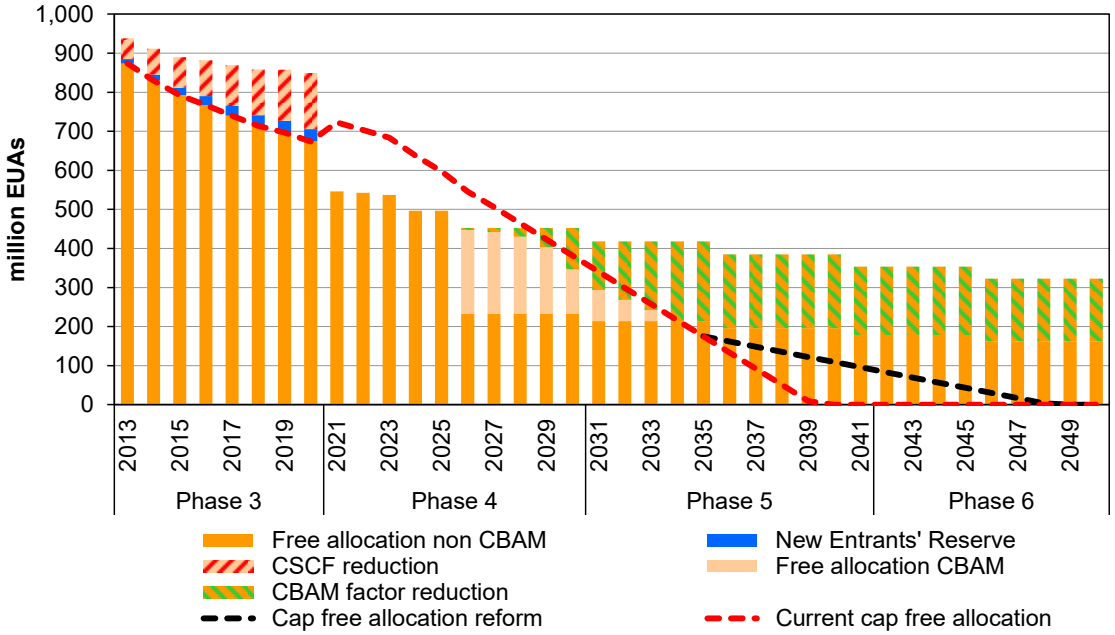
[19] In recent years, the production of energy-intensive basic materials in particular has been declining across the EU. Refinery production is also set to fall significantly as part of the energy transition. To reflect both trends (in simplified terms), the projection from 2026 onwards assumes a decline in activity levels of 5 % per allocation period.

Figure 9-7: Trend in provisional allocation quantities

a) Based on the previous allocation benchmarks



b) With the reform option for allocation benchmark



Notes: 5 % reduction in activity levels every 5 years (based on 2025), new calculation method for the cap for free allocation from 2021 (up to 2020: share of non-electricity generators), estimate of the quantities reduced via the CSCF up to 2020, calculated retrospectively from actual free allocation; unallocated allowances (decommissionings, etc.) not taken into account.

Source: Oeko-Institut

9.5. Allocation reductions based on the Cross-Sectoral Correction Factor

The proportion of free allocation in the total emission allowances available under the cap is limited to 46 % under the EU ETS Directive (57 % auction share minus a buffer of 3 %). If the total (provisional) allocation exceeds this proportion, there is a pro rata reduction in the free allocation. For this purpose, a Cross-Sectoral Correction Factor (CSCF) is applied (Article 10a(5) of the EU ETS Directive).

It should be noted that the CSCF is calculated without considering the reductions in free allocation resulting from the application of the CBAM factor (see chapter 9.6).

The CSCF becomes legally binding following a decision by the European Commission and is applied to all installations receiving free allocation. In the third trading period, the CSCF was calculated on an annual basis[20]; since the start of the fourth trading period, the CSCF has been calculated for the respective five-year allocation phases.

In the third trading period, the (final) CSCF fell from 89 % in 2013 to 78 % in 2020 (Table 9-4). Primarily due to the significant tightening of the benchmark values, the CSCF for the first allocation phase of the fourth trading period (2021–2025) was set at 100 % (EC 2021a). For the second allocation phase (2026–2030), it is also expected that there will be no reduction in free allocation via the CSCF.

Table 9-4: Effects of different variants for cap and benchmark development on CSCF

	Historical Trend	Projections			
		Current cap (LRF 4.4%)		Adjusted cap (LRF 4.4% by 2035, 1.4% from 2036)	
		Current rules	Benchmark reform	Current rules	Benchmark reform
2013-2020	89.2% →78.0% (94.3% →82.4%)*				
2021-2025	100%				
2026-2030	100%				
2031-2035	-	69%	64%	69%	64%
2036-2040	-	18%	15%	42%	37%
2041-2045	-	-	-	26%	21%
2046-2050	-	-	-	5%	3%

Notes: * The Commission's original decision was 94.3 %→ 82.4 %. Following a ruling by the European Court of Justice in April 2016, this was amended to 89.2 %→ 78.0 %. The recalculation only applied to allocation decisions made after 1 March 2017; however, as the allocation decisions for the vast majority of installations had already been implemented, most allocations remained unchanged.

Sources: European Commission, Oeko-Institut

Table 9-4 shows a projection of the CSCF for the options for developing the cap and the benchmark updating presented in chapter 9.3 (the reductions in free allocation due to the CBAM factor are not yet considered):

[20] The CSCF for the third trading period, determined in 2013, was corrected on 28 April 2016 based on a ruling by the European Court of Justice (German Federal Agency 2017). The applicable CSCFs were thereby reduced from 82 % to 94 % to 78 % to 89 %. However, the higher CSCF was only applied to changes in allocations, not to existing installations.

- A CSCF of well below 100 % is expected once again for the period from 2031 onwards.
- For the first allocation phase of the fifth trading period, assuming the current approach to benchmark updating is maintained and the linear reduction factor remains in place until 2035, a CSCF of approx. 70 % is anticipated.
- If the benchmark update method and the linear reduction factors (the latter from 2036) remain unchanged, the CSCF for the second allocation phase of the fifth trading period will fall to just under 20 %. If the benchmark update is adjusted, the reduction via the CSCF must be greater. Consequently, the CSCF falls to around 15 % due to the higher benchmark values in this case.[21] From 2041 onwards, there will be no further free allocation.
- By adjusting the linear reduction factors (to 1.4 % from 2036), the CSCF increases substantially from the second allocation phase of the fifth trading period onwards, amounting to 42 % (without adjusting the benchmark update method) and 37 % (with the described adjustment to the benchmark update method).
- With an adjusted cap, the CSCF would be considerably higher from 2036 onwards (ranging from just over 40 % to just under 40 %, depending on the benchmark update method). Even after 2041, there would still be free allocation; the reductions in the first allocation phase of the sixth trading period would amount to almost three-quarters (without benchmark revision) or almost four-fifths (with benchmark revision).
- In the second allocation phase of the sixth trading period, the CSCF would result in reductions of 95 % or more in the provisional quantity of allowances allocated for free.

The projection presented here shows that, initially, the design of the cap – and specifically the linear reduction factor – is the decisive factor influencing the CSCF. A change to the benchmark update method naturally does not alter the total volume of free allocation, but instead results in redistribution effects within the industry. The net effects are as follows:

- Installations manufacturing products for which the adjustment of benchmarks under the previous method was based on the more restrictive corridor values (e.g. 25 % over 10 years) will receive a higher free allocation under the new updating approach (e.g. 3 % over 10 years), even though the CSCF falls significantly in nominal terms under the new benchmark method.
- For installations involved in the manufacture of products whose benchmarks, under the previous method, were based on the upper corridor values (e.g. 3 % over 10 years), the free allocation under the new updating approach (e.g. 3 % over 10 years) will be lower, as the CSCF is reduced significantly once again with the transition to the new benchmark update method. However, if – in the context of the ongoing transformation of the installation portfolio – the benchmark values for the respective installations move towards the more restrictive corridor values, the net negative effect on free allocation will be correspondingly smaller.

This illustrative projection thus highlights that the debate on free allocation should not be narrowed to the question of future benchmark values; rather, the interactions with the CSCF must be carefully taken into account. Consequently, the mitigating effect varies considerably across the different installation clusters. While installations that were

[21] The change in the benchmark update method would reduce the CSCF by around 5 percentage points in the first allocation phase of the fifth trading period.

previously subject to restrictive benchmark updates will see higher levels of effective free allocation, the main advantage of changing the benchmark update method for installations where benchmark values decreased less sharply over time under the previous approach is the substantially greater predictability of future free allocations. This is because the latter are no longer dependent on changes in the best-performing segment of the respective total fleet, which individual players can no longer influence or only estimate.

It is important to note at this point that the above analyses do not yet consider the application of the CBAM factor.

9.6. Reduction in free allocation based on the CBAM factor

In the context of the EU ETS and European climate policy, the Carbon Border Adjustment Mechanism (CBAM) essentially has two key objectives (see chapter 8.2). Its primary aim is to prevent carbon leakage processes that may arise due to differing, non-existent or differently structured carbon pricing instruments in countries that export goods with a high carbon footprint from existing or newly constructed facilities. A further key objective is to incentivise more climate-friendly production methods or the introduction of greenhouse gas pricing systems in regions or countries not covered by the EU ETS. CBAM was launched in October 2023 with a two-year pilot phase for registration and reporting processes. From January 2026, CBAM will also have economic implications for importers of goods covered by CBAM, marking the start of the compliance phases in the strict sense.

In parallel with the start of this compliance phase of CBAM, free allocation – in accordance with the current legal framework – to installations covered by CBAM will be gradually reduced over a period of nine years from 2026 onwards and is set to be phased out completely by 2034. To this end, the free allocation for goods covered by CBAM will be multiplied by the CBAM factor. The provisional allocation calculated according to the respective historical activity levels is taken as a basis and then adjusted using the CSCF to ensure compliance with the maximum quantity of emission allowances available for free allocation (excluding CBAM).

The CBAM factor will be applied for the first time in 2026 and will amount to 97.5 %. Following relatively minor adjustments to 95 % (2027) and 90 % (2028), it will, under current legislation (Article 10a of the EU ETS Directive), subsequently fall quite sharply to 77.5 % (2029) and 51.5 % (2030). It will then be reduced in increments of 12.5 % each year until 2033 and fall to zero by 2034 (Article 10a of the EU ETS Directive).

The emission allowances no longer allocated for free as a result of applying the CBAM factor will be auctioned. However, the revenues will not form part of the general auction revenues but will be allocated to the Innovation Fund and used for its purposes. On the other side, when importing CBAM goods, it is necessary to purchase CBAM certificates, the value of which corresponds to that of the allowances under the EU ETS (for details on CBAM, see chapter 8.2).

When benchmark adjustments (which are typically less restrictive for CBAM installations), the application of the CSCF (which will come into effect again on a significant scale from 2031 and affects all installations equally) and the CBAM factor are combined, installations particularly exposed to international competition or carbon leakage will face a very sharp reduction in free allocation from 2030 onwards.

On an abstract level, this is also logically imperative. If CBAM ensures that the risk of carbon leakage can be robustly and comprehensively prevented, then the justification for the free allocation of emission allowances – which, after all, is presented in the EU ETS as a transitional solution and explicitly justified with reference to the issue of carbon leakage – ceases to apply.

On a practical level, however, CBAM – a relatively new instrument with which only very limited experience has been gathered – currently faces fundamental challenges which, if not addressed, could jeopardise the effectiveness of CBAM as a safeguard against carbon leakage (see chapter 8.2):

- The current legal framework does not adequately address the treatment of exports of CBAM-relevant goods and the associated risk of carbon leakage. However, the proportion of exports varies greatly across the different goods covered by CBAM (comparatively low for cement, higher for other goods in the iron, steel, and aluminium sectors). Discussions are ongoing at European level on how the carbon leakage risk for EU exports can be effectively mitigated.
- The risks of circumvention of the CBAM regime (resource shuffling, downstreaming, but also the design of any carbon pricing instruments in exporting countries) are undeniably present; attempts should be made to address these through appropriate countermeasures (see chapter 8.2). Whether this will succeed, however, remains unclear. There is a broad range of relevant measures, but at the same time, there are a number of conflicting objectives. The European Commission is currently working on a package of measures, and in various Member States in-depth analyses of the effectiveness of CBAM have been undertaken. However, robust empirical evidence regarding the effectiveness of the various sets of measures to prevent circumvention strategies will only become available over time.

This creates a tension between the effectiveness of CBAM – which cannot yet be reliably assessed in terms of protection against carbon leakage – and the short-term, tangible reduction in free allowances for installations producing goods covered by CBAM (which, in economic terms, corresponds to a reduction in contribution margins). This situation is by no means new; for many newly introduced quantity-control instruments (the EU ETS, the GHG quota model in Germany), lengthy learning processes were required before circumvention or exploitative strategies could be reliably or sufficiently ruled out. With a view to these learning processes, it should be noted that, in practice, circumvention and exploitative strategies discussed ex ante have often proved to be less relevant, while strategies employed by regulated economic operators that were not considered ex ante have, in some cases, become a significant problem.

As with other comparable instruments, this tension can be gradually resolved over time. To achieve this, CBAM must be strengthened ex ante, alongside robust evaluation measures and the necessary time frames. The key question regarding the appropriateness of reducing free allocation in the context of the CBAM factor is therefore whether the CBAM Regulation is supplemented by robust measures against circumvention strategies and against carbon leakage risks in exports, and whether the envisaged trajectory of the CBAM factor over time proves to be consistent with the attainable results of the ex ante evaluation.

If the CBAM Regulation cannot be designed robustly enough against circumvention strategies and export risks in time for the sharp reduction in the CBAM factor, it would make

sense to extend the time frame for the sharp reduction in the CBAM factor in order to resolve the tension between the phasing-out of free allocation and protection against carbon leakage. It should also be borne in mind that the number of goods covered by CBAM is set to increase substantially again from 2028 (by around 30 %), that reliable observation periods of 3 to 5 years are required to evaluate the system's effectiveness, and that legislative processes for developing CBAM further also take a certain amount of time.

However, the freeze on the reduction of free allocation decreases the auction revenues for the Innovation Fund and carries the risk of becoming established as a long-term measure. Both risks would need to be addressed. Firstly, by setting a clear time limit with review mechanisms linked to the proven effectiveness of CBAM. Secondly, by linking it to transformative investments, as described in chapter 9.8.

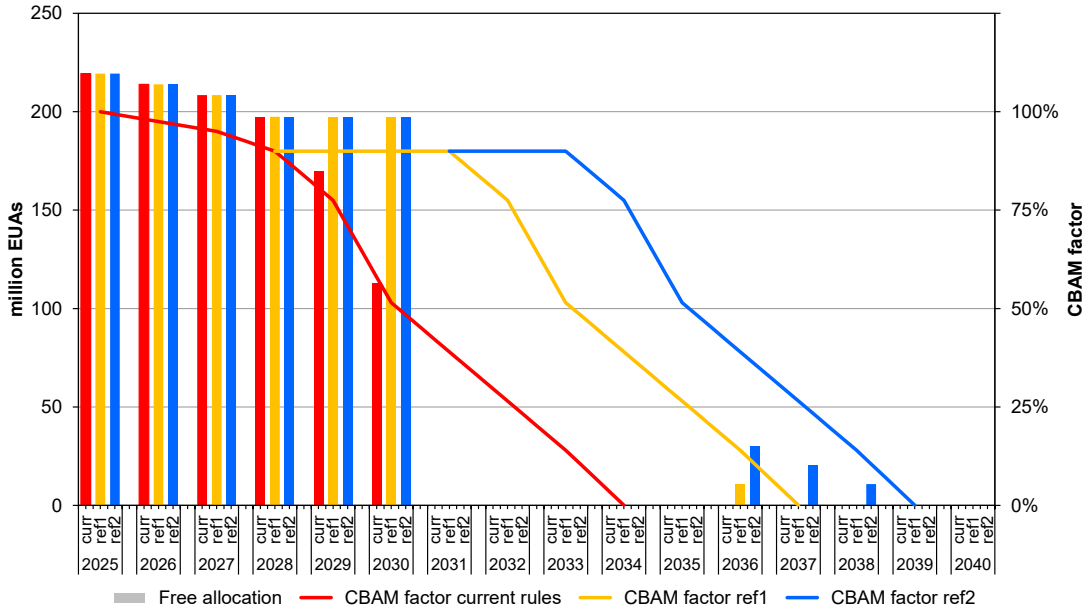
In view of the imminent allocations in the second allocation phase of the fourth trading period of the EU ETS, the reduction in free allocation via the CBAM factor for certain sectors with an increased risk of carbon leakage (e.g. iron and steel, aluminium and fertilisers) may be frozen for up to 5 years at the 2028 (CBAM factor of 90 %). The phasing down of the factor would then only resume after a delay of up to five years.

