Trends in the Emissions Trading System in the European Union, 2005-2024

July 2025

LIFE Effect

The Green Tank

The study was carried out within the framework of the LIFE Effect project (LIFE23 GIC-BE-LIFE EFFECT) by The Green Tank.

Authors

Ioanna Souka, Energy Policy Analyst, The Green Tank

Nikos Mantzaris, Policy Analyst, The Green Tank

more info: life-effect.org

For more information, please contact:
Maria-Christina Doulami, Communications Officer, The Green Tank,
doulami.maria-christina@thegreentank.gr

Publication date:
July 2025

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

Summary

This report analyses the emission trends of the sectors under the ETS (electricity & heat production; industry; aviation) for the period 2005-2024 in the EU. It is based on the latest data from the Union Registry and the European Environment Agency (2025). The main findings are summarized as follows:

- Emissions from the electricity & heat production and energy-intensive industry sectors decreased by 51.2% between 2005 and 2024, keeping the EU-27 well on track towards the -62% target for 2030. Emission reductions were primarily driven by Luxembourg, Portugal, and Denmark, while Cyprus, Sweden, and Poland had the poorest performances.

- Between 2023-2024, a 5.2% decrease was recorded in all three ETS sectors (electricity and heat production; energy-intensive industry; and aviation), despite emissions increasing in seven Member States.

- An all-time low in emissions was recorded in both electricity and heat production (574.7 million tons) and industry (430.6 million tons). Nonetheless, emissions from industry decreased by a mere 1.1% compared to 2023, whereas the electricity and heat production achieved an impressive drop (-9.7%). Aviation emissions remain on an upward trend (+15.1% compared to 2023), approaching pre-pandemic levels.

- In 2024, the cumulative emissions from all three sectors reached a 20-year low at 1,065.6 million tons. Four countries (Germany, Poland, Italy, and Spain) were the largest contributors.

- For the first time in 2024, emissions from the shipping sector were recorded, amounting to 62.2 million tons. Greece led in emissions, followed by Italy and Spain.

- With regard to the top three polluting industrial sectors, emission reductions in the cement industry and refineries were primarily driven by, respectively, Germany and France, while Czechia and Italy contributed the most to reducing emissions from the steel industry.

- In 2024, the EU-27 industry was subsidized by €27.24 billion, through the allocation of 420.78 million free emission allowances; this figure corresponds to 70% of the auction revenues (totaling €38.81) received by all Member States in that year.

Contents

Acronyms

RES	Renewable Energy Sources
EU	European Union
ETS	Emissions Trading System
EEA	European Environment Agency
SCF	Social Climate Fund
MSR	Market Stability Reserve
CBAM	Carbon Border Adjustment Mechanism
CCS	Carbon Capture and Storage
CCU	Carbon Capture and Utilization

Introduction

The year 2024 constituted a landmark in European climate policy. The European Commission initiated the discourse regarding the next decade, proposing a 90% reduction in net emissions by 2040 compared to 1990. The European elections in June and the deliberations on the composition of the new Commission fueled intense political ferment regarding the future of both European industry and the green transition.

In this context, Regulation 2024/1735 (Net Zero Industry Act) came into force, aiming to accelerate the development of innovative clean technologies, simplify licensing processes, and reduce the EU's dependence on third countries. At the same time, the energy crisis of the past summer –mainly affecting South-Eastern Europe– brought back to the spotlight the need for consumer protection and cutting fossil fuel use.

The policy directions on energy transition were reflected in the updated National Energy and Climate Plans (NECPs), most of which were submitted within 2024. The European Commission's assessment report[1] in May 2025 revealed that, even though the EU is on track to reduce emissions by at least 55% by 2030, measures should be strengthened in order to ensure achieving this target. To this end, the report highlighted the key contribution of both the "Fit for 55" package and the Emissions Trading Scheme (ETS).

The ETS, the EU's key tool for reducing emissions, initially covered the sectors of electricity and heat production, industry and –since 2012– aviation. In 2024, it was expanded to include shipping[2], in line with the latest revision of the relevant directive[3]. The first emission allowances from shipping will be surrendered in 2025[4], gradually reaching 100% by 2027.

