ETC-CM Report 2023/07

Trends and projections in the EU ETS in 2023

The EU Emissions Trading System in numbers

Authors:
Christian Nissen (Öko-Institut), Sabine Gores (Öko-Institut), Sienna Healy (Öko-Institut), Hauke Hermann (Öko-Institut)

European Environment Agency
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European Topic Centre on
Climate change mitigation
https://www.eionet.europa.eu/etcs/etc-cm
etccm@vito.be

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About this report

This annual report analyses recent, current and future emissions trends under the European Union (EU) Emissions Trading Scheme (ETS). This report is based on ETS data and information provided by the European Commission and Member States as of July 2023 and projections data from September 2023. The data on verified emissions and compliance of operators under the EU ETS for the years up to 2022 are based on an extract from the EU Transaction Log on 3 July 2023 [1]. This report is divided into three parts: historical and current emission trends, an outlook on future emissions until 2030 and 2050 and a section dedicated to the proposed Carbon Border Adjustment Mechanism (CBAM).

Main findings

The EU ETS is a 'cap and trade system', whereby a cap - a determined quantity of emission allowances - is set for the installations covered by the system. The cap decreases gradually in order to achieve emission reductions over time. Installations can trade emission allowances with one another, which ensures that emission reductions take place where it costs least. The EU ETS entered into force in 2005. Since then, it has evolved in terms of scope and many advanced design elements have been added in response to both learning by doing, responding to external shocks, and an increase in political will towards decarbonising of the EU economy.

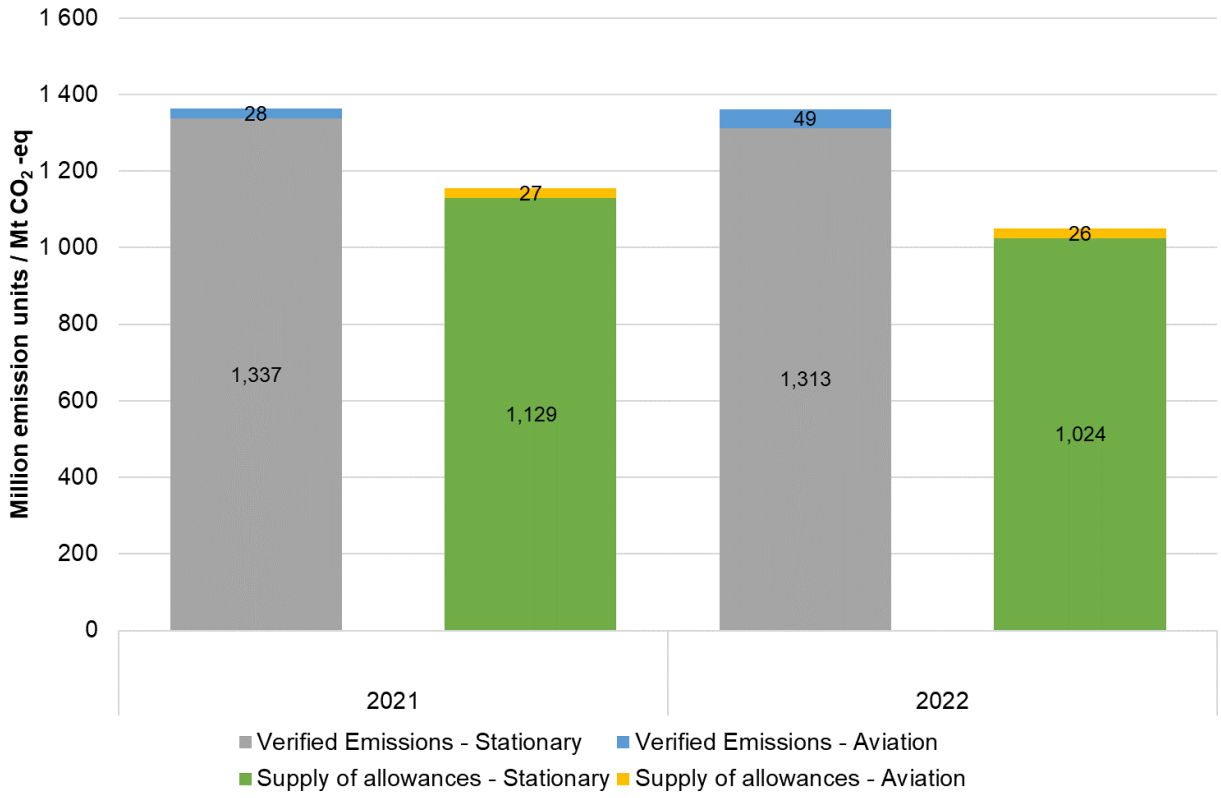
Recent trends

Total emissions in 2022 were 1361.3 Mt CO_2-eq, only 0.2% lower than in 2021 (1364.3 Mt CO_2-eq) [2]. Emissions from EU ETS stationary installations fell by 24.1 Mt CO_2-eq over this period. However, this was largely offset by an increase in aviation emissions of 21.0 Mt CO_2-eq linked to the ongoing recovery of air travel after the Covid-19 pandemic. Aviation emissions considerably increased in 2021 and 2022 but have not yet returned to pre-pandemic levels.