Figure 9-8 shows a projection for adjusting the CBAM factor under the current legal framework, as well as two variants. In the first variant, the CBAM factor is kept constant at the 2028 level for a further three years from 2028; in the second variant, this interim phase is extended to five years.

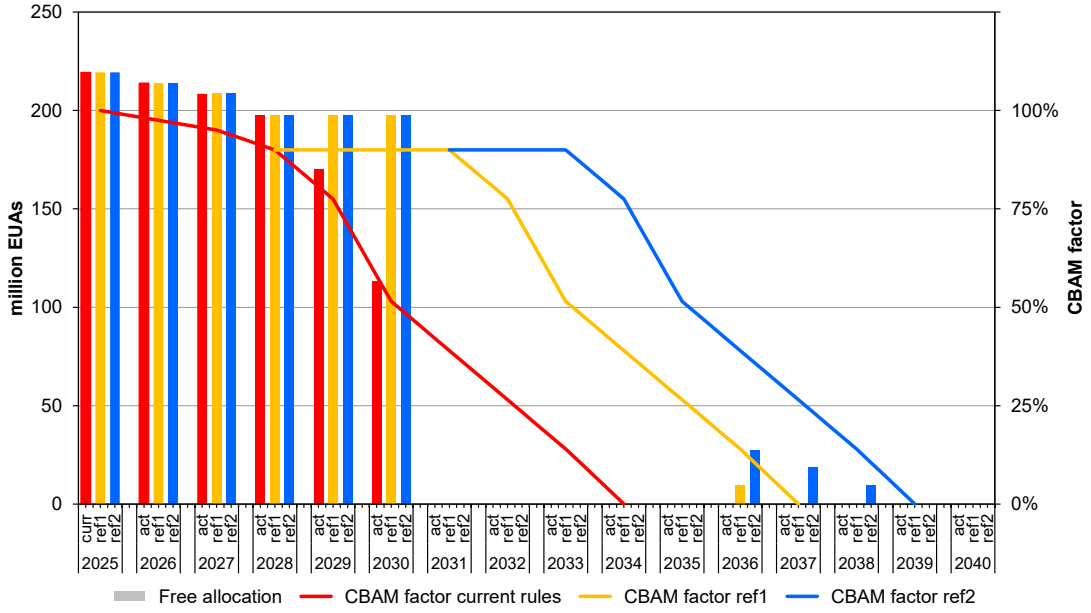
Examining the effects for 2029 and 2030, both reform variants result in considerably higher levels of free allocation. From 2031 onwards, however, the significant impact of the CSCF becomes apparent. Despite the CBAM factor being kept constant in the reform scenarios, free allocation falls by almost 40 %; nevertheless, it remains around 130 % higher than the allocation levels expected under the current legal framework for installations whose production is covered by CBAM. In the variant with a three-year delay to the further reduction of the CBAM factor, there are further substantial reductions in free allowances from 2032 onwards; for the variant with a five-year delay, the substantia reductions in free allowances do not take effect until 2034, with the cap-related adjustment (via the CSCF) having a considerable impact once again from 2036 onwards, particularly in this variant. While, under current legislation, free allocation to CBAM installations ends in 2034, this date is postponed to 2037 and 2039 respectively for the two variants shown.

Figure 9-8: Development of CBAM factor across the different variants and resulting effects on revenue for the Innovation Fund

a) Based on the current allocation benchmarks



b) With the reform option for benchmark allocation



Note: curr – current rules, ref1 – freezing the CBAM factor at the 2028 value for a further three years, ref2 – freezing the CBAM factor for a further five years.

Source: Oeko-Institut

Table 9-5 also provides an overview of a projection in which the concept of benchmark updating (chapter 9.3) is adjusted. Structurally, there are naturally no differences from the current legal situation regarding the setting of the benchmark. However, there are

slight differences in the level of effective free allocation from 2031 onwards. As a result of the effects of the amended updating of the CSCF benchmark, allocation levels for CBAM installations in the first allocation phase of the fifth trading period are 5 % lower than under the current legal framework; for the second allocation phase, this figure rises to 10 %. These changes stem from the fact that the change (increase) in the benchmarks for installations without CBAM production is greater than for CBAM installations, and the CSCF is therefore somewhat more restrictive. This further confirms the finding that the main effect of the benchmark revision lies not in additional allowances for CBAM installations, but in providing a safeguard against the uncertainties of fleet development.

The effects described are largely attributable to the impact of the CSCF and, consequently, to the methodology used to calculate the CSCF.

Further analysis was carried out on the application of the CBAM factor. In this analysis, it is assumed that the CSCF is calculated based on a provisional allocation which already takes the CBAM factor into account. Consequently, the comparison with the free allocation cap is based on respective historical activity levels, relevant benchmarks, and the CBAM factor for installations producing CBAM goods.

This altered sequence results in considerable differences in the CSCF across the various variants, as shown in Table 9-5 .

Table 9-5: Effects of different variants for developing the cap and the benchmarks on the CSCF, taking the CBAM factor into account prior to determining the CSCF

Cap	Current trading period	Projections							
		Current rules (LRF 4.4%)				Adjusted (LRF 4.4% by 2035, 1.4% from 2036)			
Benchmarks		Current		Reform		Actual		Reform	
CBAM		Current	Reform	Current	Reform	Current	Reform	Current	Reform
CSCF before CBAM factor									
2026-2030	100%								
2031-2035	-	69%	69%	64%	64%	69%	69%	64%	64%
2036-2040	-	18%	18%	15%	15%	42%	42%	37%	37%
2041-2045	-	-	-	-	-	26%	26%	21%	21%
2046-2050	-	-	-	-	-	5%	5%	3%	3%
CBAM factor before CSCF									
2026-2030	100%	-	-	-	-	-	-	-	-
2031-2035	-	100%	77%	100%	72%	100%	77%	100%	72%
2036-2040	-	42%	34%	32%	27%	99%	81%	76%	65%
2041-2045	-	-	-	-	-	67%	67%	43%	43%
2046-2050	-	-	-	-	-	14%	14%	7%	7%

Note: As a reform option for adjusting the CBAM factor, a 5-year extension is used as an example to illustrate the various effects.

Sources: European Commission, Oeko-Institut

Compared with the current legal situation, this results in a significant increase in the CSCF for the various allocation phases. However, the specific effects on the CSCF depend very heavily on the other allocation options and how they interact.

- A change in the benchmark update method causes the CSCF to decrease further, although the relative change in the CSCF remains the same here, regardless of the cap reform.

- Further developments or revisions to the CBAM factors do not change the relationships between the different reform approaches to the cap and benchmarks. Overall, however, this results in considerably higher CSCFs.

The overview also shows that, in particular, the method used to calculate the CSCF leads to substantial changes in the CSCF even in the longer term. Over time, however, these changes result primarily from redistribution effects at the expense of the auction revenues for the Innovation Fund; these effects, however, depend very heavily on the interactions between the various regulatory options (see chapter 9.5).

9.7. Conclusion: Interactions between the various reform options

The various regulatory options with a view to free allocation give rise to a relatively broad range of interactions and distributional effects.

As the free allocation cap remains unchanged in each of the options for adjusting the cap in the variants shown, the different approaches to determining the CSCF essentially result in two distributional effects. Firstly, if the CBAM factor is extended and the CSCF is calculated taking into account the deductions resulting from the CBAM factor, the auction revenues used to finance the Innovation Fund are reduced due to the effectively higher free allocation. Secondly, there are partial shifts in free allocation between installations producing CBAM-covered goods and installations used for the production of other goods.

The issue of the loss of auction revenues for the Innovation Fund must be discussed in the context of the total revenue accrued by the EU ETS and of the trade-offs for companies resulting from changes in the levels of free allocation (see chapter 9.8).

However, the interactions and distributional effects between the various installations subject to the EU ETS that receive free allocation are considerably more complex.

Table 9-6 shows the various effects for installations not producing CBAM goods and for CBAM installations:

- Under the current regulations, extending the cap naturally also leads to a longer period of free allocation. However, free allocation will decrease considerably for all installations from 2031 onwards. If the cap is adjusted from 2036, free allocation will increase considerably, but ultimately only in comparison with the already very low baseline resulting from the current legal framework. Furthermore, should the linear reduction factor be changed to 1.4 % from 2036, free allocation – albeit at comparatively low levels by then – would be possible until the end of the 2040s.
- The revision of the benchmark update initially benefits installations without CBAM production above all else when considered in Isolation. Depending on other changes to the regulatory framework beyond the order in which the CBAM factor and the CSCF are applied, this will result in additional free allowances, which could range from 5 % to 25 % up to 2045.
- Compared with the current legal situation, the free allocation for the entire fleet of installations producing CBAM goods will decrease by 5 % to 10 % as a result of the interaction between the benchmark update and the CSCF, provided that the methodology for determining the CSCF is not changed.

Table 9-6: Example effects of different variants for developing the cap, the benchmarks and the CBAM factor on free allocation

a) For the installation fleet not producing CBAM goods

Cap	Projections							
	Current rules (LRF 4.4%)				Adjusted (LRF 4.4% by 2035, 1.4% from 2036)			
Benchmarks	Current		Reform		Current		Reform	
CBAM	Current	Reform	Current	Reform	Current	Reform	Current	Reform
	million EUAs							
CSCF before CBAM factor								
2026-2030	1,343	1,343	1,343	1,343	1,343	1,343	1,343	1,343
2031-2035	599	599	631	631	599	599	631	631
2036-2040	123	123	139	139	291	291	328	328
2041-2045	-	-	-	-	137	137	172	172
2046-2050	-	-	-	-	13	13	19	19
CBAM factor before CSCF								
2026-2030	1,343	1,343	1,343	1,343	1,343	1,343	1,343	1,343
2031-2035	871	671	981	703	871	671	981	703
2036-2040	285	236	285	244	677	559	677	579
2041-2045	-	-	-	-	357	357	357	357
2046-2050	-	-	-	-	40	40	40	40

b) For the installation fleet producing CBAM goods

Cap	Projections							
	Current rules (LRF 4.4%)				Adjusted (LRF 4.4% by 2035, 1.4% from 2036)			
Benchmarks	Current		Reform		Current		Reform	
CBAM	Current	Reform	Current	Reform	Current	Reform	Current	Reform
	million EUAs							
CSCF before CBAM factor								
2026-2030	1,128	1,240	1,128	1,240	1,128	1,240	1,128	1,240
2031-2035	110	550	104	524	110	550	104	524
2036-2040	-	26	-	23	-	61	-	55
2041-2045	-	-	-	-	-	-	-	-
2046-2050	-	-	-	-	-	-	-	-
CBAM factor before CSCF								
2026-2030	1,128	1,240	1,128	1,240	1,128	1,240	1,128	1,240
2031-2035	159	616	162	584	159	616	162	584
2036-2040	-	50		41		118		98
2041-2045	-	-	-	-	-	-	-	-
2046-2050	-	-	-	-	-	-	-	-

Note: As a reform option for adjusting the CBAM factor, a 5-year extension is used here as an illustrative example to highlight the various effects.

Sources: European Commission, Oeko-Institut

The reform of the CBAM factor increases the free allocation to CBAM installations in the first allocation phase of the fifth trading period by a factor of about 5. However, this is not at the expense of installations without CBAM production, but rather at the expense of the auction revenues for the Innovation Fund. The allocation to the installation fleet producing non-CBAM goods does not initially change as a result of the adjustment of the CBAM factors alone.

- If the method for calculating the CSCF is adjusted to take the CBAM factors into account, the free allocations for both CBAM installations and installations not producing CBAM goods will increase very considerably, though again at the expense of the auction revenues for the Innovation Fund.
- Due to the revised calculation of the CSCF, the distributional effects favouring non-CBAM installations are partially offset by changes to the benchmark update method; nevertheless, even for non-CBAM installations, allocation levels remain effectively higher. A corresponding situation arises for CBAM installations.

The changes to free allocation for installations producing CBAM goods and to installations not producing CBAM goods partly result from redistribution between these two groups of installations. However, they are predominantly the result of a reduction in the quantity of allowances available, particularly for auctions whose revenues go into the Innovation Fund.

Table 9-7: Change in quantities of allowances available for auctioning under the various reform variants

Cap	Projections							
	Current rules (LRF 4.4%)				Adjusted (LRF 4.4% by 2035, 1.4% from 2036)			
Benchmarks	Current		Reform		Current		Reform	
CBAM	Current	Reform	Current	Reform	Current	Reform	Current	Reform
	million EUAs							
CSCF before CBAM factor								
2026-2030	-	-112	-	-112	-	-112	-	-112
2031-2035	-	-440	-27	-447	-	-440	-27	-447
2036-2040	-	-26	-16	-39	-	-61	-38	-93
2041-2045	-	-	-	-	-	-	-35	-35
2046-2050	-	-	-	-	-	-	-6	-6
CBAM factor before CSCF								
2026-2030	-	-112	-	-112	-	-112	-	-112
2031-2035	-321	-579	-435	-579	-371	-579	-435	-579
2036-2040	-163	-163	-163	-163	-386	-386	-386	-386
2041-2045	-	-	-	-	-220	-220	-220	-220
2046-2050	-	-	-	-	-27	-27	-27	-27

Note: As a reform option for adjusting the CBAM factor, a 5-year extension is presented here as an illustrative example of the various effects. The differences relate in each case to the two cap variants, with all other regulations remaining unchanged in accordance with the current legal situation.

Sources: European Commission, Oeko-Institut

The overview provided in Table 9-7 shows the magnitudes and the timing of the quantities of allowances no longer available for auction under the various reform options:

- In the second allocation phase of the fourth trading period (in which, in the model analyses presented, only the change in the CBAM factor comes into play), there is a reduction of just over 110 million EUAs in the allowances available for auctions whose revenues go into the Innovation Fund.
- The largest effects are seen in the first allocation phase of the fifth trading period (2031–2035). The phased decrease in the CBAM factor results in a reduction in the quantities available for auction at the expense of the Innovation Fund, amounting to approx. 440 to 450 million allowances.