Against this changing environment of increased demands for carbon footprint reduction, this report analyses the emission trends in the ETS sectors, namely, electricity and heat production, industry, aviation, and now shipping, based on the latest data of the EU Registry[5] (April 2025) and the European Environment Agency[6] (May 2025).

[1] European Commission. 27.05.2025. EU-wide assessment of the final updated national energy and climate plans. Delivering the Union's 2030 energy and climate objectives. http://bit.ly/3G9L6VW

[2] The ETS covers 100% of emissions from large ships (5,000 tons and above) travelling between EU ports and 50% of emissions from ships departing or terminating in EU ports transiting through third countries.

[3] DIRECTIVE (EU) 2023/959 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission allowance trading system, https://shorturl.at/b6YrJ

[4] By 30 September 2025, companies must surrender 40% of emission allowances.

[5] Union Registry, April 2025. https://bit.ly/3KzGxTC

[6] European Environment Agency, May 2025. https://bit.ly/3KwqO7R

Comparison among Member States

In 2024, total emissions from the three ETS sectors in the EU-27 reached a 20-year low at 1,065.6 million tons. More than half of these emissions (574.7 million tons or 53.9%) came from the electricity and heat production sector. Industry emitted 430.6 million tons (40.4%), followed by aviation with 60.3 million tons (5.7%).

The top polluters are Germany, Poland, Italy, and Spain

The four countries primarily contributing to the EU-27's total emissions -accounting for 58.3% of the latter- were Germany, Poland, Italy, and Spain; these countries were responsible for 26.4%, 14%, 9.8% and 8.1% of emissions, respectively. As in the EU-27 overall, the largest share of emissions in the first three countries came from the electricity and heat production sector[7]. In contrast, industry accounted for the majority of emissions (52.7%) in the case of Spain.

Progress for all Member States with respect to 2005

On average, the European Union reduced its emissions by 51.2% in 2024 compared to 2005 in the two original ETS sectors (electricity and heat production and energy-intensive industry)[8]. This performance paves the way to the target of reducing emissions by 62% in 2030 compared to 2005, in line with the revised ETS Directive of 2023[3].

The countries that were most successful in reducing emissions were Luxembourg (-71.5%), Portugal (-70.6%), and Denmark (-68.6%)[9]. Conversely, as in 2023, Poland (-33%), Sweden (-28.3%), and Cyprus (-14.4%) were the least successful. Performing worse than in 2023, Greece dropped from 4th to 6th place; nonetheless, it achieved a 63.9% reduction in emissions, thus exceeding the European average.

A mixed picture for Member States' performance compared to 2023

All countries have cut emissions from 2005 to 2024; nonetheless, seven EU Member States[10] increased their emissions between 2023 and 2024. As a result, the EU on average achieved only a slight drop in emissions (-5.2%). The largest percentage increase in emissions came from aviation in most countries, with the exception of Lithuania, where it was due to the industrial sector. Nonetheless, absolute quantities paint a different and varied picture. Most additional emissions in Belgium, Lithuania, and the Netherlands came from energy-intensive industry, as opposed to the electricity and heat production sector in the case of Greece and Slovenia. Finally, both Malta and Ireland recorded additional emissions exclusively from aviation, with other sectors achieving reductions.

[7] The electricity and heat production sector accounts for 74.6%, 61.2%, and 58% of total domestic ETS emissions in Poland, Germany, and Italy, respectively; in the EU, on average, this sector accounts for 53.9% of total emissions.

[8] The two sectors' total emissions for each country include the estimated emissions for the years 2005-2012, according to the European Environment Agency, based on Directive 2003/87/EC, as in force, with regard to the inclusion of plants and countries under the ETS.

[9] The Green Tank. 2024. Trends in the Emissions Trading System in the EU and Greece 2005-2023. https://shorturl.at/aLNI0

[10] Malta Slovenia, Greece, Lithuania, Ireland, Ireland, the Netherlands, and Belgium. https://shorturl.at/aLNI0