(1) Due to different cut-off times, there may be different values compared to other publications

(2) Only taking emissions reported in the EUTL into account. Does not include emissions from Swiss aviation operators reported in the Swiss registry and does not include emissions covered by the Swiss ETS and reported in the EUTL (compare chapter 1.2).

Figure ES.1 Verified emissions and supply of allowances for stationary installations



Note: Supply of allowances includes Modernisation & Innovation Fund

Sources: EEA (2023a)

Long-term trends

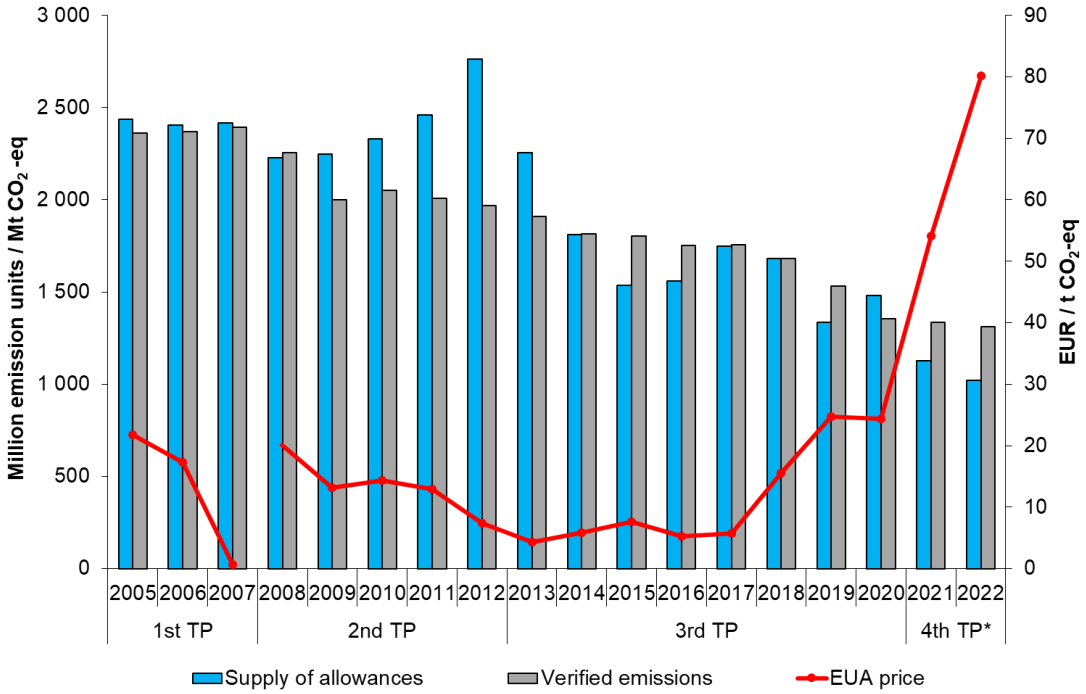
Between 2005 and 2022, emissions from stationary sources were reduced by 37% (excluding UK emissions). Much of the emission reductions observed so far in the EU ETS are the result of changes in the fuel mix for heat and electricity generation, in particular a reduction in the use of hard coal and lignite fuels and an increase in electricity generation from renewable energy sources. In recent years, the rising price of CO_2 has put further pressure on carbon-intensive fuels. However, lignite and hard coal-fired power plants (mainly in Germany and Poland) remain the largest emitters in the EU ETS.

Emissions from the largest industrial sectors decreased at a slower pace than from power generation. Abatement options for industrial sectors are often more expensive requiring longer-term investments in order to decarbonise production processes that historically were beyond the financial incentive provided by just the ETS price signal alone. At the same time policy instrument for the support of renewable electricity have been implemented since many years. Comparable policy instruments for the decarbonisation of industrial sectors such as the innovation funds have been implemented later.

In the first years, the number of allowances available in the ETS market exceeded the demand for these allowances (i.e. verified emissions). During this period, a surplus of allowances accumulated, leading to lower allowance prices and limiting the incentive to invest in clean, low-carbon technologies (Figure ES.2). In response to this situation, EU legislators implemented a number of measures, including the 'backloading' of 900 million allowances between 2014 and 2016 and the introduction of the Market Stability Reserve (MSR) in 2019, which has reduced the surplus of allowances in the last years.

Prices for EUA allowances have seen a steep increase starting in 2018. The price increase reflects the currently high cost of applying abatement measures and the expectation that the supply of allowances will be reduced in the long-term, confirmed by the reduced cap implemented with the adoption of the revised EU ETS directive (EU 2023b). One important short term abatement measure in the EU ETS is the switch from coal fired to natural gas fired electricity generation. With the higher prices for natural gas this abatement option also becomes more expensive, thus leading to higher prices for EUAs.

Figure ES.2 Emissions, allowances and prices in the stationary EU ETS, 2005-2022



Note: The cumulative surplus represents the difference between allowances allocated for free, auctioned or sold plus international credits surrendered or exchanged from 2008 to date minus the cumulative emissions.