- In the second allocation phase (2036–2040), the quantity of allowances that can no longer be auctioned will fall to around 15 to 40 million EUAs (with the cap remaining at current levels) or 50 to 90 million EUAs (if the cap is adjusted from 2036 onwards), depending on the interactions with the other allocation rules. In the subsequent allocation phases, the variants involving a reform of the benchmark update will result in deficits of 35 and just over 5 million EUAs respectively.
- However, during the 2031–2035 allocation phase, the change to the CSCF calculation – possibly combined with an altered timeline for applying the CBAM factor – will have larger effects on the availability of emission allowances for auctions whose revenues go into the Innovation Fund. Depending on the benchmark update method applied, these quantities range from approx. 320 million EUAs (change to the CSCF calculation, unchanged trajectory of the CBAM factor, without changing the benchmark update) to 580 million EUAs (change to the CSCF calculation, altered trajectory of the CBAM factor, and a change to the benchmark update).
- In the second allocation phase of the fifth trading period (2036–2040), there are considerable differences between the two cap variants. The quantity of allowances for auctioning decreases by approx. 160 million EUAs in the variant with the current cap. In the variant with an adjusted cap (LRF 1.4 % from 2036), the quantity of allowances for auctioning decreases by approx. 385 million EUAs. The changes to the other allocation rules do not lead to any changes in this regard.
- For the first allocation phase of the sixth trading period (2041–2045), the quantity of allowances no longer available for auction decreases to around 220 million EUAs (reform variant of the cap); in the following five-year period, the corresponding value is approx. 30 million EUAs.

From this combination of factors, two overarching conclusions can initially be drawn regarding the (necessary) package for any reform of free allocation. Firstly, the various design elements of the changes must be considered as a package if vast and ultimately unintended distributional effects between ETS-regulated installations are to be avoided. Secondly, the issue of the quantities of allowances no longer available for the Innovation Fund must be addressed through appropriate measures.

9.8. Investments in the context of higher free allocations

Background

The transition to climate-neutral production processes, which is being pursued in the context of the EU's overarching climate policy targets and under the EU ETS 1, requires investment as well as, at least temporarily, the bridging of the operating cost gap between conventional and transformative manufacturing processes. The corresponding investments and higher operating costs are necessary, but must also be feasible in the context of international competition and of the new geopolitical conditions.

Free allocation is intended to provide plant operators with the liquidity needed to prevent carbon leakage. Changes to auction volumes also alter the financial resources available to support the transition, which are intended to promote, in particular, transformation investments. Both aspects are relevant, and both must be considered when designing the overall package.

To demonstrate the scale of the various financing mechanisms, Table 9-8 shows an estimate of the monetary value of the emission allowances no longer available for auction, depending on the reform options discussed above (see chapters 9.3 to 9.7).[22]

Table 9-8: Changes in auction revenues as a result of the various reform options

Cap	Projections							
	Current rules (LRF 4.4%)				Adjusted (LRF 4.4% by 2035, 1.4% from 2036)			
Benchmarks	Current		Reform		Current		Reform	
CBAM	Current	Reform	Current	Reform	Current	Reform	Current	Reform
	billion EUR							
CSCF before CBAM factor								
2026-2030	-	-11	-	-11	-	-11	-	-11
2031-2035	-	-51	-3	-51	-	-51	-3	-51
2036-2040	-	-3	-2	-5	0	-8	-5	-13
2041-2045	-	-	-	-	-	-	-5	-5
2046-2050	-	-	-	-	-	-	-1	-1
CBAM factor before CSCF								
2026-2030	-	-11	0	-11	-	-11	0	-11
2031-2035	-37	-67	-50	-67	-37	-67	-50	-67
2036-2040	-22	-22	-22	-22	-52	-52	-52	-52
2041-2045	-	-	-	-	-30	-30	-30	-30
2046-2050	-	-	-	-	-4	-4	-4	-4

Note: As a reform option for adjusting the CBAM factor, a 5-year extension is used here as an illustrative example of the various effects. The differences relate in each case to the two cap variants, with all other regulations remaining unchanged in accordance with the current legal situation. The calculations are based on example average EUA prices of EUR 95 per EUA for 2026–2030, EUR 115 per EUA for 2031–2035 and EUR 135 per EUA from 2036 onwards.

Source: Oeko-Institut

The reduced supply of allowances for auctioning thus primarily comes about from changes to the regulations governing the CBAM factor and the inclusion of the CBAM factor in calculating the CSCF (see Table 9-8):

- Without changing the calculation methodology for the CSCF, adjusting the timeline for the CBAM factor would result in a revenue shortfall of up to EUR 11 billion for the second allocation phase of the fourth trading period (2026–2030). These figures are independent of the LRF variants.
- In the first allocation phase of the fifth trading period (2031–2035), the revenue shortfall swells to approx. EUR 51 billion, again independently of the LRF variant.
- In the subsequent allocation phase (2036–2040), the revenue shortfall decreases to approx. EUR 3 to 5 billion (with the current LRF) or EUR 8 to 13 billion (with the LRF adjusted from 2036).
- Due to the interactions between the provisional allocation and the CSCF, as well as the corresponding consequences for the values to which the CBAM factor is applied, the benchmark revision only has a minor effect (EUR 2 to 5 billion).

[22] This estimate provided for illustrative purposes was based on the most recent analyst forecast for the 2026–2030 period, as described in chapter 6.1. It was extrapolated for the following decade at a rate of EUR 20 per EUA per five-year period and held constant thereafter.

- From the sixth trading period onwards, revenue effects will only be incurred for the variant involving an LRF adjusted from 2036.
- However, the adjustment to auction volumes resulting from including CBAM deductions in calculating the CSCF is far greater. In the 2031–2035 allocation phase, it ranges between EUR 27 billion and EUR 67 billion, depending on the reform option for updating the benchmarks and the CBAM factors.
- For the second allocation phase of the fifth trading period (2036–2040), the reduction is around EUR 22 billion if the LRF remains unchanged. If the LRF is reduced from 2036 onwards, the figure is EUR 52 billion, falling to around EUR 30 billion in the subsequent allocation phase, and then to EUR 4 billion.

Three perspectives on linking free allocations and investment

Against the backdrop of this huge funding gap for the transition (mainly through the Innovation Fund), the question arises of how sufficient investment funds can be secured for the transition of industrial sites, given such an expansion of free allocation (theoretically, the decrease in auction revenues corresponds to an equivalent injection of liquidity for installation operators).

With a view to possible rules for linking free allocation to investment or other climate policy measures, three distinct perspectives can be identified:

1. From the first perspective, the expanded allocation of free allowances is justified on the grounds of combating carbon leakage effects. The free allowances thus serve to offset the cost differential compared with conventional, emission-intensive products, where the costs generated by the EU ETS 1 cannot be passed on to product prices, leading to production relocations that result in higher overall emissions. Given this cost-offsetting function, regulations governing the use of funds allocated through free allowances are ultimately precluded. According to this logic, the additional costs of transformative investments must be financed, supported or subsidised from other sources.
2. From a second perspective, a distinction is made between operational leakage and investment leakage with regard to leakage risks (Matthes 2008). According to this view, operational leakage occurs when ETS costs alter the marginal costs of production in such a way that the (full) costs of additional production using processes not subject to emission costs are exceeded. Investment leakage occurs when, although relocations do not take place in the short term, the cost situation is altered in such a way that investments are relocated. In this context, the effective prevention of leakage depends on whether funds for investments within the scope of the EU ETS 1 can be generated with sufficient certainty from the free allocations. From this perspective, regulations to safeguard investments in order to prevent investment leakage could be justified through the corresponding share of free allocations.
3. A third perspective concerns the uncertainties regarding the actual effects of CBAM, which will remain at least during transitional periods (see chapter 8.2). If the risks are overestimated, there is a risk of windfall profits, as there would be additional relief – beyond the compensation for the competitive disadvantage caused by carbon pricing in Europe. If, on the other hand, the risk of carbon leakage remains high or even increases despite CBAM, an investment obligation would not be appropriate. The free allowances justified in this way ultimately create a safety buffer that

can sufficiently and robustly prevent carbon leakage effects in the face of significant uncertainties regarding the effectiveness of other instruments.

These differing perspectives show that regulations requiring the investment of the equivalent value of free allowances depend, on the one hand, very heavily on the view taken of the carbon leakage problem (first perspective versus second perspective and, on the other hand, also on other regulations (e.g. third perspective depending on how allocation cuts are handled in the context of CBAM). However, they also illustrate that, for new investments, only a limited portion of the equivalent value of free allowances could be used in a sufficiently robust manner.

In any case, when considering the second and third perspectives, investment activities and their links to free allocation should be based on longer time frames – at least those relevant to investment leakage processes. Even if the free allocation were extended by five years through a temporary freeze on the CBAM factor (see chapter 9.6), the aim should be to take investment measures into account over periods of 10 to 15 years, even if this presents challenges in terms of administrative implementation. The relevant investment period would therefore extend well beyond the allocation period.

Options for action

The options for mobilising additional investment funds as part of the extended free allocation of emission allowances to eligible companies, along with their respective assessments, are as follows.

Under current legislation (Articles 22a and 22b of the EU Free Allocation Regulation), free allocation under the EU ETS is linked to the fulfilment of specific requirements. Free allocation is reduced by 20 % if cost-effective emission reduction measures with a payback period of less than 3 years are not implemented. Article 22b further stipulates that, in the case of highly inefficient installations (the 20 % least efficient sub-installations within each benchmark group), the free allocation is reduced by 20 %. This reduction does not apply if a climate neutrality plan is submitted on time and verified by the authorities, or if the sub-installation in question receives no more than 20 % of the allocation for the entire installation. The implementation of this legally binding requirement is currently underway.

A first and more ambitious alternative option to this exists in the form of the regulation implemented in Germany's national fuel emissions trading system (Section 11 BECV). Under this, there is an obligation to invest at least 80 % of the equivalent of the free allocation in cost-effective emission reduction measures from 2025 onwards. Such measures are defined as those that exhibit a positive net present value after 90 % of their intended useful life. These measures, which are already legally binding, are also in the process of being implemented in Germany; consequently, any further action required would primarily involve scaling up and adapting them for EU-wide application.

A second alternative option, which goes beyond this, could involve companies being required to commit a portion of their savings from free emission allowances to transformative measures over a specific period. These transformative measures could be defined as follows, based on the first call for proposals for Contracts for Difference in Germany, as set out by the Federal Ministry for Economic Affairs and Climate Action (BMWK 2024):

'a production process characterised by fundamental technological changes to conventional production processes, which entails a significant need for investment in new technologies not yet established on the market or which set the market price, and which substitutes fossil fuels or raw materials with climate-friendly energy sources or raw materials (such as electricity, hydrogen or biomass). A production process is also considered transformative if technologies are used for the capture and long-term storage, or for the long-term sequestration or recycling of carbon dioxide (CO_2). A production process that is not operated in an energy- and resource-efficient manner and does not contribute to the climate neutrality of industry is not transformative."

Under this framework, the measures addressed would not be limited to options that are economically attractive in the short term, such as gradual efficiency improvements. Such measures are already being implemented in many cases, particularly by companies facing high energy costs. Options involving extensive changes to processes or energy sources would also be addressed. These do not present an economic business case in the short to medium term, are associated with significant risks and are therefore considerably more difficult to finance. Nevertheless, they are essential for climate-friendly production. Consequently, additional funding is often required to enable targeted investment.

A period of 10 to 15 years, which could begin in 2026, could serve as a sensible reference period for assessing the use of the monetary equivalent of the accumulated free allocations. The requirements for providing evidence should be as streamlined and low-bureaucracy as possible. The necessity of security deposits and other details still need to be concretely worked out for this option. Given that the reduced availability of emission allowances is primarily at the expense of the Innovation Fund, the second alternative option would represent the most consistent approach for the targeted investment of at least part of the value of the relief provided by the (increased) free allocation.

Finally, it also remains to be examined to what extent the additional free allocation can or should be counted towards other support instruments. In many cases, the free allocation alone is unlikely to be sufficient to finance the investment and additional operating costs. In order to maintain competitiveness during the transition while simultaneously building new climate-friendly generation capacity, supplementary funding is likely to be required. This is because the transition is predominantly not a 'greenfield' process, in which new climate-friendly plants are built on greenfield sites. Rather, it is a 'brownfield' transition, in which existing fossil-fuel power plants continue to operate for the time being, while new climate-friendly capacity is built at the same sites (see chapter 2.4).

9.9. Conclusion, options for action and recommendations

Requirements and framework conditions

The future design of free allocation is the most complex aspect of the upcoming EU ETS 1 reform, with numerous regulatory elements, such as benchmarks, the Cross-Sectoral Correction Factor (CSCF) and the CBAM factor, interacting with one another. It is therefore recommended that they be assessed and implemented as a comprehensive package, rather than as a sequence of individual measures.

Free allocation in the EU ETS serves primarily to prevent carbon leakage, but is at the same time a powerful source of funding for the transformative restructuring of industrial

production processes, both for companies (free allocation based on emissions benchmarks that significantly exceed the specific emissions of the transformative installations) and for public support measures (e. g. via the Innovation Fund, which is financed from auction revenues) or other accompanying instruments (e.g. electricity price compensation for the indirect CO_2 component of electricity prices).

In light of the findings and considerations discussed above, the following reform package is recommended with a view to the free allocation of emission allowances:

A slower and more uniform reduction in benchmark values

Firstly, from the fifth trading period (2031–2035) at the latest, the updating of product benchmarks should, as a general rule, be adjusted to the lower end of the previously applicable adjustment corridor (0.3 % p.a. instead of up to 2.5 % p.a.), based on the values from the 2026–2030 allocation phase (or, in the event of an earlier reform, those from the 2021–2025 allocation phase). This avoids abrupt breaks and unpredictable jump effects, such as those that can arise from the emission reductions achieved by the top 10 % of installations. When adjusting the free allocation to the total quantity of emission allowances available for free allocation, the focus would thus be primarily on applying the CSCF in future and in a significantly more transparent manner.

This method of adjusting the allocation by 0.3 % per year should be applied not only to the product benchmarks but also to the fallback benchmarks. In this regard, the European Commission has already proposed an adjustment from 2026 onwards. This earlier adjustment makes sense.

Cap on free allocation and CBAM

When combined with the cap adjustment, higher benchmark values result in a more restrictive CSCF. This tends to put those installations that do not produce goods covered by CBAM at a (relative) advantage as their benchmarks are already, for the most part, adjusted based on the lower end of the update range.

However, the largest changes to the free allocation of emission allowances affect those installations that produce goods subject to CBAM. As a new instrument that is indispensable for both European and international climate policy, CBAM still faces a multitude of uncertainties, potential loopholes (resource shuffling, downstreaming, carbon pricing), outstanding regulatory requirements (approach to exports) or unresolved conflicts of interest and tensions with transformation policy objectives beyond the EU ETS or the risk of carbon leakage (imports of green intermediate products), as well as the need to gather relevant experience.

Should the CBAM legal framework fail to provide robust countermeasures in time for a large reduction in the CBAM factor, a second reform measure would appear sensible and appropriate: the temporary fixing of the CBAM factor at the 2028 level, limited to a maximum of five years, in order to gain reliable insights into CBAM circumvention strategies. For sectors or CBAM product groups where it is sufficiently clear that circumvention strategies relating to CBAM are unlikely, such a deferral of applying the CBAM factor could be waived. This would reduce the shortfall in revenue for the Innovation Fund, which is vital for the transition to transformative production technologies.

Making better use of the ‘free allocation cap’

The interactions between the CSCF and CBAM depend crucially on whether the adjustment to the quantity of emission allowances available for free allocation (‘free allocation cap’) via the CSCF is made with or without taking CBAM adjustments into account. When determining the CSCF, it is important to consider the effects of the CBAM factor. This will help to minimise the allocation corrections for the entire installation fleet and ensure that any distributional effects are (over-)compensated for through other adjustments.

A third reform option is therefore proposed: taking into account the reduction in free allocation caused by the CBAM factor when determining the CSCF. This would result in substantial additional allocations for all installations.

Free allocation and investments in decarbonisation

Such an expansion of free allocation would considerably reduce the funds available to finance the Innovation Fund.

As a fourth reform option, therefore, at least part of the financial resources – equivalent to the value of free allocation over a period of 10 to 15 years – should be earmarked and made mandatory for the transition to transformative production processes. However, as the primary aim is to offset existing competitive disadvantages, these financial resources can only be tied to investment commitments to a limited extent.