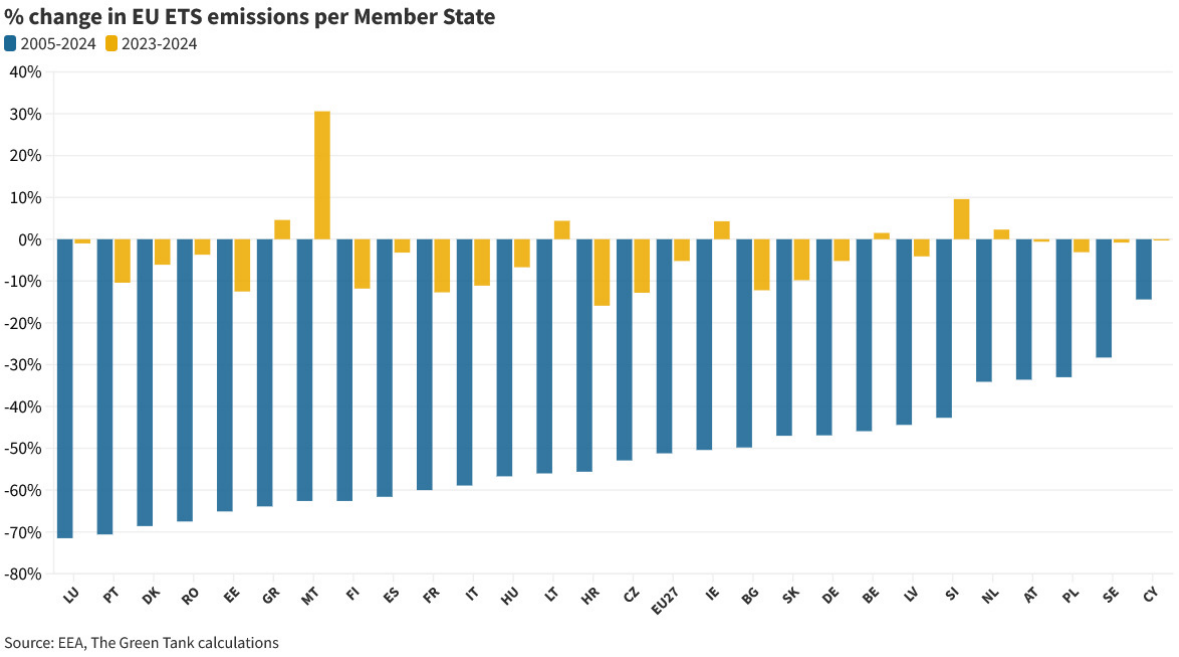

Figure 1: Change in ETS emissions for each EU-27 Member State in 2024 compared to the ETS base year (2005) and the previous year (2023)[11]. Source: EEA; processed by The Green Tank

Evolution of emissions by sector

In 2024, the EU's electricity and heat production sector records an all-time low in emissions

Compared to the other two sectors under the ETS, electricity and heat production has achieved a larger drop in emissions from 2018 onwards (42.4%); this trend can be attributed to the elimination of free emission allowances that had been granted to power plants under the ETS up to 2012, as well as to the increase in carbon prices as of 2018. The latter have been rising due to both the reforms introduced by the penultimate revision of the ETS and the establishment of the Market Stability Reserve (MSR), aimed at addressing allowance surplus in the market.

In 2024, at 574.7 million tons, this sector achieved a new low in emissions, thus beating the previous low of 2023 (636.3 million tons) by 9.7% (Figure 2). The largest percentage reductions were achieved in Portugal (-41.7%), Croatia (-22.7%), Finland (19.4%), and Bulgaria (19.3%), as a natural consequence of the corresponding reduction in the use of fossil fuels in electricity production[12]: -41.8% in Portugal; -27.4% in Bulgaria; -20% in Croatia; and -6.5% in Finland (where fossil fuels contributed a mere 5.5% to the electricity production mix in 2024). Portugal leads the board regarding renewables penetration, with clean energy accounting for 74.5% of total electricity production in 2024. As Portugal has no coal, the decrease in emissions is mainly attributed to the reduction of fossil gas use, unlike in Bulgaria, where the large decrease came from phasing out lignite's contribution.

[11] As aviation was not included under ETS in 2005, the comparison between 2005-2024 takes into account only electricity & heat production and industry, whereas all three sectors are considered in the comparison between 2023-2024.