Sources: Point Carbon (2012), EEA (2023a), EEX (2023), ICE (2021)

Outlook

In May 2023, the revised ETS directive to meet the more ambitious target of a 55% net reduction in greenhouse gas emissions by 2030 compared to 1990 levels entered into force. This led to a significant tightening of the ETS cap, increasing the target from a 43% to a 62% reduction by 2030 compared to 2005. Maritime transport will be included from 2024. A CBAM will be introduced from 2026 onwards and consequently free emission allocations will be phased out gradually. In addition, a new EU-wide emissions trading system for distributors that supply fuel to the buildings, road transport and certain other sectors (ETS-2) will be introduced from 2027, but without an immediate link to ETS-1. GHG projections submitted in 2023 under the Governance Regulation from EU Member States cover the time span until 2050 for the first time. Aggregated ETS-1 emissions in 2050 add up to more than 600 Mt CO_2. In addition, aviation emissions are projected to increase steadily until 2050. These emission levels are well above what is needed to achieve the overall target of climate neutrality in 2050 for all emitting sectors.

1 Historical and actual trends in the EU ETS

This section describes the historical and current trends in emissions, and the supply of allowances within the EU ETS. A distinction is made between stationary installations, split between the combustion and industrial sectors, and aviation emissions.

1.1 Stationary installations

1.1.1 Overview

In 2022, stationary EU ETS emissions in general decreased by 2% compared to the previous year (see Table 1-1). Although combustion emissions increased by about 1%, primarily as a result of a small increase in the combustion of hard coal and lignite, industrial emissions decreased by 6% and this was influenced, in part, by the higher natural gas price.

The total supply of allowances in 2022 decreased by 9% compared to the year 2021, amounting to 1022.3 million allowances. This amount includes free allocation and auctioned allowances. The supply of allowances allocated for free was 1% lower than in 2021. Since 2013, power generators have been required to buy all their allowances, with exceptions made for some countries. Sectors and subsectors deemed to be exposed to a significant risk of carbon leakage receive free allocation based on benchmarks.

In 2022, 368.5 million allowances were placed in the MSR instead of being auctioned, which is 6% more than in 2021.

Table 1-1 EUA demand, supply and price (stationary installations), 2021-2022

	2021	2022	Change
Verified emissions (Mt CO_2-eq.)	1 336.6	1 312.6	**-2%**
Combustion emissions	814.2	821.9	**1%**
Industrial emissions	522.4	490.7	**-6%**
Total supply of allowances (millions of EUAs)	1 128.6	1 022.3	**-9%**
Free allocation (incumbents, new entrants)	545.7	542.8	**-1%**
To existing installations	545.7	542.8	**-0.5%**
To new entrants and capacity extensions	0.0	0.0	
Auctioned amounts/primary market sales	583.0	481.5	**-17%**
Supply/demand balance (millions of EUA)	-208.0	-288.3	**40%**
MSR intake	348.0	368.5	**6%**
EUA price (EUR)	54.15	80.18	**47%**

Notes: Based on data from July 1st 2023

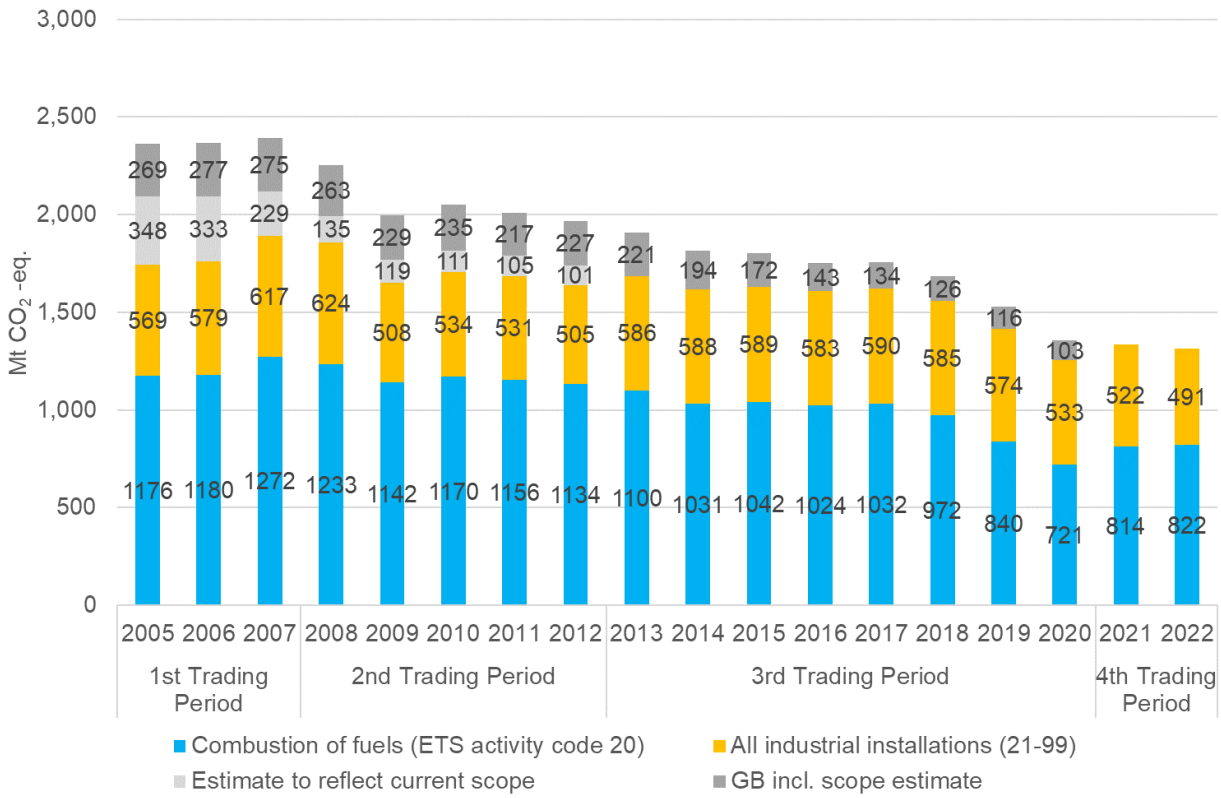
The distinction between combustion (activity code 20) and industrial emissions (activity code 21 and above) is based on the EUTL classification of activities and does not take into account waste gas transfers from the production of iron and steel or cross-boundary heat flows.