The four components – a slower reduction in the benchmark, a temporary freeze on the CBAM factor, taking CBAM into account before the CSCF, and linking funds to investment — are interlinked and must be considered together. Only in this way can free allocation be designed to serve simultaneously as reliable protection against carbon leakage and as an effective lever for industrial transformation.

10. In focus: revenue frontloading to finance the Investment Booster

The starting point for potential revenue frontloading is the objective that the Investment Booster announced by the Commission should have a swift impact and trigger investment in industrial decarbonisation well before 2030. At the same time, there are indications that the quantities of allowances auctioned for this purpose – in particular any remaining NER allowances – may not necessarily be auctioned in the short term, but rather spread over a longer period, potentially even extending beyond the fifth trading period (chapter 5.3.5). This results in a time lag between the immediate need for funding and the auction revenues, which will only become available at a later stage. The key challenge would then be to make funds available at an early stage without having to release large additional quantities of allowances onto the market at short notice, thereby undermining price formation, market stability and investment signals within EU ETS 1.

One way of addressing this problem is through what is known as 'revenue frontloading'. This approach is currently being pursued, in particular, in the context of the EU ETS 2. The European Commission and the European Investment Bank (EIB) have jointly developed the 'ETS2 Frontloading Facility,' which provides Member States with financial resources even before the actual auction revenues from the EU ETS 2 become available (EIB 2025b; EC 04.02.2026). The basic principle is to finance expected future revenue from the auctioning of allowances and to repay the funds provided later from the auction revenues actually received, without directly influencing the price signal through additional short-term auctions (EPICO and Frontier 2026). The chosen figure of EUR 3 billion suggests a deliberately limited first installment rather than a complete advance on the expected ETS 2 revenues. This is further supported by the fact that the Commission expressly leaves open the possibility of a subsequent increase in this facility.

In principle, a similar approach could also be relevant in the EU ETS 1 if the Investment Booster requires short-term financing while the underlying quantities of allowances are auctioned over a longer period during the fifth trading period. This would partially alleviate the conflict between the need for early financing and the maintenance of market stability. The design of the ETS2 Frontloading Facility suggests that revenue frontloading should be understood as targeted bridging finance for the initial phase of an instrument, rather than a complete advance of future revenues. Within the EU ETS 1, this also supports the initial determination of the potential frontloading requirement based on the actual timing of disbursements under the Investment Booster.

Furthermore, the funding requirements of an Investment Booster do not necessarily materialise in full at the beginning of the funding period. Industrial and infrastructure projects are usually developed, approved and implemented over several years. Accordingly, funding is typically disbursed in stages as the project progresses. Therefore, front-loading future revenue in full would be neither necessary nor efficient. Instead, limited or phased front-loading of revenue could suffice to bridge the instrument's start-up phase until ongoing auction revenues become available. Experience gathered with existing ETS-funded support instruments also supports this approach. For example, the Innovation Fund is financed through the monetisation of ETS allowances, while funds are allocated to projects over time, linked to selection and implementation processes. When designing a potential revenue front-loading scheme for the Investment Booster, it is therefore necessary to assess what proportion of the expected revenue needs to be mobilised early on and what proportion can be made available as projects progress without any loss of efficiency.

11. Accompanying policies for industrial transformation

11.1. Introductory remarks

Carbon pricing via the EU ETS 1 creates comprehensive incentives for the various options for reducing emissions. These include incremental improvements to installations, optimal utilisation of at least some of the installations in the system as a whole, the decommissioning of emission-intensive installations and the construction of installations using transformative production, by means of which the climate neutrality of industry can be achieved.

However, particularly with regard to investment in new installations, the incentives and financial contributions provided by the EU ETS 1 are, under the specific conditions of industrial transformation (very long plant lifetimes and lead times, international competition and other market uncertainties, etc.), the incentives and financial contributions provided by the EU ETS 1 will, at least in part, be insufficient to enable investment in transformative production processes on the necessary scale and with sufficient robustness. The construction of such installations is, however, essential not only for achieving German and EU climate targets, but also in the interests of a resilience-orientated location policy.

At the same time, the question arises as to whether the sometimes high abatement costs of new industrial processes should be covered solely through the EU ETS 1 mechanism, if this inevitably brings about high carbon prices across the system as a whole. Such prices would have substantial distributional effects on other installations within the system's scope that still need to purchase emission allowances. Where applicable, these costs would also be passed on to consumers in the relevant markets (e.g. the electricity market), which could potentially give rise to additional carbon leakage effects or other distortions in some areas. While these distributional effects could in principle be counterbalanced by redistribution or compensation mechanisms, the considerable effort involved and the inevitable uncertainties associated with these mechanisms would need to be taken into account.

Relevant industrial processes include parts of industrial electrification and, without a doubt, the use of hydrogen or hydrogen derivatives and CCS.

The transition to production processes that can incorporate these technologies or a change of energy sources generally extends beyond standard investment cycles. This applies not only to the scale of the investments required but also to the associated risks, which can make financing more difficult. It should also be noted that the transition of industrial processes – particularly with regard to the electrification of industrial processes, hydrogen and CCS – shifts the cost structure of industrial production towards operating costs, at least for long (transitional) periods. This is qualitatively different from other areas of the transition to climate neutrality, such as energy generation, where the shift is overwhelmingly from operating-cost-intensive to capital-cost-intensive options

Finally, fundamentally new technologies must be developed, particularly with a view to hydrogen and CCS; infrastructure and markets must be developed anew with a sufficiently long lead time.

When viewed holistically, these very diverse aspects and challenges call for companion policies to the EU ETS-1 in some areas. This section describes the role of comprehens-

ive instruments for stimulating demand (chapter 11.3) and investment support (chapter 11.4), and the various options for supporting the operating costs of industry (chapter 11.5). The next section focuses on the issue of financing (chapter 11.2).

11.2. Funding

By placing a price on greenhouse gas emissions, the EU ETS 1 not only creates incentives for more climate-friendly industrial production; it also generates substantial revenue for the Member States and the EU budget through the auctioning of emission allowances and within the framework of CBAM.

Under Article 10(3), Member States are required to use the funds they receive from the auctioning of allowances for specific purposes. These include offsetting indirect CO_2 costs (electricity price compensation), reducing emissions at national and international level, expanding the use of renewable energy and improving energy efficiency, measures relating to natural sinks as well as forests and other terrestrial or marine ecosystems, CCS, and financial support for low- and middle-income households.

Under the current regulations, the fiscal revenue from EU ETS 1 auctions for Germany is expected to amount to between EUR 4 and EUR 6 billion annually over the coming years, and is therefore likely to be significantly lower than that generated by the national fuel emissions trading system or the EU ETS 2, which is due to start in 2028. Overall, the various emissions trading systems could generate fiscal revenue in the region of EUR 18 to 20 billion annually over the coming years (see chapter 3.5). The largest portion of the auction revenues from the EU ETS 1 is currently used to offset indirect CO_2 costs; for 2025, a volume in the region of EUR 4 billion is anticipated (see chapter 11.5.2).

From 2030 onwards, under the current regulations, auction revenues from the EU ETS 1 will increase as a result of the very sharp and escalating reduction in free allocation in the context of the introduction of CBAM, with these funds due to be channelled into the EU Innovation Fund. Should these CBAM reductions be postponed (see chapters 9.6 and 9.8), the inflow into the Innovation Fund will also be considerably reduced, and other sources of funding would need to be found for the necessary investments. The financing of investment measures by companies will need to be taken into account in this context (see chapter 9.8).

In any case, the revenue from auctions under the various emissions trading systems should be used in full and consistently by all EU Member States for the purposes of climate protection and the corresponding accompanying measures.

Across the full range of necessary funding requirements – some of which cannot be attributed solely to climate protection or the prevention of carbon leakage effects – (additional) funds will need to be made available for industrial transformation, even beyond the revenues generated by greenhouse gas pricing instruments. This applies in particular, though by no means exclusively, to measures to support operating costs and investment in transformative production processes, which require lengthy innovation lead times and infrastructure.

Finally, the (partial) financing of industrial transformation through the creation of corresponding demand segments will play an important role (see chapter 11.3).

11.3. Green lead markets

Current situation: Climate-neutral products are still considerably more expensive today

The climate-neutral transformation of industry requires a far-reaching overhaul of existing production processes in many areas. The basic materials industry, in particular, faces a twofold challenge: the transition requires high initial investment with long payback periods, while future operating costs, such as those for hydrogen or electricity, are only partially foreseeable. This creates financing and sales risks for companies.

Furthermore, basic materials produced in a climate-friendly manner are generally still more expensive than their conventional counterparts. In the case of hydrogen-based primary steel, low-emission cement or green plastics, there are considerable additional costs per tonne. However, if these mark-ups are passed on through the value chain, they are considerably reduced at the level of many final products – often amounting to only a low single-digit percentage of the total costs.

Nevertheless, companies face a dilemma: investment decisions must be made today without any certainty as to whether the climate-friendly products manufactured in the future will actually find reliable buyers. Particularly in the case of standardised and internationally traded basic materials, even small price differences are enough to steer purchasing decisions in favour of conventional alternatives. As the forthcoming investments tie up capital in the long term and commit companies to specific technological paths, their financial viability depends directly on whether there is sufficient demand for the new products. This is precisely where lead markets come into play. Secured demand creates planning certainty and thus improves the conditions under which investments in climate-friendly production processes become viable in the first place.

A similar logic applies to circular products. These, too, are often more expensive than conventional alternatives today, without their added value being immediately apparent to procurers, companies or final consumers. As long as there is a lack of standardised definitions, robust indicators and transparent labelling, circularity remains an elusive quality characteristic. Circular lead markets therefore employ the same lever: they aim to specifically direct demand towards circular solutions – as soon as the conditions are in place to make these products visible and comparable.

Policy options

Policymakers can help make green products competitive by establishing standards that make them clearly recognisable; by facilitating the ramp-up of private lead markets, setting targets for the proportion of green products used either across the board or in selected sectors or for specific products; and by leading by example through public procurement. They can also utilise the purchasing power of the national government, the federal states and the local authorities.

Labels and markings

A key problem is that climate-friendly or circular products often cannot be clearly distinguished from conventional products. This can result in the additional costs of sustainable production not being passed on in the market, leading to such products being squeezed out. Uniform certification and the use of labels enable sustainable characteristics to be

clearly identified, including for private customers (Fischer and Küper 2021). Standards such as the Low Emission Steel Standard (LESS) and the Cement Carbon Class (CCC) simplify the process of providing evidence for climate-friendly materials and can be used directly in procurement procedures. In addition, further labels for various products exist in other EU Member States and internationally. Within the EU, the aim should be to harmonise these approaches as much as possible in order to create transparency for buyers, avoid bureaucratic hurdles and enable the industry to scale up the development of green production capacities.

Minimum requirements

Regulatory minimum standards are being discussed as measures to support the transition towards climate-friendly production. If such requirements are communicated with a clear and progressively rising level of ambition over the long term, they can provide additional incentives for investment. However, they entail rising administrative costs and do not provide incentives for emission reductions beyond the required minimum level. Furthermore, if designed too ambitiously, they may be less conducive to transformation for the basic materials industry and instead act as a burden. As the ETS already provides increasing incentives to reduce greenhouse gas emissions in a technology-neutral manner, the additional introduction of minimum requirements would need to be well justified.

Public procurement

In many markets, the public sector itself acts as a significant buyer and can, through appropriate specifications, generate demand for climate-friendly products in a targeted manner (Fischer and Küper 2021). For example, sustainability criteria such as limits on the CO_2 emissions of individual products, requirements regarding energy consumption or recycling rates can be integrated into procurement guidelines. The impact of public procurement varies greatly between sectors and products. Reliable demand reduces the risks associated with transformation projects and can thus also promote technological innovation.

In addition to its direct impact on demand, public procurement can also send an important signal and contribute to the market launch of products that were previously uncompetitive. This can make sense from a macroeconomic perspective if initially high costs are expected to fall in the long term due to economies of scale and learning curve effects. For this to happen, however, public procurement must generate sufficient demand for green products. Furthermore, public demand can help to overcome coordination problems by offering planning certainty to both suppliers and buyers.

Limitations

Objectives – short-term CO_2 savings vs. long-term incentives for transformation

In the short and medium term, lead markets primarily focus on low-carbon basic materials that are already available, as near-zero technologies such as DRI steel or cement with subsequent CCS will only become available in significant quantities in the long term. A comparison of scenarios by Samadi (2025) shows that the share of expected near-zero production capacity in Germany in 2030 could be just over 20 % for cement and 30 % for steel – provided there are no further delays in establishing the necessary infrastructure.

This raises the key question of which objective should be prioritised with lead markets. In political discourse, they are often understood as a market-based instrument for limiting the subsidy costs associated with the decarbonisation of the energy-intensive basic materials industry. However, this expectation is only partially accurate: In the years ahead, green public procurement will primarily incentivise low-carbon alternatives that are already available – such as cement with a reduced clinker factor and secondary steel produced using green electricity. Some of these options are already established on the market and incur little or no additional costs; however, their leverage effect on the capital-intensive investments actually required for transforming the basic materials industry remains limited. By contrast, the near-zero technologies that are crucial for structural change will only become available gradually and at considerably higher costs – and are not addressed by procurement requirements that are primarily geared towards cost-efficiency.

If lead markets are to provide targeted support for long-term transformation, near-zero technologies must therefore be addressed separately. One possible approach would be a combination of minimum quotas for low-carbon basic materials with separate sub-quotas for near-zero products.

Sectoral suitability – industry- and product-specific differences

There is no single leading market. Depending on industry structure and product complexity, different approaches must be developed for individual sectors. Two dimensions are crucial here: the demand structure – in particular the ratio of public to private demand – and the point in the value chain at which the initiative is implemented. These two dimensions also determine the extent of the instrument's leverage in the respective sector – and thus whether lead markets can act as a key component of the sectoral mix of instruments or, initially, only as an accompanying instrument with limited scope.

In the cement sector, public procurement with binding quotas can play a central role: demand is comparatively concentrated, the products are highly standardised, and the public sector accounts for around 23 % of total demand – a significant direct lever (Küper et al. 2026). In the case of steel – particularly flat and long products – however, market-based ramp-up mechanisms are required along the value chain (Lotz et al. 2025). Demand is more widely dispersed, with the vast majority coming from private customers: the public sector accounts for only around 8 %, and in the case of primary steel relevant to the transition, as little as around 3 % (Küper et al. 2026). In this context, lead markets can hardly generate the necessary depth of demand through public procurement alone – they therefore remain, for the time being, a complementary element that does not replace other instruments. In the chemicals industry – for example, with ethylene – the value chains are so complex that lead markets can only be usefully applied to downstream products like packaging (Lotz et al. 2025).

Lead markets are therefore not a 'one-size-fits-all' instrument; they must be tailored both to the sector and to the specific position within the value chain, and, depending on the circumstances, can have a very different scope within the sectoral mix of instruments.

Incentivising private lead markets – taking into account the respective impacts

Public procurement addresses only part of the sectoral demand. In the case of primary steel in particular, the decisive lever lies in the private market: over half of the primary steel demanded in Europe goes to the automotive industry – precisely the segment

whose decarbonisation is to be achieved via hydrogen-based direct reduction. If the ongoing DRI investment projects in Germany and Europe are to be secured, correspondingly reliable demand signals from this sector are crucial.

Model calculations by Leipprand et al. (2026) on the European Commission's proposal for the Automotive Package show that, if manufacturers fully utilise the proposed crediting of green steel credits against fleet limits, this could generate an annual demand of just under six million tonnes of low-emission steel for European passenger car production. This would account for approx. half of the European DRI capacities expected by the World Steel Association (2026) for the early 2030s and would therefore make a significant contribution to ongoing investment projects.