[12] Ember. 2024. Electricity Data Explorer. http://bit.ly/45RLxyX

The upward trend in emissions from the aviation sector persists

In contrast to the electricity production sector, aviation within the European Economic Area has seen a steady increase in emissions since the record low of 2020, which was due to the COVID-19 pandemic. In 2024, at 60.3 million tons, emissions approached pre-pandemic levels (64. 9 million tons in 2019), recording a 15.1% and 34.1% increase compared to 2023 and 2013, respectively. Emissions in the aviation sector rose between 2023 and 2024 in all Member States, except for Cyprus, Bulgaria, and Hungary, where reductions were recorded. The largest percentage increases came from Slovenia, Slovakia, and Estonia.

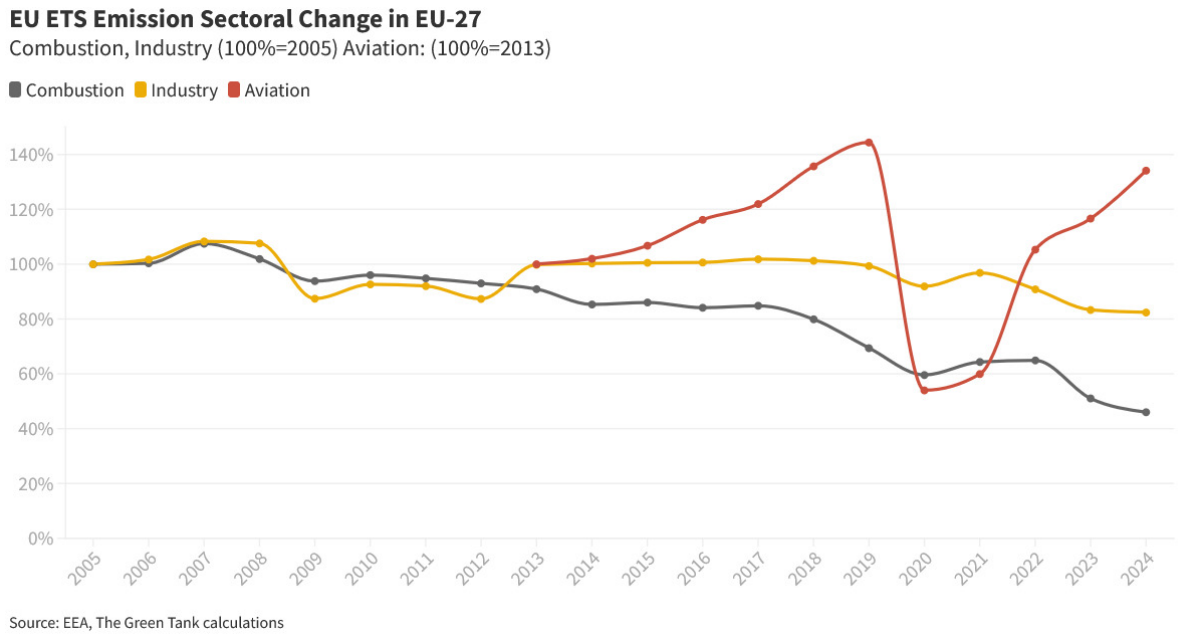

Figure 2: Annual change in EU-27 emissions in the three ETS sectors, normalized against 2005 for the electricity & heat production and industry sectors (100%=2005), and against 2013 (100%=2013) for aviation. Source: EEA; processed by The Green Tank

Industry achieves a small reduction in emissions compared to 2023

In the energy-intensive industry sector, emissions have remained stagnant since 2013; this trend is mainly due to the provision of an abundance of free emission allowances, which still exceed several industrial sectors' actual emissions. In 2020, the pandemic affected industrial production, leading to a sharp drop in emissions. Following a temporary rise in 2021, emissions have since followed a downward course.

Emissions in 2024 (430.6 million tons) reached a 20-year low (-17.6% compared to 2005); nonetheless, they merely decreased by 1.1% compared to 2023. As illustrated in Figure 3, this reduction was driven by the three main industrial sectors, namely refineries (-2%), steel (-1.2%), and cement (-4.7%); these sub-sectors cumulatively accounted for 66% of industrial emissions in 2024. Nonetheless, emissions from other industrial sectors rose, with the largest increases recorded in the production of gypsum, acids, and chemicals.