Sources: EC (2023b), EEA (2023a), EEX (2023)

1.1.2 Trend of Emissions

Figure 1-1 shows the evolution of verified emissions within the EU ETS for stationary installations over time. Since 2005 an emissions reduction of 37% was reached. Emission trends were quite volatile in the last years. The lowest emissions were registered with 1,253 Mt CO_2-eq. in 2020 during the Covid-19 pandemic. Since then, emissions have slightly increased again in 2021. In 2022 emissions from stationary installations equalled 1,313 Mt CO_2-eq. This means that emissions from stationary installations decreased by 24 Mt CO_2-eq in 2022 compared to the previous year. The emission reductions were driven by industrial installations (-31 million t CO_2-eq). An increase in emissions can be observed in the category "combustion of fuels" (+8 million t CO_2-eq), which includes the majority of fossil power plants.

Figure 1-1 Verified emissions 2005 - 2022



Note: The estimate to reflect current scope takes into account emissions (not split by activity) for those countries, sectors and activities that have not been part of the EU ETS since its inception in order to provide a consistent time series.

Emissions from Great Britain do not include electricity generators from Northern Ireland but include other ETS-Installations in Northern Ireland

Sources: EEA (2023a)

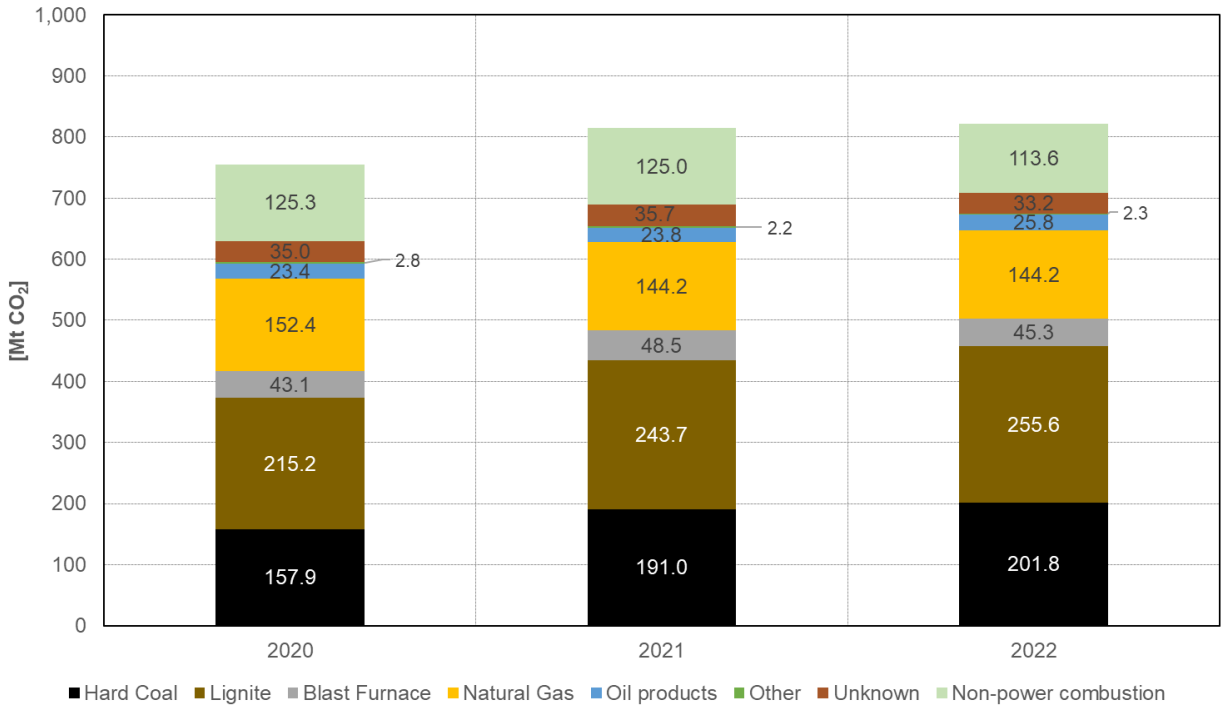
1.1.2.1 Combustion/Power Sector

In total combustion installations emitted 822 Mt CO_2-eq in the year 2022 (Figure 1-1). The following Figure 1-2 takes a closer look at the emissions of the combustion installations (activity code 20). Emissions from combustion installations are dominated by power plants that cover about 80% the emissions under this activity code. As no official data is available to identify power plants in the EUTL, the power plants were