The challenges discussed in the previous sections also arise in a similar form in the private market. These include the question of how additional costs can be apportioned across the individual stages of the value chain and the limited quantities of the required near-zero grades that will actually be available on the market in the short term. From the buyer's perspective, another aspect to consider when designing the scheme is: Binding quotas for green steel in new cars would mean that manufacturers' own CO_2 targets would depend heavily on supply decisions and scaling-up progress in the upstream steel industry. Delays in ramping up DRI production would directly impact car manufacturers' balance sheets, leaving them with no control over the situation. Against this backdrop, the industry's preference for the flexible crediting mechanism envisaged in the Automotive Package, as opposed to rigid minimum shares, is understandable. In terms of designing private lead markets, reliable demand signals from the private market and close coordination between the basic materials and consumer industries must be addressed jointly.

Keeping the instrument's objective in mind

Lead markets were originally conceived as a tool for industrial transformation rather than primarily as a tool for improving industrial competitiveness, although the latter can be seen as an indirect benefit. Clarity regarding the objective is a prerequisite for effective implementation. As previously mentioned, achieving an international level playing field and maintaining trade relations with China requires specific, targeted instruments. Through the Industrial Accelerator Act (IAA), the European Commission is pursuing three objectives: decarbonisation, geopolitical resilience, and competitiveness (EC 2026f). However, this could overburden the instrument and impair its effectiveness, obscuring its limitations.

If the aim is to transform domestic industry, lead markets must primarily generate demand for European products. CO_2 criteria alone are insufficient for this purpose, since investments in climate-friendly production, such as in the steel sector, are also being made outside Europe, particularly in China. Therefore, combining these with 'Made in Europe' requirements would seem an obvious step, but would present

One argument in favour of such a link is that global overcapacity – for example in the steel and automotive industries – is exacerbated by China's strategic industrial policy involving substantial subsidies and protectionist measures, as well as the increasingly unpredictable and protectionist US trade policy. In this context, objectives such as security of supply, resilience, and technological sovereignty are becoming more important alongside pure economic efficiency. From this perspective, reducing import

dependencies in strategic sectors and making more active use of the EU single market as a source of demand for European production are legitimate policy objectives.

The argument against this is as follows: in the short term, 'Made in Europe' requirements lead to higher costs because efficiency gains from the international division of labour are lost – with the risk of slowing down and increasing the cost of industrial transformation and the energy transition. In the long term, competitiveness may be weakened, as protection from international competition reduces incentives for innovation and efficiency. Added to this is the risk of retaliatory measures, which could undermine cooperation with like-minded partners and the stability of the global trading system. Finally, in highly globalised value chains, 'Made in Europe' can often only be implemented through complex rules of origin, entailing a corresponding administrative burden.

On balance, taking resilience criteria into account in selected sectors appears justifiable. However, the increasingly strained trade relations with China should primarily be addressed using the instruments intended for this purpose – such as tariffs – rather than by overburdening the key markets.

Distribution of additional costs and administrative burden

The basic assumption underlying lead markets is that at least a limited level of demand for green products is guaranteed and that the final consumers bear the additional costs, thereby reducing the need for supply-side subsidies. However, the actual impact on the respective mid- and downstream players remains underexplored. Particularly in the case of public procurement by local authorities, it needs to be clarified more precisely what consequences the passing-on of additional costs (e.g. to municipally-owned companies and energy suppliers) entails, especially in local authorities already facing financial strain. The financial burden on private-sector companies and industries must also be taken into account when designing the relevant schemes.

These cost implications may be exacerbated by overly ambitious additional sustainability criteria, which restrict the pool of potential bidders. Fewer bids in public procurement reduce competitive pressure, which tends to lead to higher prices for the public sector. This effect is all the more pronounced the fewer green products that have been scaled up to date, and the fewer suppliers that meet the required standards.

Added to this are rising transaction costs. The implementation and evaluation of complex sustainability criteria increase the administrative burden for both public contracting authorities and companies. This is particularly true where requirements are implemented differently across EU Member States, thereby creating additional complexity. The bureaucratic burden (e.g. in the area of public procurement) should therefore be kept manageable and proportionate.

One possible approach would be to start with national public construction projects and very large supra-regional projects, and to gradually expand the scheme on the basis of the experience gathered thereby.

Conclusion

Lead markets can complement the mix of instruments for transforming the energy-intensive basic materials industry. However, their effectiveness largely depends on how they

are tailored and which objective they prioritise. Furthermore, there is no single 'lead market': potential and suitability vary greatly between sectors.

- In the case of **cement**, public procurement can make a substantial contribution to the transition through binding quotas. The relatively concentrated and standardised nature of demand means that, if designed wisely, it can make a significant contribution to the transition.
- In the case of **steel**, in contrast, the key lever lies in the private market; public procurement alone cannot generate the necessary depth of demand, at least not for the ramp-up of DRI capacity. Counting green steel towards the automotive industry's fleet limits, as envisaged in the Automotive Package, is therefore a relevant starting point.
- In the **chemicals sector**, with its complex, broadly fragmented value chains, lead markets are not a key driver of transformation; they do not make a substantial contribution to the current debate on the sector's competitiveness.

As a general principle, lead markets can complement the sector-specific mix of instruments but cannot replace other (funding) instruments. They require a clear and realistic vision that distinguishes, in particular, between short-term decarbonisation via low-carbon alternatives and the long-term development of near-zero capacities. Overloading them with additional objectives – such as industrial competitiveness or geopolitical resilience – should be avoided; these should instead be addressed through instruments specifically designed for that purpose.

Table 11-1: Impact and suitability of green lead markets by sector or product

	Steel	Cement	Ethylene
Climate-neutral products are still considerably more expensive Average additional costs on basic materials level[1,2]	+55%	+50%	+400%
In short term, lead markets primarily support transitional technologies – near-zero technologies only in early development Proportion of expected near-zero production capacity in 2030[3]	30%	20%	-
Lead markets must operate at various stages of value chain Complexity of the value chain[1]	medium	low	high
Public procurement creates initial markets and sets example – though its share varies considerably Share of public procurement in total demand[4]	8% (~3% primary)	22%	-
Private demand is in some respects more important – but faces similar challenges Largest non-public sector in terms of demand[1]	Car	Construction sector	Packaging

Sources: [1] Lotz et al. (2025) , [2] Fischer and Küper (2021) , [3] Samadi (2025) and [4] Küper et al. (2026)

Above all, however, lead markets do not stand alone. The production processes relevant to the transition – DRI-based steel, electricity- and hydrogen-based processes in the chemicals industry, and carbon capture in the cement industry – are not only enormously capital-intensive but also highly OPEX-intensive. Given the current uncertainties (e.g. regarding future hydrogen and electricity prices), sustainable financing is virtually

unfeasible for many companies. Complementary measures are therefore needed to provide targeted support for operating costs. The following section addresses this issue.

11.4. Investment support

Many decarbonisation technologies require investment on a scale that goes beyond standard maintenance and expansion measures. They therefore require greater investment commitments and often have different risk profiles. Although these technologies are generally future-orientated, which in principle makes them attractive to investors and banks, the uncertainties surrounding potential returns often outweigh this. This is not primarily because the technologies in question have not yet been tested on the market to the same extent as their conventional counterparts, but because the cost risks associated with renewable energy are higher than those associated with fossil fuels. This is particularly the case when decarbonisation investment involves switching to a different energy source.

Investments in the transformation of industrial sectors are often capital-intensive and involve long payback periods. They are also subject to technological uncertainty and therefore attract high-risk premiums from private investors. This makes accessing debt capital more difficult for small and medium-sized enterprises (SMEs), as well as companies in regions with limited access to capital markets. In particular, those companies for which energy represents a significant cost factor simply lack the financial leeway to make such extensive investments after years of high energy prices, especially given the comparatively uncertain risk-return profile. The volatility of the allowance price within the EU ETS also contributes to this uncertainty. Due to political interventions in the EU ETS framework, it is difficult to anticipate price trends and factor them into investment calculations. Furthermore, the ETS price is geared towards marginal abatement costs rather than the financing costs of far-reaching structural transformations (so-called ‘deep decarbonisation’), which often require high initial investments alongside initially uncompetitive operating costs.

At the same time, such leapfrog investments are necessary in order to bring innovative technologies to market. The positive spillover effects, such as learning curve effects and technological knowledge, generate economic benefits that extend beyond individual companies' business calculations. Consequently, the private sector’s propensity to invest is systematically below the socially optimal level. This justifies state support for such investments, whether in the form of direct grants, such as those provided by the European Innovation Fund, or national programmes like Germany’s Federal Funding for Industry and Climate Action, or as conditional loans or state guarantees. State grants directly reduce the cost of capital for climate-friendly investments. They are particularly well-suited to technologies in the pre-commercial stage, where the market risk is too high for profit-seeking capital. The Innovation Fund’s resources are drawn from the auctioning of ETS allowances (Article 10a(8) of the ETS Directive), establishing an institutional link between allowance revenues and innovation funding — a form of revenue recycling that is economically coherent. Low-interest loans from the EIB or national development banks, like the KfW Banking Group, as well as government guarantees for private loans, reduce borrowing costs without requiring direct funding from the national budget.

11.5. Operating cost support

11.5.1. Introduction

The supply of electricity is central to many climate-friendly production processes. This ranges from directly electrifying industrial applications to providing renewable electricity for hydrogen production. Consequently, electricity demand will rise substantially in many industrial sectors. At the same time, electricity prices are already high in many European locations, presenting what are, in some cases, considerable competitive disadvantages by international standards. This puts energy-intensive industries under increasing pressure, particularly compared with regions that are less reliant on expensive energy imports, such as North America and parts of Asia, or that subsidise energy prices to a greater extent. It is unlikely that this disparity will be completely resolved in the medium to long term, as structural factors such as grid charges, levies, and the need for investment in energy infrastructure will continue to influence electricity costs. Furthermore, many locations worldwide offer considerably more favourable conditions for renewable energy in the long term, and thus lower electricity costs than most European locations (Samadi et al. 2023). Against this backdrop, the challenge lies in reconciling the growing importance of electricity for climate-neutral industry with competitive framework conditions in order to prevent production relocation and safeguard industrial value creation in Europe.

In principle, and to a greater extent in some cases, the same applies to other operating costs that will be incurred during the transition to climate-neutral production processes. This is particularly true of (imported or domestically produced) hydrogen and its derivatives, as well as CCS technology. Current costs in both areas are high, which substantially increases the operating cost-to-capital cost ratio, particularly in the case of the transformative production processes required to achieve climate neutrality.

Unlike electricity costs, there is still considerable potential for vast cost reductions through technological development and market scaling, at least in the hydrogen sector and, to a lesser extent, in carbon capture. However, the largest difference between the hydrogen and CCS sectors and the need for action in the provision of low-cost electricity is that market segments of the energy system must be established and developed from scratch, encompassing both technical aspects and the full range of market infrastructures. Unlike the established energy sources – coal, oil, gas and electricity – the market ramp-up for hydrogen and CCS must take place within a competitive framework in the EU context. For the other energy sources, this process took place largely under monopoly conditions, with both coordination and financing functions secured by the monopolies. These functions must now be facilitated by other processes.

As the support measures for the transition, which are prevalent in other sectors, will not be sufficient in terms of capital costs for many areas of the industrial transition towards climate neutrality, the following sections discuss key support measures relating to the supply of electricity and hydrogen for industry, as well as the deployment of CCS.

11.5.2. Electricity price compensation

Under the EU ETS 1, particularly electricity-intensive industrial companies may be eligible for compensation under EU state aid schemes and the corresponding funding guideline in Germany (BMWE 2026), in addition to other concessions (e.g. regarding grid

access charges). A very large proportion of the (indirect) CO_2 costs passed on via the electricity markets can, in principle, be compensated (electricity price compensation, EPC).

In Germany, industrial electricity consumption of just under 90 TWh was eligible for aid in this regard in 2021. Due to cyclical factors in particular, this consumption had fallen to around 59 TWh by 2024 (DEHSt 2025a). This corresponded to a share of approx. one third of total industrial electricity consumption and approx. 12 % of total final electricity consumption in Germany. By far the largest shares of the funds disbursed under the electricity price compensation scheme went to the steel and aluminium industries, the chemicals industry and the paper manufacturing sector (DEHSt 2025a).

Following the amendment of the EU State Aid Guidelines (EC 2026c) and the approval under state aid law of the corresponding directive for Germany in July 2026, the number of sectors eligible for electricity price compensation has been expanded from 16 to 31. The corresponding compensation payments can be made for the period from the start of 2025.

Currently, the following compensation may be provided for costs passed on to wholesale electricity prices in Germany under the carbon pricing mechanism via the EU ETS (although various special provisions still apply to individual sectors):

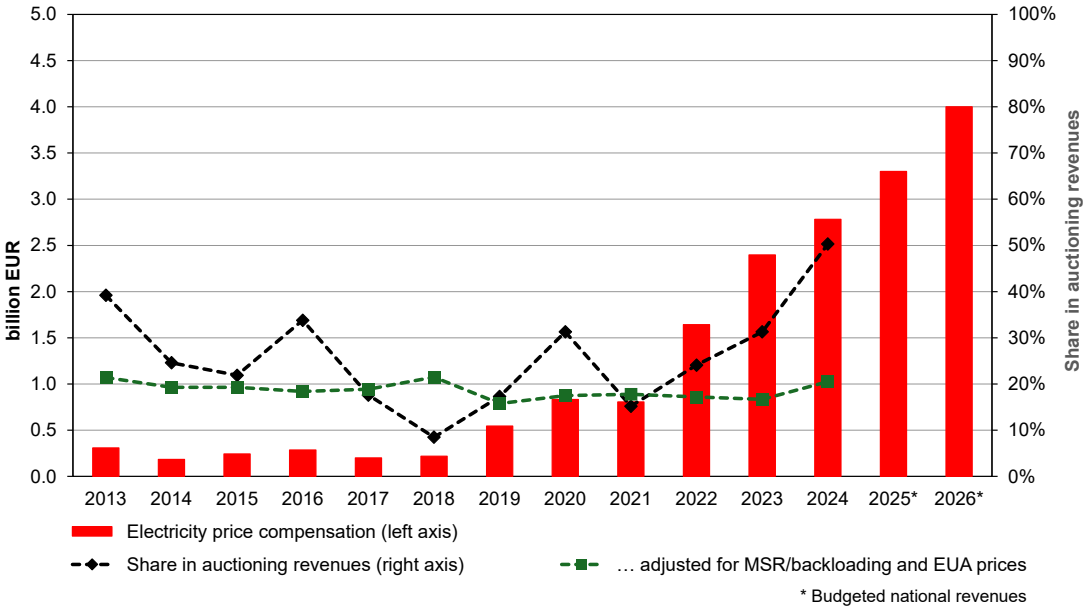
- for the electricity-intensive sectors defined in Annex I (Tables 1 and 2) of the state aid guidelines;
- based on a carbon intensity of 0.73 t CO_2/MWh applicable to Germany (Annex III);
- a compensation level of no more than 75 % (for sectors eligible up to 2024 as set out in Table 1 of Annex I) to 80 % (for sectors eligible from 2025 as set out in Table 2 of Annex I) of the additional costs arising from the carbon content combined with the EU ETS 1 allowance price;
- relative to a maximum consumption level based on specific electricity efficiency benchmarks (Annex II).

To quantify the effects of EPC, the product of the emission factor and the state aid intensity is considered below. This is referred to as the 'aid multiplier' hereafter.

For the years 2025 to 2030, the aid multiplier for installations in the 15 sectors previously covered is 0.584 and for the newly covered sectors 0.5475. For every Euro of the average price in EU ETS 1, eligible companies can thus receive aid of EUR 0.584 or EUR 0.5475 respectively for every megawatt-hour of electricity consumption that meets the electricity efficiency benchmarks.