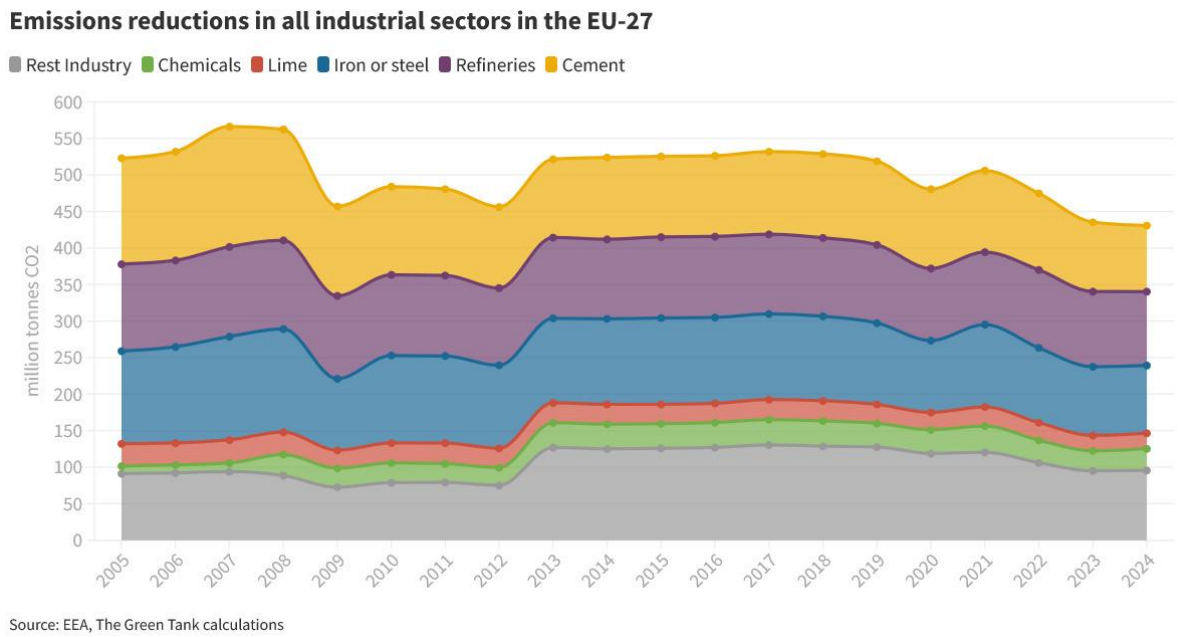

Figure 3: Emissions from EU-27 industrial installations under the ETS from 2005 to 2024. Source: Union Registry; processed by The Green Tank

Latvia, Ireland, and Czechia record the highest reductions in industrial emissions; however, these countries cumulatively account for just 2.6% of total industrial emissions

Among Member States, the highest emission reductions were observed in Latvia (-20.8%), Ireland (-16%), and Czechia (-14.6%). The cement production sub-sector was mainly responsible for this performance in the first two countries; in Czechia, however, the decrease was primarily driven by the steel industry.

Conversely, Belgium recorded the largest percentage increase in emissions among Member States (+7.6%), mainly due to its chemical industry and its steel production sub-sector. Regarding the latter in particular, the rise in emissions was driven by the sector's recovery, denoted by a 21% production increase in 2024 compared to 2023[13] -a year that saw reduced steel production due to the energy crisis.

The largest increase in absolute quantities of emissions was also observed in Belgium (+1.8 million tons), followed by Poland (+1.5 million tons), the Netherlands (+1.2 million tons), and Germany (+1.1 million tons).

Emission reductions in the cement industry and refineries were primarily driven by Germany and France, respectively; Czechia and Italy contributed the most to emission reductions in the steel industry

With regard to the cement sector (Figure 4), among the leading cement producing countries (Germany, Italy, France, Germany and Spain), Germany recorded the largest decrease in absolute terms (-1.6 million tons or -9.9%), followed by Ireland (-0.42 million tons or -15.6%). France and Spain, respectively, ranked third (-0.36 million tons or -3.8%) and fourth (-0.33 million tons or -2.9%) in terms of absolute emission reductions. In contrast, the largest absolute increase was recorded in Portugal (+0.26 million tons or 7.1%) and Romania (+0.13 million tons or 2.4%).