manually identified from the EUTL (see methodology from ETC/CME 2021). Figure 1-2 shows the trend in emissions from combustion installations, broken down for power plants and combustion installations that were identified as not being power plants:

- Emissions from both hard coal and lignite power plants increased by a little more than 20 Mt CO_2 in 2022 compared to the previous year.
- Emissions from power plants using natural gas were constant in 2022 compared to the previous year.
- Emissions from combustion installations not producing electricity decreased by about 10 Mt CO_2 in 2022 compared to 2021.

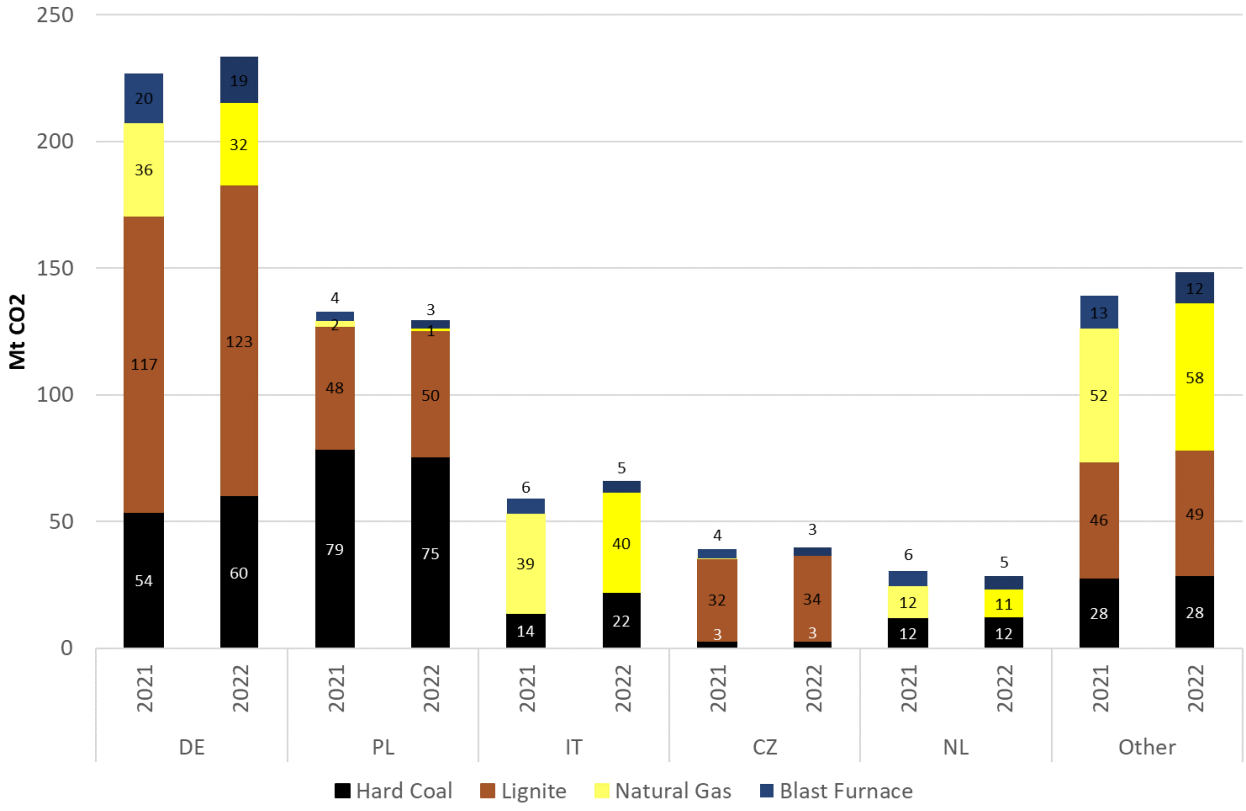
Figure 1-2 Emissions of combustion installations 2020-2022 (without UK)



Source: ETC/CME (2021) based on updated data from EU (2023a)

Figure 1-3 takes a closer look at the change in emissions from power plants in the countries with the highest power-related emissions. Five countries were responsible for nearly 80% of the CO_2 emissions from all power plants in the EU ETS. The emission increase is highest in Germany (+ 6 Mt CO_2 from lignite and + 6 Mt CO_2 from hard coal), followed by Italy (+ 7 Mt CO_2 from hard coal). Emissions from power plants in other countries are relatively constant. Emission reductions from gas-fired power plants was observed in Germany (-5 Mt CO_2), while emissions from gas fired power plants in Italy and the Netherlands were constant. For the emissions trends from power plants in the other countries refer to Figure 1-4.