In return for the EPC payments made, the relevant companies must fulfil certain environmental obligations. These include operating an energy management system, implementing energy efficiency measures, purchasing renewable electricity and other climate protection measures (DEHSt 2026).

Figure 11-1: Trend in payments made under the electricity price compensation scheme in Germany



Source: Oeko-Institut, based on DEHSt (2025a)

Until 2021, payments from the national budget (specifically the Climate and Transformation Fund) under the electricity price compensation scheme remained below EUR 1 billion per year, partly due to low allowance prices. Since then, however, they have risen considerably, and with the scheme's expanded scope of application from 2025, they are expected to exceed EUR 3 billion. In 2024, the share of EPC payments in the total fiscal revenue from EU ETS 1 auctions amounted to more than 50 %. However, when assessing the relationship between EPC payments and auction revenue, the effects arising from the transfer of allowances earmarked for auction into the MSR must also be taken into account. Furthermore, considerable effects sometimes arise from the different reference periods for auction revenue and the averaging of eligible allowance prices under EPC, particularly when market prices fluctuate sharply during the year. Corresponding adjustments result in EPC payments currently accounting for just under 20 % of auction revenue in Germany.

Electricity price compensation is therefore a highly effective measure to provide relief for electricity-intensive industrial consumers, and its continuation for the period after 2030 – announced well in advance and with a firm commitment (albeit with modified parameters) – is of paramount importance.

11.5.3. Industrial electricity price

Planning certainty through protection against price spikes

The industrial electricity price is intended to reduce electricity costs for industry between 2026 and 2028 and to reimburse companies for a portion of these costs in the following year.

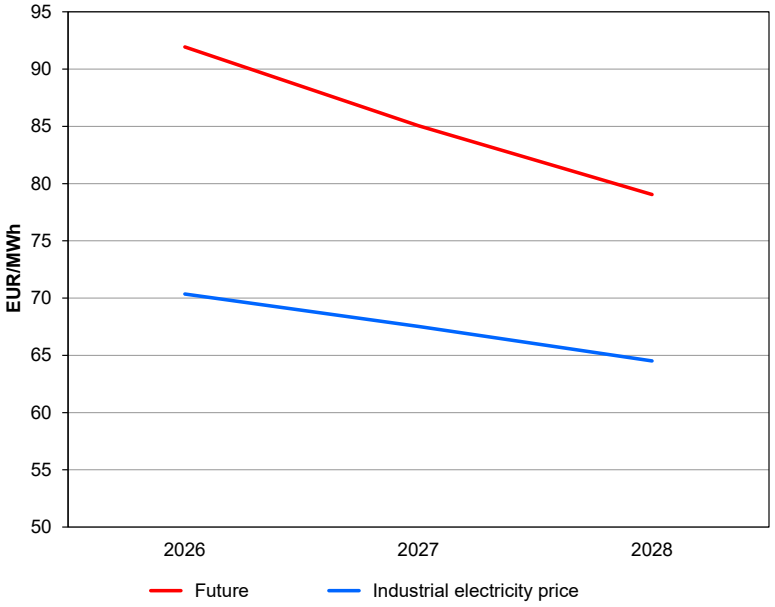
The mechanism of the industrial electricity price is aimed in particular at companies with very high electricity consumption. Contrary to initial public perception, however, this does not involve a comprehensive cap on the electricity price at, for example, 5 ct/kWh. Rather, only the exchange electricity price is capped, whilst grid charges and government levies remain unaffected. Furthermore, the price cap applies only to half of the electricity consumption of eligible companies. This structure is deliberately modelled on the logic of the electricity price brake introduced during the 2022/23 energy crisis: on the one hand, it is intended to provide direct relief; on the other hand, it aims to maintain price signals for consumption not covered by the cap, thereby preserving incentives to save electricity. In this way, the measure seeks to strike a balance between the fundamentally conflicting objectives of price capping and efficiency.

The industrial electricity price is accompanied by investment-related conditions. Companies that make use of the subsidy are obliged to reinvest half of the funds saved specifically in transformation measures. These include, in particular, investments in energy efficiency and the electrification of production processes. This is intended to ensure that the short-term relief does not merely stabilise existing structures, but also provides impetus for the long-term decarbonisation of industry.

Actual relief: up to approx. 2 ct/kWh

Due to the restrictions outlined above, the actual reduction in the industrial electricity price per kilowatt-hour is comparatively small. Based on current futures prices as an approximation of present and future electricity procurement costs, the price for the subsidised volume of electricity would fall nominally from approx. 9.2 ct/kWh to 5 ct/kWh (EEX 2026). However, as the price cap applies to only around half of electricity consumption, the average cost relief across total consumption is reduced to approx. 2.2 ct/kWh (see Figure 11-2). Based on current figures for grid costs and other taxes, levies and charges, the average electricity price for a company with an annual electricity consumption of over 150 GWh would currently stand at 15.4 ct/kWh rather than 17.5 ct/kWh as a result of this measure.

Figure 11-2: Comparison of expected price levels for electricity procurement without (future) and with relief (industrial electricity price) and relief for eligible companies



		Difference
2026	ct/kWh	2.16
	%	14%
2027	ct/kWh	1.75
	%	12%
2028	ct/kWh	1.45
	%	10%

Source: IW Cologne, EEX (2026)

Furthermore, electricity prices are generally expected to fall in the years ahead. In such a scenario, the scheme's total relief effect would also decrease further, averaging only approx. 1 to 2 ct/kWh. Additionally, the effective relief provided in day-to-day operations is offset by the requirement of companies to reinvest half of this in measures such as improving energy efficiency and electrifying processes. Overall, this results in noticeable but limited financial relief, the immediate effect of which on competitiveness is moderate.

Limitation: Insufficient safeguards for electrification investments

The industrial electricity price is fundamentally caught between the conflicting priorities of short-term relief and long-term market efficiency. On the one hand, capping electricity prices is intended to strengthen the competitiveness of domestic industry. On the other hand, this intervention distorts price signals in the electricity market, which may weaken important incentives for an efficient electricity supply that is sustainable in the long term. Consequently, there is a risk that such intervention may actually increase the system costs of electricity supply in the long term, as the price signals from volatile electricity prices – and the associated incentives for flexibility – are dampened. Accordingly, the incentive for companies to contribute to a permanently more cost-efficient electricity supply through flexible operations, investment in battery storage or similar measures is reduced.

The actual relief for energy-intensive companies is also moderate, but is likely to be perceptible, particularly during periods of sharply rising electricity prices. The key effect lies not so much in a permanent reduction in electricity price levels, but rather in cushioning unexpected price spikes. In this respect, the industrial electricity price bears clear

parallels to the electricity price caps introduced during the 2022/23 energy crisis. Given ongoing geopolitical risks – such as potential disruptions to key energy supply chains – volatile gas prices and corresponding effects on electricity prices are likely to persist in the future. In such situations, the industrial electricity price can help to smooth out extreme price fluctuations and temporarily limit the burden on companies.

In its current form, the industrial electricity price is not a reliable basis for investment decisions regarding the electrification of industrial processes due to its short duration. Accordingly, it is not to be expected that it will provide a significant incentive for transformation investments to complement the EU ETS. At the same time, this will result in considerable subsidy costs amounting to several billion Euro over this period. The limited and time-bound relief it provides is thus offset by a considerable outlay of public funds. What is crucial, rather, is to stabilise electricity costs at a competitive level in the long term. Above all, this requires a cost-effective transition and the economical operation of the electricity supply. Individual transformation projects can also be addressed using targeted support instruments.

11.5.4. Hydrogen support

Context

The use of hydrogen and its derivatives is indispensable for achieving climate neutrality targets in the industrial, energy, aviation and maritime sectors, and probably also for parts of long-distance heavy goods transport. However, hydrogen can also make an important contribution to the resilience of the energy supply and industry, as well as to industrial competence within the European Union.

Hydrogen production remains a very cost-intensive option of emissions reduction across all supply routes. This applies, firstly, to the various production processes (renewable hydrogen, low-carbon hydrogen based on natural gas combined with CCS, and low-carbon hydrogen from water electrolysis); secondly, the various production sites (in Germany, in the EU or internationally); thirdly, the various transport options (national and international pipelines, maritime transport including any conversion processes that may be necessary); and fourthly, the various application areas, some of which involve large differences in willingness to pay (lorries, refineries subject to the GHG quota, the energy sector without free allocation under EU ETS 1, industry with free allocation under EU ETS 1, etc.).

Cost levels for hydrogen currently range from 7 to 10 €/kg H_2 for renewable hydrogen in northern continental Europe, whilst on the Iberian Peninsula, in the Middle East and North Africa they are (well) under 5 €/kg H_2, while for blue hydrogen (which is heavily dependent on the price of natural gas) they amount to approx. 5 €/kg H_2 (EEM 2025; Matthes and Brauer 2025).

To achieve a fundamental balance in costs between conventional energy sources and hydrogen, carbon prices would need to be at substantially high levels, without taking other cash flows into account. Figure 11-3 shows the order of magnitude of the corresponding abatement costs compared with the use of natural gas (on the wholesale level). With natural gas prices ranging from 25 to 40 €/MWh, allowance prices of around 1,000 €/t CO_2 would be required to offset the cost difference compared to a hydrogen price of 7 €/kg H_2. For hydrogen prices of 5 €/kg, the corresponding value is 600 to

700 €/kg H_2, and for hydrogen prices of around 3 €/kg H_2, it amounts to 280 to 350 €/t CO_2. This overview shows that even with substantial cost reductions achieved through technical innovations, improved regulation, market scaling, etc., substantial carbon prices would be necessary to close the cost gaps compared with fossil fuels. This remains true even when taking into account the fact that the scale of the cost gap that needs to be closed may be up to 30% lower in some areas of hydrogen application, either due to the efficiency advantages of hydrogen application technologies (e.g. in industry) or due to the use of other reference energy sources (e.g. in the transport sector), and that carbon price levels are correspondingly lower.

Figure 11-3: Total costs of reducing CO_2 emissions by substituting hydrogen for natural gas

Hydrogen costs/prices [EUR/kg H_2]	Natural gas costs/prices [EUR/MWh(GCV)]														
	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
1.0	112	84	56	28	0	-28	-56	-84	-112	-140	-168	-196	-224	-252	-280
1.5	196	168	140	112	84	56	28	0	-28	-56	-84	-112	-140	-168	-196
2.0	280	252	224	196	168	140	112	84	56	28	0	-28	-56	-84	-112
2.5	364	336	308	280	252	224	196	168	140	112	84	56	28	0	-28
3.0	448	420	392	364	336	308	280	252	224	196	168	140	112	84	56
3.5	532	504	476	448	420	392	364	336	308	280	252	224	196	168	140
4.0	616	588	560	532	504	476	448	420	392	364	336	308	280	252	224
4.5	700	672	644	616	588	560	532	504	476	448	420	392	364	336	308
5.0	783	755	727	700	672	644	616	588	560	532	504	476	448	420	392
5.5	867	839	811	783	755	727	700	672	644	616	588	560	532	504	476
6.0	951	923	895	867	839	811	783	755	727	700	672	644	616	588	560
6.5	1,035	1,007	979	951	923	895	867	839	811	783	755	727	700	672	644
7.0	1,119	1,091	1,063	1,035	1,007	979	951	923	895	867	839	811	783	755	727
7.5	1,203	1,175	1,147	1,119	1,091	1,063	1,035	1,007	979	951	923	895	867	839	811
8.0	1,287	1,259	1,231	1,203	1,175	1,147	1,119	1,091	1,063	1,035	1,007	979	951	923	895

Cell values: Fuel switch costs natural gas → H_2 [EUR/t CO_2]

Notes: The figures relate to the use of hydrogen and natural gas with identical energy content (e.g. in power plants). In other applications (transport, steel production, chemicals industry), the CO_2 abatement costs may be around a third lower.

Source: Oeko-Institut

An effective policy mix

The ramp-up of a hydrogen sector or hydrogen market in Germany and the EU necessitates the complete development of technical and market infrastructures; for the first time in the history of the energy sector, this will not take place under the conditions of a monopoly system, but within the strictly competitive framework of the EU single market.

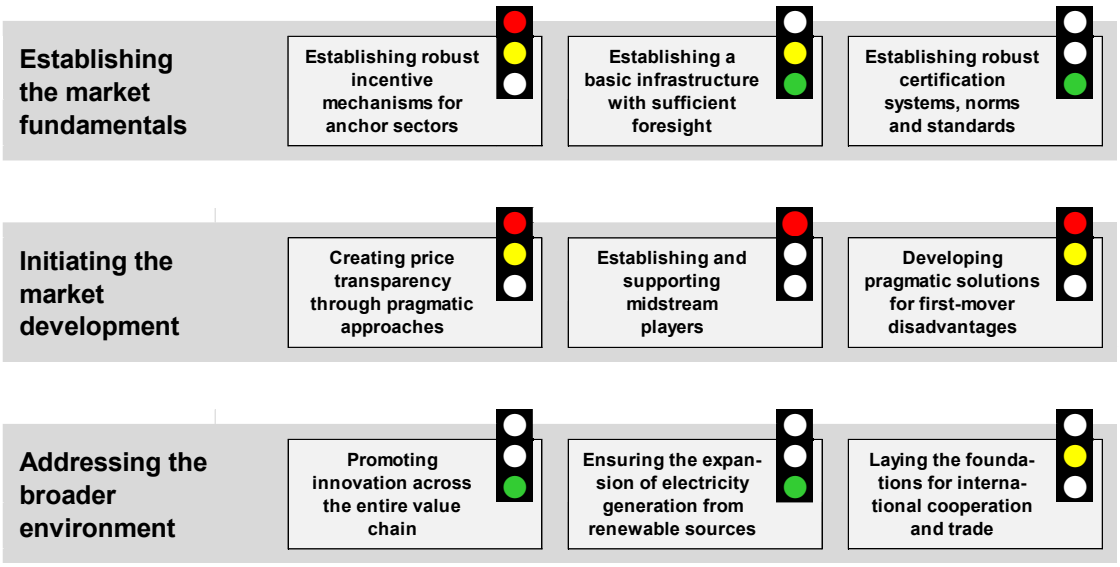
The various areas of action for the hydrogen ramp-up, along with an assessment of the status of implementation and success, are summarised in Figure 11-4.

With a view to the fundamental requirements for developing a hydrogen market, the situation is as follows:

- Following protracted processes, the necessary certification frameworks for hydrogen have been established (EU 2023a; EC 2024c; 2025b). However, for a variety of reasons, approaches have been adopted in certain sub-areas that are of little use, at least

in the early stages of market development (e.g. with a view to temporal correlation and the additionality of renewable electricity generation) and which result in considerable cost-driving effects. However, corresponding revision processes are expected in the near future. With regard to other standardisation processes, a wide range of developments are currently underway (DIN; DKE; DVGW; NWB; VDA; VDI; VDMA 2025).