[13] GMK Center. 31.01.2025. "Belgium increased steel production by 21.1% y/y in 2024" http://bit.ly/3HYMr2I

With regard to refineries, the largest installations can be found in Italy, Germany, the Netherlands, and Spain. With the exception of Spain, which increased its emissions by 2.3%, the other three were among the five countries that achieved the highest emission reductions between 2023-2024. The largest contribution to the sector's emissions decline came from France (-2 million tons or -26.1%). The remaining countries' performance was less impressive: Finland, Italy, and the Netherlands reduced emissions, respectively, by 0.7 million tons (or -25.3%), 0.5 million tons (or -4.8%), and 0.47 million tons (or -4.4%).

With regard to the steel production sector, the largest decrease came from Czechia (-1.2 million tons or -30.7%), a country that is not among the EU's leading steel producers. Italy, however, is: reducing emissions by 1 million tons (or -14.2%), it ranked second, followed by France (-0.94 million tons or -8.1%). Conversely, other countries with high steel production -such as Germany, Spain, and the Netherlands- increased their emissions. The Netherlands recorded the highest increase (+13.5 million tons or +29.7%), followed by Belgium (+0.9 million tons or 23.2%).

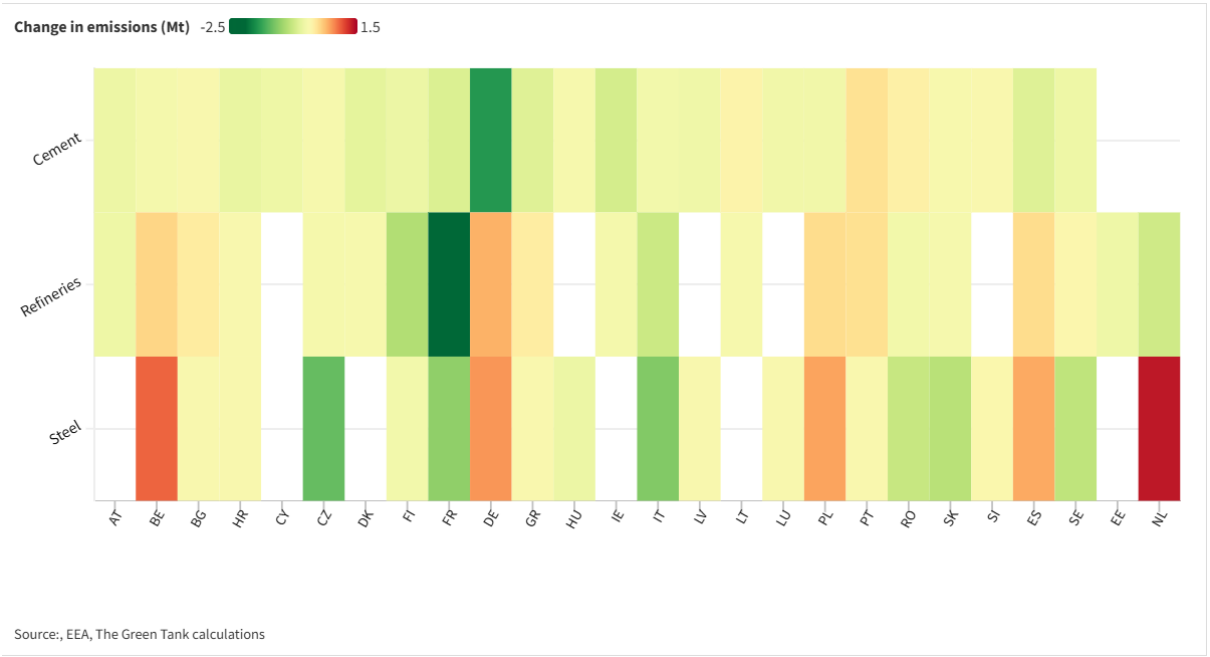

Figure 4: Change in emissions from the three main industrial sectors between 2023-2024. Dark green denotes the largest emission decrease, while dark red indicates the largest emission increase. Source: EEA; processed by The Green Tank

Greece accounts for the most emissions from the -newly introduced- shipping sector

As of 2024, shipping was added to the sectors covered by the ETS. This sector shall include 100% of emissions from large ships (5,000 tons and above) moving between EU ports and 50% of emissions from ships departing from or arriving at EU ports transiting through third countries[14].