Figure 1-3 Fuel distribution by country in 2022 (power plants)



Note: Iceland, Liechtenstein and Norway had no identified power plants in 2023

Source: Own matching of EUTL data EU (2023a)

Table 1-2 gives some background on why emissions from (coal) power plants increased in year 2022. There have been substantial changes in electricity production and consumption in the year 2022. Several factors have had an impact:

- A low availability in the French nuclear fleet (-82 TWh) and the closure of three nuclear power plants in Germany (-33 TWh) reduced nuclear production considerably.
- Low precipitation reduced hydro generation (-80 TWh) in many countries (Italy, Norway, Spain and France).
- This reduced production was partly offset by increased production from wind and solar (+ 80 TWh) and a demand reduction (- 87 TWh). As can be seen in Table 1-2 in all countries electricity consumption in 2022 was lower than in 2021, except for Ireland, Cyprus, Portugal and Iceland.
- Coal fired generation only increased by 15 TWh and production from natural gas fired power plants remained more or less constant. Overall, the high prices for natural gas had a lower impact on emissions and electricity generation than initially expected.

Table 1-2 Change in electricity generation between 2021 and 2022

	Change in emissions 2022 vs. 2021*	Consumption 2022 vs. 2021 [TWh]	Net electricity generation [TWh]								
			Total	of which							Net Import
				Thermal	of which **		Nuclear	Hydro	Wind	Solar	
					Coal	Gas					
Total	0.9%	-86.9	-95.1	24.6	14.9	2.6	-118.4	-79.8	37.3	41.2	
LV	-29.9%	-0.3	-0.8	-0.9	N/A	-0.9	N/A	0.0	0.1	N/A	0.5
LT	-25.4%	-0.7	-0.5	-0.5	N/A	-0.5	N/A	-0.1	0.1	0.0	-0.5
SK	-20.5%	-2.6	-3.2	-2.7	0.0	-2.3	0.2	-0.7	0.0	0.0	0.6
LU	-18.7%	-0.3	0.0	-0.1	N/A	-0.1	N/A	0.0	0.0	0.0	-0.2
SI	-18.7%	-0.5	-2.3	-0.6	-0.6	0.0	-0.1	-1.6	0.0	0.1	1.7
RO	-11.6%	-4.4	-3.4	-0.6	-0.6	0.0	-0.3	-3.0	0.4	0.1	-1.0
SE	-9.0%	-7.0	1.0	0.0	0.0	-0.2	-1.4	-4.0	5.6	0.8	-7.7
NL	-7.9%	-4.2	0.3	-9.3	-0.1	-8.4	0.3	0.0	3.2	6.2	-4.5
PL	-6.5%	-2.8	-0.4	-7.0	-2.8	-3.9	N/A	-0.1	2.5	4.2	-2.6
HU	-6.0%	-0.8	-0.4	-1.0	0.0	-0.8	-0.2	0.0	-0.1	0.8	-0.6
GR	-5.6%	-3.7	-3.4	-4.3	0.2	-2.9	N/A	-1.4	0.4	1.8	-0.2
AT	-4.1%	-2.0	-2.1	0.3	-0.2	0.3	N/A	-3.2	0.5	N/A	1.2
FI	-3.2%	-4.1	0.8	-2.3	-0.1	-2.5	1.6	-2.1	3.6	0.0	-4.7
IE	-2.6%	0.9	2.2	0.7	-0.8	1.4	N/A	-0.1	1.6	0.0	-1.4
DK	-0.6%	-3.1	1.7	-2.0	-2.2	-0.4	N/A	0.0	3.0	0.8	-3.5
NO	-0.3%	-6.4	-11.1	0.7	N/A	N/A	N/A	-14.9	3.1	N/A	5.1
CY	0.7%	0.1	0.1	0.0	N/A	N/A	N/A	N/A	0.0	0.1	N/A
CZ	0.9%	-2.5	-0.5	-0.4	2.5	-2.9	0.3	-0.5	0.0	0.1	-2.5
FR	1.3%	-17.7	-78.9	10.6	-1.7	11.4	-81.7	-13.0	1.0	4.2	59.8
PT	1.6%	2.0	-1.7	1.6	-0.7	2.4	N/A	-4.6	0.1	1.1	4.5
DE	2.6%	-14.5	-5.4	7.0	14.4	-7.6	-32.7	-1.2	11.6	10.1	-8.4
MT	3.3%	0.2	0.1	0.0	N/A	0.0	N/A	N/A	N/A	0.1	0.1
BE	5.7%	-5.1	-5.1	-0.1	0.5	-0.3	-6.3	0.3	-0.1	1.2	0.3
IT	9.0%	-1.2	-1.7	12.7	N/A ****	N/A ****	N/A	-16.6	-0.3	2.5	0.2
HR	11.4%	-0.2	-0.9	0.6	0.1	0.4	N/A	-1.7	0.2	0.0	0.8
ES	20.4%	-5.3	16.7	18.4	2.8	16.0	1.9	-10.6	0.6	6.3	-20.7
BG	22.4%	-0.7	2.3	3.0	4.1	-0.9	0.0	-1.3	0.1	0.5	-3.4
EE	30.5%	-0.5	1.1	1.0	N/A	N/A	N/A	0.0	-0.1	0.2	-1.6
IS	60.0%	0.5	0.5	0.0	N/A	N/A	N/A	0.4	0.0	N/A	N/A
LI***											
XI***	-4%										

Note: * Combustion installations (Activity Code 20)

** Additional thermal electricity generation is reported by Eurostat from oil, renewable and non-renewables, which are not shown here.