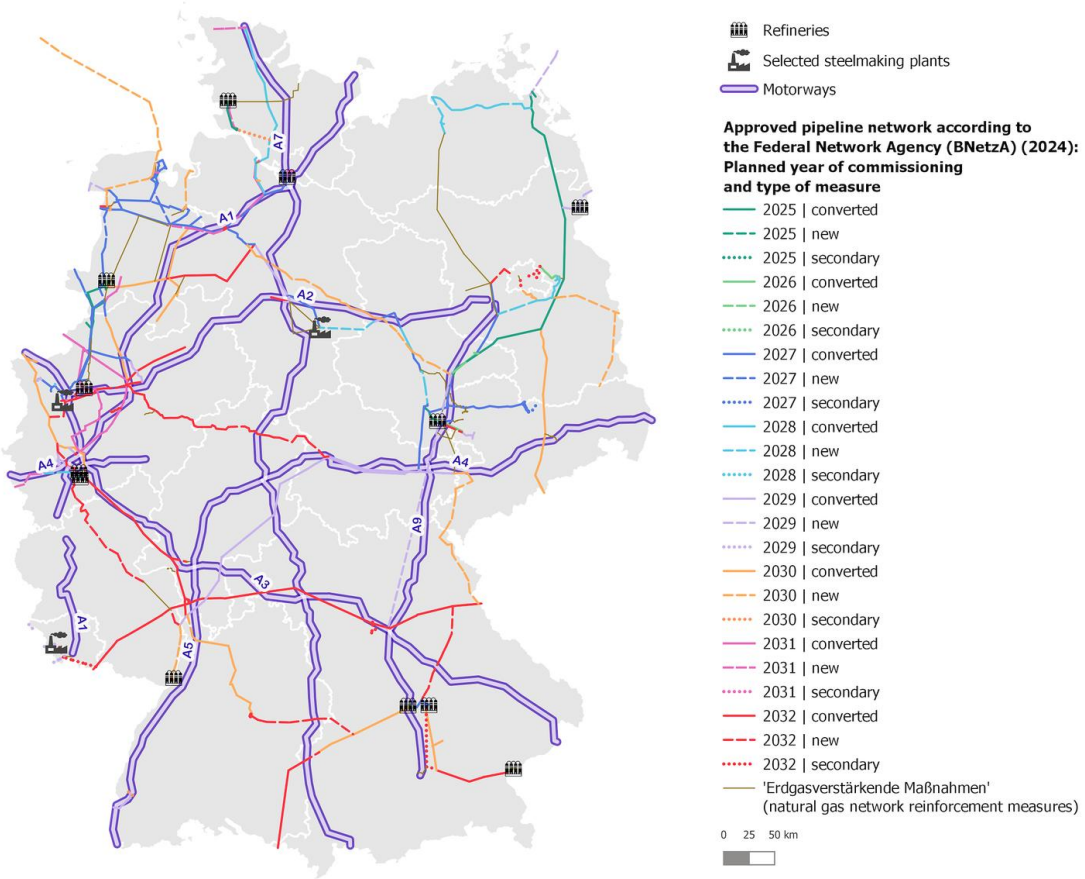
Figure 11-4: Action areas of the necessary policy mix to support the hydrogen ramp-up



Source: Oeko-Institut

- The development of a hydrogen core network can be identified as a successful area of action (Figure 11-5). To this end, decisions were made in favour of a regulated infrastructure model, ambitious planning processes KO·NEP (2026) and a targeted model for intertemporal cost allocation (amortisation account) (BNetzA 2024; 2025b; Fraunhofer IEG; Fraunhofer ISI 2025). Although there are still some outstanding issues requiring action in the areas of hydrogen storage, regulatory frameworks, connection to the core grid, and import and refuelling infrastructure for heavy-duty vehicles, fundamental questions regarding transport infrastructure have been comprehensively addressed. However, given that the hydrogen ramp-up has fallen short of initial expectations, a delay in establishing the hydrogen core network is to be expected (EEM 2025).
- Securing demand from high-purchasing-power consumers has so far been the biggest weak point in the hydrogen ramp-up. For the next 10 to 15 years, a cost gap of approx. EUR 0.8 billion (low-carbon hydrogen) to EUR 1.4 billion (renewable hydrogen) is expected to have to be closed for every 10 TWh of hydrogen (EEM 2025). Sufficiently robust financing instruments are currently available only for the heavy-duty vehicle sector (energy taxes and toll systems) and the refinery sector (GHG quota). Other potentially suitable funding instruments (Carbon Contracts for Difference, CCfDs) or auctions conducted by the European Hydrogen Bank have so far had only a minor impact on the hydrogen ramp-up and are, in some cases (CCfDs), too complex. There remains a considerable need for action in this area.

Figure 11-5: Current commissioning plans for a hydrogen core network and geographical distribution of anchor customers



Source: Oeko-Institut

Even if the market foundations are established comprehensively and adequately, the market ramp-up for a new resource like hydrogen remains a challenge that needs to be addressed. Key areas in this regard, which will not be discussed further below, are:

- the creation of sufficient price transparency within a complex market and funding environment;
- the development of hedging solutions to establish a midstream segment in the hydrogen market, through which volume and maturity transformation can be implemented and portfolio formation enabled; and
- the development of pragmatic solutions for those areas where disadvantages for early-stage ramp-up investments – particularly on the supply side – may arise (e.g. due to connections to the hydrogen core network becoming available only at a late stage).

In all three areas, the necessary adjustments to the policy mix fall considerably short of what is required.

Finally, a broader framework must also be created to facilitate the ramp-up of the hydrogen market. In addition to simplifying and accelerating approval procedures (e.g. via the

German Hydrogen Acceleration Act), the following areas for action should be highlighted (without being discussed in greater detail below):

- measures to further strengthen innovation processes across all areas of the hydrogen value chain;
- measures to boost the expansion of electricity generation based on renewable energies; and
- strengthening international cooperation structures to support cross-border supplies of hydrogen and hydrogen derivatives.

In these areas, strong measures have been and are being taken in Germany and should be continued with considerable vigour.

Proposal: Contracts for Difference for the hydrogen ramp-up

The hydrogen ramp-up requires a mix of instruments over extended periods, which can close the cost gap between hydrogen and competing fossil fuels (including any carbon costs) and provide sufficient planning certainty to ensure that investments on both the demand and supply sides actually materialise in the real world.

The range of suitable instruments is diverse and extends from GHG quotas, which are particularly used in the refinery and heavy goods vehicle sectors, to various individual funding schemes, e.g. under the IPCEI framework or climate, environmental protection and energy aid guidelines, as well as Contracts for Difference. Apart from the GHG quota, however, there is as yet no instrument that, beyond individual projects (which often also include an investment support component), addresses the hydrogen ramp-up on the necessary scale and with the necessary robustness. The ‘green gas quota’ is being discussed as such an instrument, including in the context of the amendment to the German Building Modernisation Act. However, for various reasons, it is clear that this cannot achieve the necessary ramp-up effect (the limited duration of contracts that can be concluded within the competitive gas market; price effects in the event the quota is met; sufficient robustness of quota demand given the interplay between a commitment base that tends to decline amid high uncertainties and a quota level that is cost-relevant for final consumers, etc.).

Particularly in view of the green gas quota – an instrument that is of little use in the current phase of the hydrogen ramp-up (Küper and Merten 2025) – and the foreseeable lack of support for the hydrogen ramp-up from CCfDs, it seems sensible to specify an alternative instrument to incentivise the hydrogen ramp-up. The key requirements here are:

- simplicity and transparency;
- ensuring a significant ramp-up volume;
- high suitability for final investment decisions (predictable income streams over the long term);
- allocation of (funding) resources through competitive procedures;
- compatibility with the brownfield nature of the hydrogen funding landscape; and
- compatibility with German and European law.

Against the backdrop of these requirements, developing and introducing a Contract for Difference for hydrogen seems to be a suitable instrument.

The basic principle of a CCfD is that the instrument offsets the cost difference between the market price for hydrogen (differentiated, where applicable, by renewable and low-carbon hydrogen) and the relevant alternative fossil fuel (including any carbon costs). It makes sense to use natural gas as the alternative fuel in this context.

When calculating incremental costs in the context of a CCfD, carbon costs must be taken into account alongside the fuel costs. In contrast to the electricity sector, where CO_2 allowances are generally allocated via auction and thus have a full impact in the form of the allowance price, it must be borne in mind for industrial hydrogen applications that, until further notice, free allocations of emission allowances are also in place to prevent carbon leakage.

Natural gas and CO_2 data with high temporal resolution are available as market data for calculating incremental costs. Until a liquid hydrogen market emerges, proxy indicators will need to be used. For the CfD, following extensive comparisons, the transaction-based HYDRIX indicator from EEX for renewable hydrogen and the cost-based HYDEX Plus Blue indicator from E-Bridge are currently being used. However, the CfD also includes a provision allowing the calculation of differential costs to be switched to other indicators or market data if it creates a more robust or market-relevant data basis for calculating differential costs.

The duration of CCfDs is a key advantage over other instruments, particularly those with yield profiles that are robust only in the short term. In light of experience gathered in the energy sector, 10 to 15 years are appropriate time horizons in this context. However, it is also conceivable to have various products with different durations (in typical capacity markets in the electricity sector, products with durations of one, four and 15 years are common – product differentiation that would also be sensible for CCfDs).

Ultimately, only a state body or a body commissioned by the state can act as the counterparty for the (long-term) CfD contracts. If the counterparty for the CCfDs is to be the state, either directly or indirectly, and the issue of special levies (due to the requirement for ‘use for the public good’, which is particularly problematic in the context of hydrogen policy) is to be avoided, the only option is funding from the national budget (and here, most likely, from the Climate and Transformation Fund).

11.5.5. CCS support

Context

In addition to hydrogen, the use of carbon capture and storage (CCS) is also a crucial prerequisite for achieving climate neutrality, particularly in the industrial sector. Furthermore, CCS plays an important role in creating technical sinks, which are needed to offset emissions that cannot be avoided, or can only be avoided with great difficulty – for example in the industrial sector – in the context of EU-wide climate neutrality, at least in the long term.

CCS is also one of the more cost-intensive climate protection options. The cost situation depends on a range of very different factors:

- A large proportion of the costs can usually be attributed to investment costs and above all to the energy required for carbon capture. While there are a few processes that already produce high concentrations of CO_2 (e.g. bioethanol production), many essential applications of CCS (e.g. the cement and lime industries, waste incineration) require capture costs of between 50 and 100 €/t CO_2. The primary factor influencing these costs is the availability of a cost-effective supply of heat and electricity. Innovations currently on the horizon may help to reduce these costs (slightly) further. For underutilised plants (such as gas-fired power plants), capture costs can amount to well over 100 €/t CO_2. If CO_2 is to be captured from the ambient air (Direct Air Capture and Storage – DACCS), capture costs currently run to several hundred euros.
- The cost of transporting CO_2 is dependent on the mode of transport (pipeline, rail or inland waterway vessel) and the distances involved (within the country). This raises difficult trade-offs. Rail transport is comparatively expensive (7 to 15 €/100 km for one tonne of CO_2), but offers great flexibility in terms of volume. The costs of pipeline transport (1 to 9 €/100 km) are only a fraction of those for rail transport (Mendelevitch et al. 2026). However, pipeline transport is confronted with considerable challenges in terms of capacity utilisation and the associated uncertainties. The distance component of domestic transport costs depends primarily on the locations of the emitting installations and their distance from suitable CO_2 storage sites. In this regard, the availability of onshore storage sites in Germany can have a substantial impact on the costs incurred.
- The storage of CO_2 and, where applicable, its transfer by ship or pipeline also incur significant costs. For offshore storage, costs of 100 to 150 €/t CO_2 are expected in the medium term (Mendelevitch et al. 2026). For onshore storage, costs of just under 50 €/t CO_2 may be achievable.

Figure 11-6: Total costs of CO_2 emissions reduction as a function of the costs of capture as well as transport, transfer and storage of CO_2

Costs of CO_2 capture [EUR/t CO_2]	Costs for CO_2 transport, transfer and storage [EUR/t CO_2]														
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
0	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
25	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185
50	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210
75	95	105	115	125	135	145	155	165	175	185	195	205	215	225	235
100	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260
125	145	155	165	175	185	195	205	215	225	235	245	255	265	275	285
150	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310
175	195	205	215	225	235	245	255	265	275	285	295	305	315	325	335
200	220	230	240	250	260	270	280	290	300	310	320	330	340	350	360
300	320	330	340	350	360	370	380	390	400	410	420	430	440	450	460
400	420	430	440	450	460	470	480	490	500	510	520	530	540	550	560
500	520	530	540	550	560	570	580	590	600	610	620	630	640	650	660
600	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760
700	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860

Cell values: total costs of CCTS [EUR/t CO_2]

Notes: For the quantities of CO_2 not captured, a capture rate of 90 % and a carbon price of EUR 100 were consistently assumed.

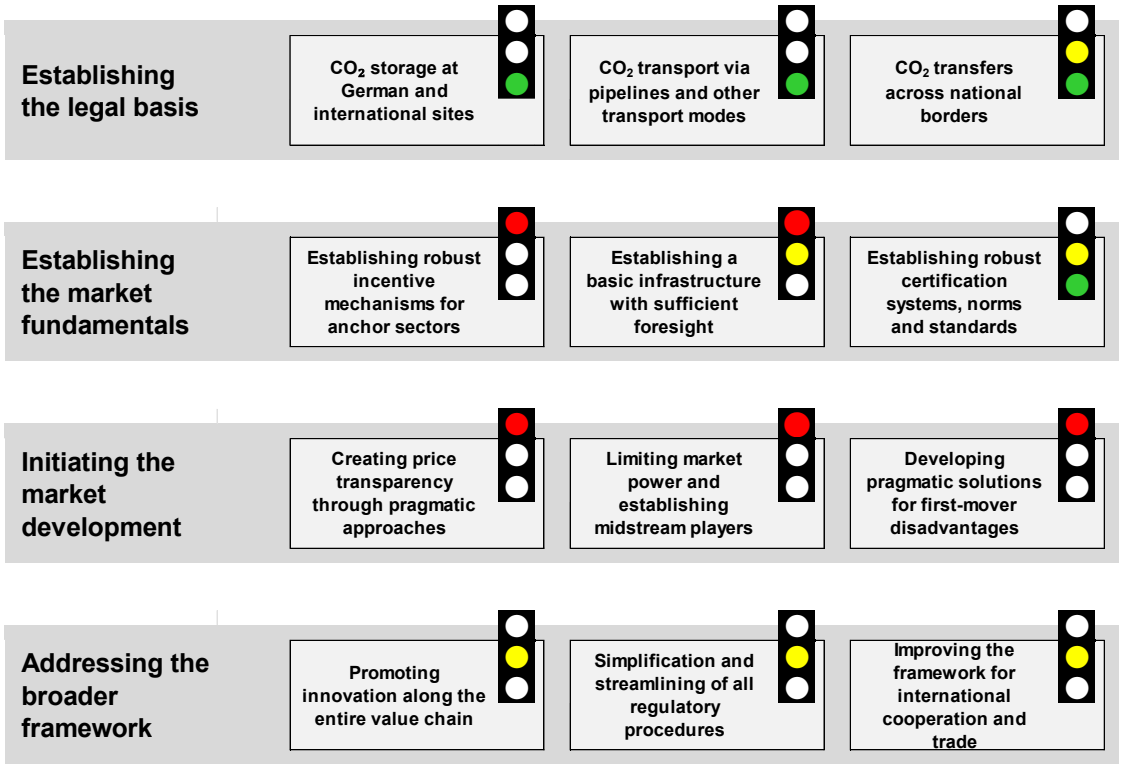
Source: Oeko-Institut

Figure 11-6 shows the total costs of CO_2 emission reduction or the necessary CO_2 costs for various combinations of the costs of capture, transport, transfer and storage of CO_2. For the entire technology chain, effective carbon prices of 200 to 300 €/t CO_2 or more are likely to be required for the implementation of CCS in the industrial sector. For the implementation of DACCS, on the other hand, the expected costs amount to around several hundred Euro.

An effective policy mix

The CCS ramp-up also involves the creation of an entirely new system or market. Here, too, this ramp-up cannot be achieved with a few mechanisms. Rather, it requires a systematic approach encompassing strategies and instruments across a wide range of policy areas (Figure 11-7).