As recorded in the Union Registry (up to the time of drafting this report)[15], emissions from shipping within the EU-27 in 2024 amounted to 62.2 million tons. Greece led with 11.2 million

[14] European Commission. "Reducing emissions from the shipping sector". http://bit.ly/3Ua8Xbw

[15] Shipping emissions recorded in the MRV system and covered by the ETS have not yet been fully transferred to the Union Registry http://bit.ly/4kxPc8t

tons, as it hosts the most companies included under the ETS. Italy followed closely with 11 million tons, while Spain was third (9.4 million tons).

Member States are required to surrender 40% of the allowances recorded in 2024 by the end of September 2025, thus contributing the first ETS revenues from the shipping sector. In 2026, they shall surrender 70% of the previous year's (2025) emissions, while, from 2027 onwards, they shall submit 100% of allowances[14].

Subsidies granted to industry

The industrial sector continued to be subsidized in 2024, through the provision of free emission allowances. A total of 503.17 million free emission allowances were allocated to the three ETS sectors, with the vast majority subsidizing European industry (420.78 million tons), while electricity & heat production and aviation received 65.4 million and 17 million allowances, respectively. Taking into account the evolution of carbon prices last year, it is estimated that, in 2024, the EU industry was subsidized with €27.24 billion through free allowances. It is worth noting that, in the same year, the auctioning revenues of all EU-27 Member States that were dedicated to finance climate actions totaled €38.81 billion. This figure could have been much higher had industry been granted fewer free allowances.

Unlike in 2023, in 2024 actual industrial emissions (430.6 million tons) slightly exceeded free allowances. Therefore, cumulatively, all European industry sectors had to buy less than 10 million allowances or just 2.3% of their actual emissions.

Among the main industrial sectors, steel and cement production were allocated the majority of free allowances, while refineries paid for the most allowances compared to their actual emissions

As illustrated in Figure 5, the majority of free emission allowances were granted to the steel and cement industries (122 and 93 million tons, respectively), exceeding both sub-sectors' confirmed emissions (93 and 90 million tons, respectively) and, thus, leading to a €2.1 billion net profit for 2024 from the EU ETS. Refineries ranked third, receiving 72.4 million free allowances while emitting 100.8 million tons. Further behind, the chemicals sector was allocated 28.9 million allowances for free, nearly matching its actual emissions over 2024 (29.7 million tons).

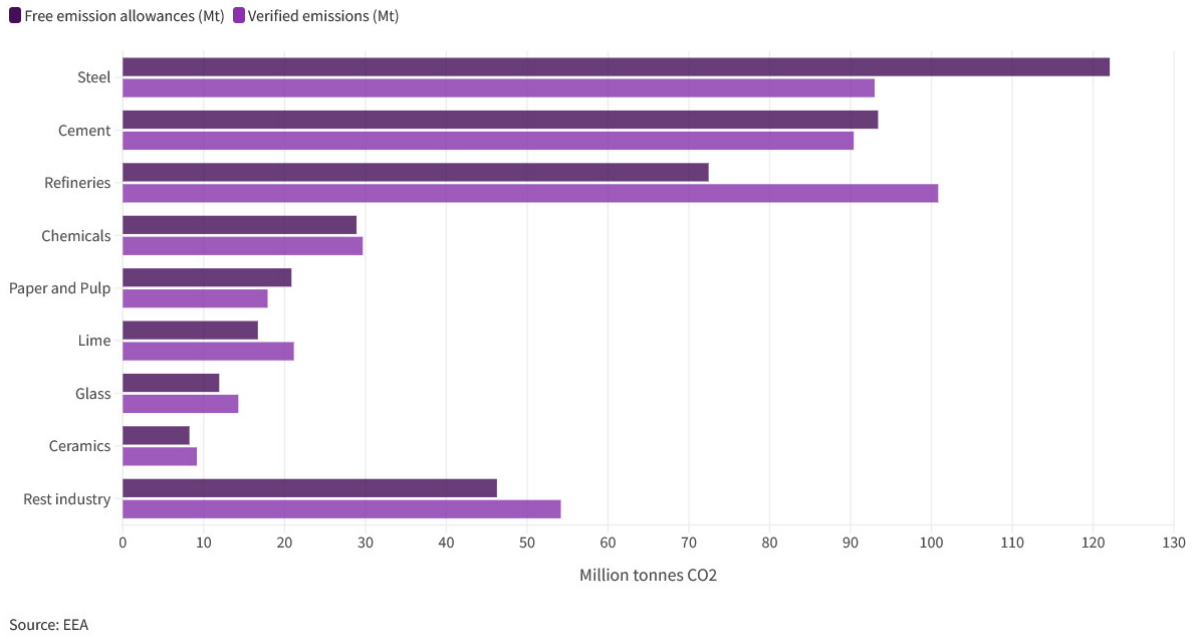

Figure 5: Free allowances and confirmed emissions of European industry sectors in 2024. Source: EEA.