*** No data for Liechtenstein (LI) and Northern Ireland (XI) available

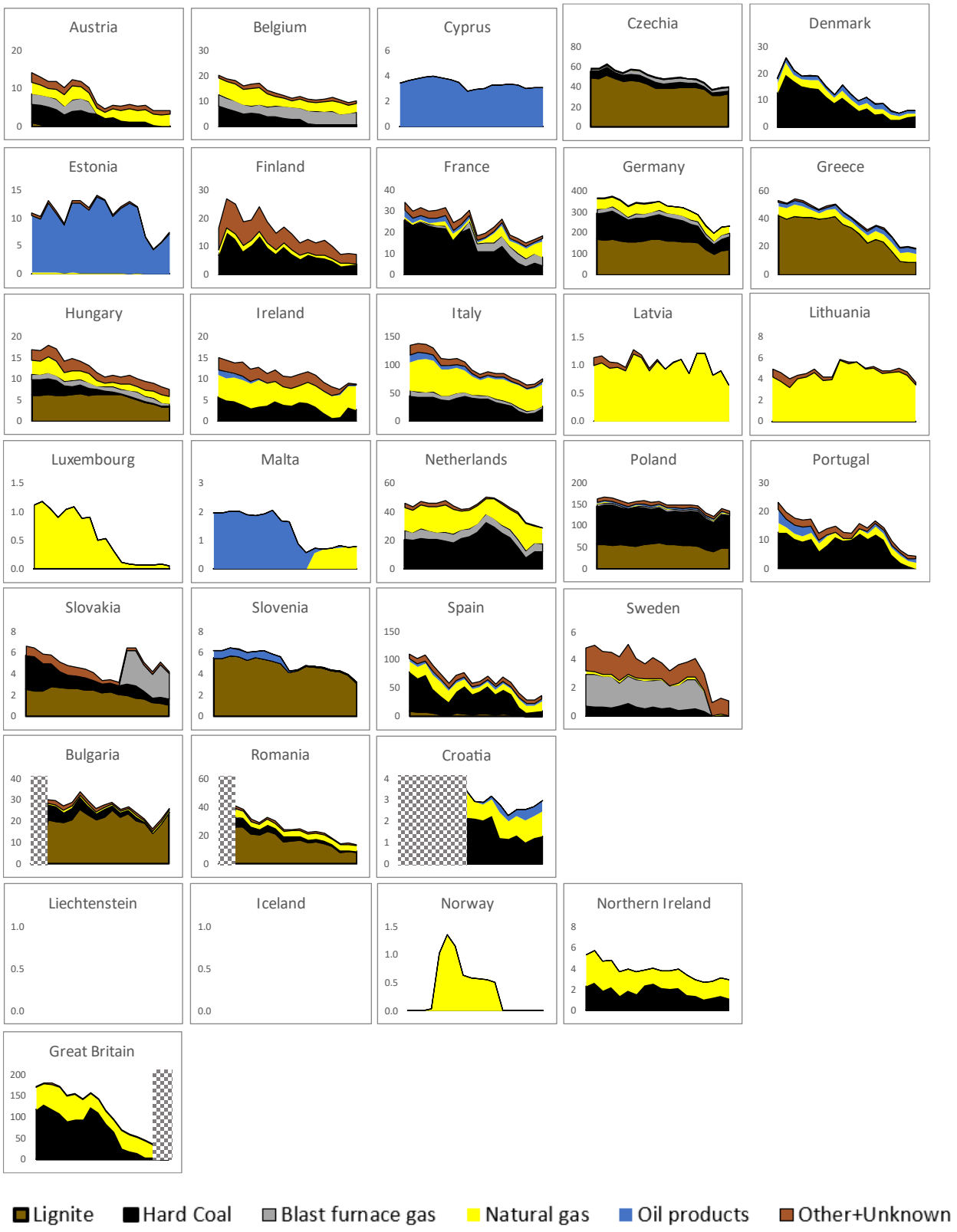
**** No monthly data for Italy

Source: EEA (2023a), Eurostat (2023)

The long-term development of ETS emissions from power plants by fuel and country since 2005 are shown in Figure 1-4 [3]. The trend of emissions shows quite a big difference between countries. Some countries show emission reductions of more than 80% since 2005 (Luxembourg & Portugal). Austria, Denmark, Greece, Romania, Spain and Slovakia achieved emission reductions of more than 60% since 2005. While emissions reductions from power plants were relatively low in other countries: Bulgaria, Cyprus, Croatia and Poland, reduced emissions by less than 20% since 2005 (Bulgaria since 2008, Croatia since 2013).