Figure 11-7: Action areas of necessary policy mix for CCS ramp-up



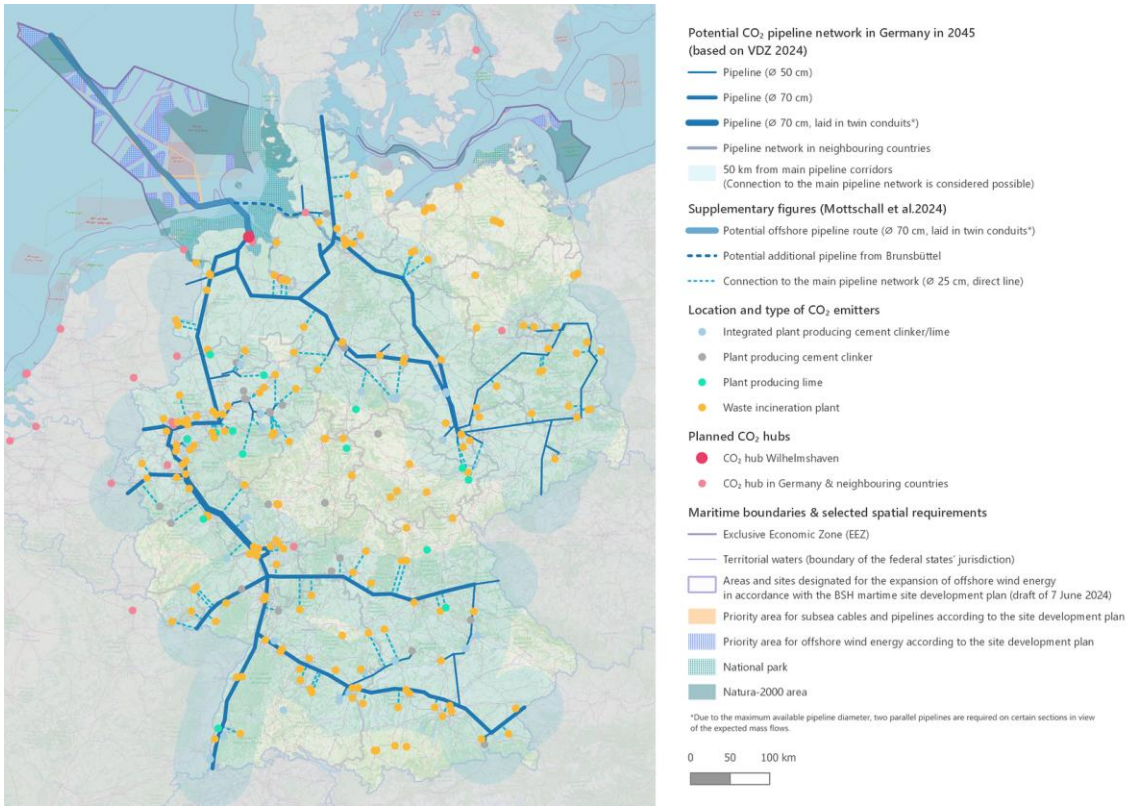
Source: Mendelevitch et al. (2026)

In the case of CCS, too, this policy mix must address various aspects of the ramp-up. In addition to issues relating to fundamental market factors, the active shaping of the market ramp-up and the broader context, this also concerns, for CCS, the permissibility of CO_2 storage and CO_2 transport (Mendelevitch et al. 2026):

- The legal framework for CO_2 storage was established domestically through the amendment to the Carbon Dioxide Storage and Transport Act (KSpTG). For onshore storage, however, the respective federal states must exercise their discretionary powers under the Act's enabling clauses.

- The domestic transport of CO_2 by pipeline has also been enabled by the amendment to the Act; transport by rail was already possible and is subject to the relevant safety regulations.
- For the cross-border transport of CO_2, a wide range of measures under international law were necessary; these have now been almost fully implemented.

Figure 11-8: Structures of a prospective CO_2 network in Germany in 2045



Source: Oeko-Institut based on VDZ (2024) and Mottschall et al. (2024)

With a view to the fundamental foundations of a CCS market, a very nuanced picture emerges (Mendelevitch et al. 2026):

- The necessary certification frameworks have already been established to a very large extent through the close link between CCS and the EU ETS 1. The same applies to CO_2 storage certification.
- Fundamental issues relating to CO_2 infrastructures have not yet been adequately addressed. While there are certainly proposals for the structure of a future CO_2 network for Germany (Figure 11-8) and initial market surveys have been carried out, However, there has as yet been no clear decision to implement a regulated system for a future CO_2 network – an approach that will be necessary to address the wide-ranging issues involved in scaling up the infrastructure. Nor are there any corresponding planning processes or concepts in place for this, like a CO_2 core network. However, the infrastructure issue is also complicated by the competition or coexistence of transport via pipeline, rail and inland waterway, for which robust solutions have yet to be found. In

this context, one attractive approach is the implementation of hub concepts for combining pipeline and rail transport. Nonetheless, there is still much analytical, conceptual and implementation-orientated work to be carried out in this area.

- To date, the demand with sufficient purchasing power for CCS applications has only been addressed through CCfDs in Germany. CCS projects are also eligible in the second round of tenders for these CCfDs. However, this measure will not be sufficient to close the cost gap of EUR 0.3 to 2.2 billion per year arising for every 10 Mt CO_2 over the next 10 to 15 years.

For all other action areas within the dimensions of 'initiating the market development' and 'addressing the broader framework' (Figure 11-7), there remains a very broad need for action.

Proposal: A focused Contract for Difference for the CCS ramp-up

A key feature of the CCS ramp-up is the particularly significant role played by spatial structures. In order to achieve cost savings in the CCS value chain, particularly with regard to transport modes and distances, it is essential to establish CCS ramp-up clusters. Nationwide instruments that do not differentiate by region will therefore only be able to play a limited role.

As part of a combined approach for the transport of CO_2 by rail and pipeline, with corresponding hub structures, CCS development clusters could be defined and CCS CfDs put out to tender for these clusters. These should be designed to be significantly simpler than the current CCfDs – i.e. without using complex baseline systems – and should only compensate for the cost difference arising from CCS. Corresponding concepts are yet to be developed, but could be structurally based on the model outlined in chapter 11.5.4.

12. Summary and outlook

Context

As a mechanism for pricing greenhouse gas emissions, the EU ETS 1 is and remains a key policy instrument of EU climate policy in the energy, industry, and air and maritime transport sectors. At the same time, it is a key component of the European climate policy framework, which is closely linked to EU-wide and, in some cases, international target and commitment mechanisms at a higher level, as well as in other sectors (road transport, buildings, agriculture and waste management, and carbon sinks). Amendments have been made to the overarching targets, with the EU's target of reducing CO_2 emissions by 90 % by 2040 (using high-quality international carbon credits) being of particular note. This necessitates an adjustment of the quantities of emission allowances available under the EU ETS 1. However, it should be noted that changes to the emission reductions implemented under the EU ETS 1 also have an impact on the emission reductions to be achieved in other sectors.

In addition to these structural aspects, adjustments to the EU ETS 1 have repeatedly become necessary on the basis of practical experience, but also in light of the socio-political, economic and international context, in order to keep the system operational and to ensure its compatibility with other EU economic and social policy objectives. The EU ETS 1 has been, is and will remain a system that is subject to frequent reviews and revisions.

The forthcoming reform of the EU ETS 1 in 2026 is taking place against the backdrop of these requirements and will affect many different individual provisions of the EU ETS 1. Many of these individual provisions interact with one another, meaning that a holistic approach is always both sensible and necessary. The objective of this analysis is to provide a comprehensive basis for discussions on the forthcoming reforms of the EU ETS 1.

Huge emissions reductions in the energy sector have led to a shift in focus within the scope of the EU ETS 1 towards emission-intensive industries. This is in terms of the necessary emissions reductions and the transition to transformative production processes. These are key to achieving the goal of climate neutrality. The EU ETS 1 will be able to make an important contribution to this. Furthermore, companion policies are required to ensure the success of this industrial transformation in a comprehensive sense.

EU ETS 1 reform: strategic guidelines and reform proposals

Reconciling climate targets and competitiveness. The EU ETS 1 must be further developed in such a way that it keeps the 2040 and 2050 climate targets within reach, whilst at the same time making investment and industrial production in the EU economically viable. Both objectives are of equal importance. A mechanism that would reduce emissions primarily through the relocation of production rather than through investment would fail to serve its purpose.

Taking account of different rates of transformation. Companies that have already invested need planning certainty. Necessary reforms must not undermine these projects. In instances where alternatives are not yet available or cost constraints are hindering investment, it is essential to establish the necessary technical, infrastructural, regulatory and economic frameworks as a priority. For at least a decade, the industrial transition

will also have to take into account the coexistence of transformative and conventional production processes, with a view to the upcoming modernisation cycles, in order to preserve and make the best possible use of the existing 'transition windows' for efficient climate protection measures (in the sense of the opportunities for action over time resulting from these modernisation cycles). It is also important to consider that existing conventional plants must generate the financial scope for transformative investments. A reform of the EU ETS 1 must take these four perspectives into account.

Maintaining the scope of application and expanding it cautiously. Removing sectors from the EU ETS 1 shifts emission reductions and the incentives for them, where applicable, into the scope of national instruments. This is not conducive to achieving objectives within the European single market. Some expansions make sense: waste management and indirect emissions from aviation can be integrated without destabilising the market. A short-term merger with the EU ETS 2 or the direct inclusion of sinks, in contrast, entails considerable operational risks; there is as yet a lack of reliable practical experience to assess or manage these. It is precisely here that the approach involving frequent reviews and revisions should continue to be pursued.

Assessing interactions within the overall system. The EU ETS 1 is a fundamental element of the EU's climate policy framework. In the reform, a wide range of interactions must be taken into account as a matter of urgency – both with other climate instruments and between the mechanisms within the system. In order to achieve the common goal, it is essential that adjustments to the cap, the Market Stability Reserve (MSR) and free allocation are made consistently.

Earmarking revenue. Revenue from the EU ETS 1 must be consistently used for the transformation of industry and the energy system and should not be channelled into the general budget.

Aligning with the new EU targets. The 2040 climate target is to achieve a 90% reduction in emissions compared with 1990 levels, with at least 85% of this to be achieved through reductions within the EU, including CO_2 sequestration via sinks. The emissions pathway must be adjusted accordingly. Initially, the greater short-term reduction potential in the energy sector makes it possible to maintain an ambitious pathway (a linear reduction factor of, for example, 4.4 % by 2035). By 2036 at the latest, the trajectory should stabilise to the point where the industry's transformation potential is taken into account and the conditions for transformation can be established. At the same time, this trajectory must align with the climate neutrality target set out in the European Climate Law.

Integrating flexibility mechanisms. Article 6 of the Paris Agreement allows for the possibility of meeting up to 5 percentage points of the EU's 2040 climate target through international carbon credits. In addition to this, the potential for carbon sinks must be considered. Both options must be taken into account in the EU ETS 1. However, it is particularly important that they robustly rule out any risk to market integrity, as demonstrated by past experience. Integration into the EU ETS 1 should take place exclusively via cap mechanisms or central gateways (e.g. the MSR), not through the use of international carbon credits or removal credits to fulfil individual companies' allowance surrender obligations. It is clear that long-term allowances from negative emissions will continue to be necessary in order to offset residual emissions that are difficult or impossible to abate. These residual emissions include those originating in industry.

Ensuring market liquidity. The MSR should be calibrated using the TNAC formula so that it responds more quickly and effectively. In the long term, it addresses remaining industrial residual emissions. In the long term, it will address any remaining industrial residual emissions. The replenishment of the MSR could be used as a channel to introduce credits from international mechanisms under Article 6 of the Paris Agreement and from sink projects into the EU ETS 1.

Developing the method for calculating free allocation further. The current benchmark calculation, which forms the basis for free allocation, is no longer a suitable mechanism for the future. It should be replaced by a simple, linear mechanism. It should be replaced by a simple, linear mechanism. Industrial process heat requires its own fallback benchmark. This is particularly relevant for the chemicals industry. Changes are also possible with a view to free allocation in the context of introducing of CBAM (see below).

Driving industrial transformation through a robust policy mix

The EU ETS 1 is a necessary condition for the success of industrial transformation, but not a sufficient one. As well as the reform proposals outlined above, a set of companion policies is required. These policies will enable the necessary investment decisions and ensure the economic operation of installations. This policy mix comprises two levels: technology-specific measures, which cushion higher operating costs and ensure infrastructure expansion; and sector-specific measures for energy-intensive industries.

Lead markets can create demand for climate-neutral basic materials. A step-by-step approach is recommended for their design: first, testing in large-scale projects, then a gradual roll-out to other areas. It is important to note that there is no single lead market – sectoral differences are crucial. In the case of cement, public procurement has the potential to make a substantial contribution to the transition, given that the public sector accounts for a significant proportion of demand in Germany.

The time horizon is a crucial factor. In the short and medium term, lead markets primarily address low-carbon alternatives that are already available – cements with a reduced clinker factor or secondary steel produced using green electricity – which are often available at little or no extra cost. The actual objectives of the lead markets – near-zero technologies such as DRI steel or CCS cement – are only gradually becoming available in significant quantities and should be addressed separately.

Need for action regarding operating cost support: Targeted measures with a view to operating costs are required for each of the following three key decarbonisation pathways:

- **Electrification**: Long-term measures are needed that are designed to ensure a more competitive and reliable level of electricity prices. These include measures such as the continuation of electricity price compensation and, on a transitional basis, an industrial electricity tariff. However, it is also crucial to considerably accelerate grid expansion and connection procedures (at the level of transmission grids and above all distribution grids), as well as to implement further measures to increase cost efficiency in the expansion and operation of the electricity system, in order to permanently reduce system costs and thus the need for subsidies from the governmental budget.

- **Hydrogen**: The ramp-up of the hydrogen economy requires a broad-based policy mix, not all elements of which have so far been pursued with the necessary intensity. The major role played by (regulated) infrastructure development and the supporting measures in the areas of planning and mitigating ramp-up risks are, and will remain, areas of action in which government involvement is indispensable. It is both useful and necessary to further develop or supplement the current Carbon Contracts for Difference into long-term Contracts for Difference that specifically offset, for hydrogen users, the cost difference between hydrogen and hydrogen derivatives on the one hand, and conventional energy sources on the other hand.
- **Carbon capture, transport and storage (CCS)**: The need for a comprehensive policy mix also applies to the CCS ramp-up. The areas requiring clarification and action are even broader here than for hydrogen. Only a clear policy decision regarding pipeline-based CO_2 transport and storage as a regulated business can enable the necessary measures for the deferred refinancing of these infrastructures, which will initially be underused. The government bears a particular responsibility in this regard. For CCS, too, the introduction of specific Contracts for Difference is a useful approach to closing the cost gaps remaining outside the scope of EU ETS 1 and thereby also to harnessing learning curves and economies of scale.

Investment support is necessary for many transformative production processes and their value chains: The focus here is on large-scale capital expenditure on novel application technologies and infrastructure. At least some of these investments will not fit within the usual modernisation cycles, particularly given their scale and risk profiles. It must be clarified in the short term whether the existing financing and implementation models are sufficient, and they must be improved where necessary. With regard to the CO_2 network, financing solutions must be put in place promptly to take the first steps towards establishing the initial sections of a core network.

Supporting market protection: keeping European industry competitive

The introduction of CBAM is a new and essential mechanism for ensuring effective protection against carbon leakage for European industry. However, it also establishes incentives for the international roll-out of greenhouse gas pricing instruments. It is imperative that the system be tested over the coming years and developed further in various areas (exports, scope of coverage, valuation methods). Until reliable experience is available, a (time-limited) cap on the reduction in free allowances should be considered.

The EU ETS 1 and its accompanying instruments are based on one fundamental condition: that the industry they are intended to transform remains in Europe. This prerequisite is no longer automatically guaranteed. The dominant drivers behind the recent declines in production are of a geo-economic nature: industrial subsidies, exchange rate policies and increasing protectionism. Through the diversion of exports, this has direct and indirect effects on Europe. Climate policy instruments alone cannot offset this pressure; ultimately, targeted support measures in the areas of trade and industrial policy are also necessary.

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13.2. Further legislation

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