Nonetheless, in addition to the allocation of free allowances, certain energy-intensive industries in the EU-27 are also protected against the "carbon leakage risk" through the measure of indirect cost compensation. More specifically, under the ETS Directive, Member States can channel part of their public revenues from the auctioning of emission allowances to companies in sectors and sub-sectors that are exposed to a significant "carbon leakage risk" due to the cost of emission allowances being passed on to the price of the electricity consumed in their respective industrial processes.

According to the European Commission's annual reports on ETS operation, since 2013 when the implementation of the indirect cost compensation measure began, and up to 2022 (latest available data), the eligible sectors in 17 Member States[16] received a total amount of €12.67 billion. The lion's share of these funds corresponds to Germany, which allocated €5.3 billion to its energy-intensive industry, followed by France (€1.96 billion); Spain (€980 million); Poland (€800 million); and Belgium (€784 million).

[16] Austria, Portugal, and Slovenia (as of 2022); Czechia, Romania, and Italy (as of 2020); Poland (as of 2019); Luxembourg (as of 2017); Finland (as of 2016); France (as of 2015); Slovakia, Lithuania, and the Netherlands (as of 2014); Germany, Belgium, Greece, and Spain (as of 2013). Lithuania and the Netherlands stopped applying the indirect cost compensation measure in 2020 and 2021, respectively.

Conclusions - Prospects

The ETS continues to significantly contribute to Europe's progress towards achieving its climate goals. Its impact is evident in the large emission reductions observed in the EU's electricity & heat production sector, which achieved a 20-year low in 2024.

Industry is making slow progress in reducing emissions, highlighting the need for quicker adoption of decarbonization technologies. The phasing out of free allowances and the implementation of the Carbon Border Adjustment Mechanism (CBAM) exert growing demand for solutions such as electrification via renewables; green hydrogen use (mainly in the steel and refinery sectors); carbon capture and storage or carbon capture and use (CCS/CCU) technologies; and investments in the circular economy.

Moreover, in addition to the aforementioned sectors, from 2027 onwards, buildings and transport will be covered by the ETS2; thus, the coming years are expected to bring new challenges and opportunities. Given that the carbon costs paid by fuel suppliers will be passed on to end consumers, it is vital that measures are taken to protect them. Indeed, a Social Climate Fund (SCF), budgeted at €86.7 million to be dispersed over the seven-year period 2026-2032, has been designed to address the socio-economic impacts of ETS2 implementation, particularly regarding the most vulnerable households and small enterprises. In addition, revenues from the ETS emission allowance auctions could be used to ensure the provision of direct financial support to the vulnerable where necessary, while safeguarding the implementation of structural measures aimed at permanently decoupling from fossil fuels in a socially just and climate-positive manner. The development of effective Social Climate Plans by Member States -which were required to be submitted by June 2025- constitutes a precondition for the design and implementation of all the aforementioned measures.

In addition to the launch of the SCF, 2026 will also see the first ETS review following the changes introduced by the last revision in 2023. In this context, the European Commission will be called upon to evaluate the Union's progress towards achieving the 62% emission reduction target by 2030; the strengthening of the Market Stability Reserve (MSR); and the extension of the ETS to cover additional sectors -such as waste management and Carbon Dioxide Removal technologies (CDR)- or to expand existing ones (for instance, through the inclusion of international aviation or voyages of smaller ships). The Commission will also examine transparency in the use of revenues, as well as the possibility of establishing a stricter assessment of projects financed by the Innovation and Modernization Funds.

Therefore, the next two years will be decisive for the course and expansion of the ETS. The system's success will be determined by its impact on emission reductions, as well as by its ability to advance the green transition of industry, while protecting the most vulnerable and contributing to social justice.


LIFE Effect