[3] See ETC/CME 2021 for methodology.

Figure 1-4: ETS emissions of power plants by fuels and by country from 2005-2022 [Mt CO2]



Note: No fossil power plants in Iceland and Liechtenstein. Bulgaria and Romania joined in 2007, Croatia in 2013. Great Britain left in 2020 but Northern Ireland remained in the EU-ETS. Since 2020 Sweden reports the emissions from the blast furnace power plant under activity code 24

Source: Own matching of EUTL data EU (2023a)

Table 1-3 shows the 30 largest power plants covered by the EU ETS. They emit about 278.5 Mt CO_2 in 2022, about 9% more than in 2021. These power plants account for about 34% of total combustion emissions in 2022. The individual installations with the highest emissions in the EU ETS are lignite-fired power plants, mainly located in Poland or Germany. The largest emitter of all EU ETS installations is the lignite-fired power plant in Bełchatów, Poland, which emits 35.1 Mt CO_2 in 2022. This is 6% more than in 2021. Bełchatów is followed on the list of top emitters by five German lignite-fired power plants. Lignite dominates the top 30 list. The 17 lignite-fired power plants in the top 30 had verified emissions of 201 Mt CO_2 (17 Mt CO_2 more than 2021). This represents 72% of all emissions in the top 30. Most emissions in the top 30 list come from Germany (46% of all emissions in the top 30 list).

Table 1-3 Top 30 emitters in 2022 (power plants)

Rank		EUTL ID	Company	Power Plant	Main Fuel	Verified Emissions 2021 ($MtCO_2$)	Verified Emissions 2022 ($MtCO_2$)	Change
1	=	PL 1	PGE	Bełchatów	Lignite	33.2	35.1	6%
2	=	DE 1606	RWE	Neurath	Lignite	22.1	24.2	10%
3	=	DE 1649	RWE	Niederaußem	Lignite	16.1	17.0	6%
4	=	DE 1456	LEAG	Jänschwalde	Lignite	15.2	15.3	1%
5	=	DE 1607	RWE	Weisweiler	Lignite	14.5	14.9	3%
6	↑(8)	DE 1460	LEAG	Lippendorf	Lignite	11.1	11.9	8%
7	=	PL 4	Enea	Kozienice	Hard coal	11.6	11.9	2%
8	↑(10)	PL 3	PGE	Turów	Lignite	10.2	11.2	10%
9	↑(11)	DE 1454	LEAG	Boxberg Werk IV	Lignite	8.6	11.1	30%
10	↑(13)	BG 50	TPP	Maritsa East 2	Lignite	6.7	10.9	64%
11	↓(6)	DE 1459	LEAG	Schwarze Pumpe	Lignite	11.8	9.6	-19%
12	↓(9)	PL 2	PGE	Opole	Hard coal	10.7	9.1	-15%
13	↓(12)	DE 1453	LEAG	Boxberg Werk III	Lignite	7.0	8.0	15%
14	↑(32)	IT 521	ENEL	Brindisi Sud	Hard coal	3.9	7.4	91%
15	↓(14)	BG 9	Contour Global	Maritsa East 3	Lignite	6.4	7.1	12%
16	↓(15)	PL 5	ENEA	Połaniec	Hard coal	6.0	7.1	18%
17	↑(19)	DE 1380	Großkraftwerk Mannheim	Mannheim	Hard coal	5.0	6.0	19%
18	↑(20)	GR 15	ΔΕΗ AE	Dimitrios	Lignite	4.5	5.9	29%
19	↑(28)	IT 439	ENEL	Torrevaldaliga Nord	Hard coal	4.1	5.4	31%
20	↑(23)	CZ 124	Sev.en	Pocerady	Lignite	4.4	5.1	16%
21	↑(37)	BE 750	Electrabel	Electrabel - Knippegroen	Blast furnace gas	3.6	5.0	38%
22	↑(27)	DE 1457	EnBW	RDK Karlsruhe	Hard coal	4.2	4.8	15%
23	↓(16)	NL 205957	RWE	Eemshaven Centrale	Hard coal	5.3	4.7	-11%
24	↓(22)	BG 152	AES	Maritza East 1	Lignite	4.4	4.7	6%
25	↓(17)	ES 201	EDP	Aboño 1	Hard coal	5.2	4.6	-12%
26	↑(42)	CZ 120	Sev.en	Elektrarna Chvaletice	Lignite	3.4	4.6	34%
27	↓(24)	DE 1376	Saale Energie	Kraftwerk Schkopau	Lignite	4.4	4.4	0%
28	↓(21)	FR 988	Engie Thermique France	CENTRALE DK6	Blast furnace gas	4.4	4.0	-11%
29	=	NL 188	Nuon Power Generation B.V.	Nuon Power Velsen	Blast furnace gas	4.0	3.9	-3%
30	↑(53)	EE 2	Eesti Elektrijaam	Narva	Oil products	2.6	3.8	48%

Note: All installations are power plants reporting under the activity code combustion in the EUTL.

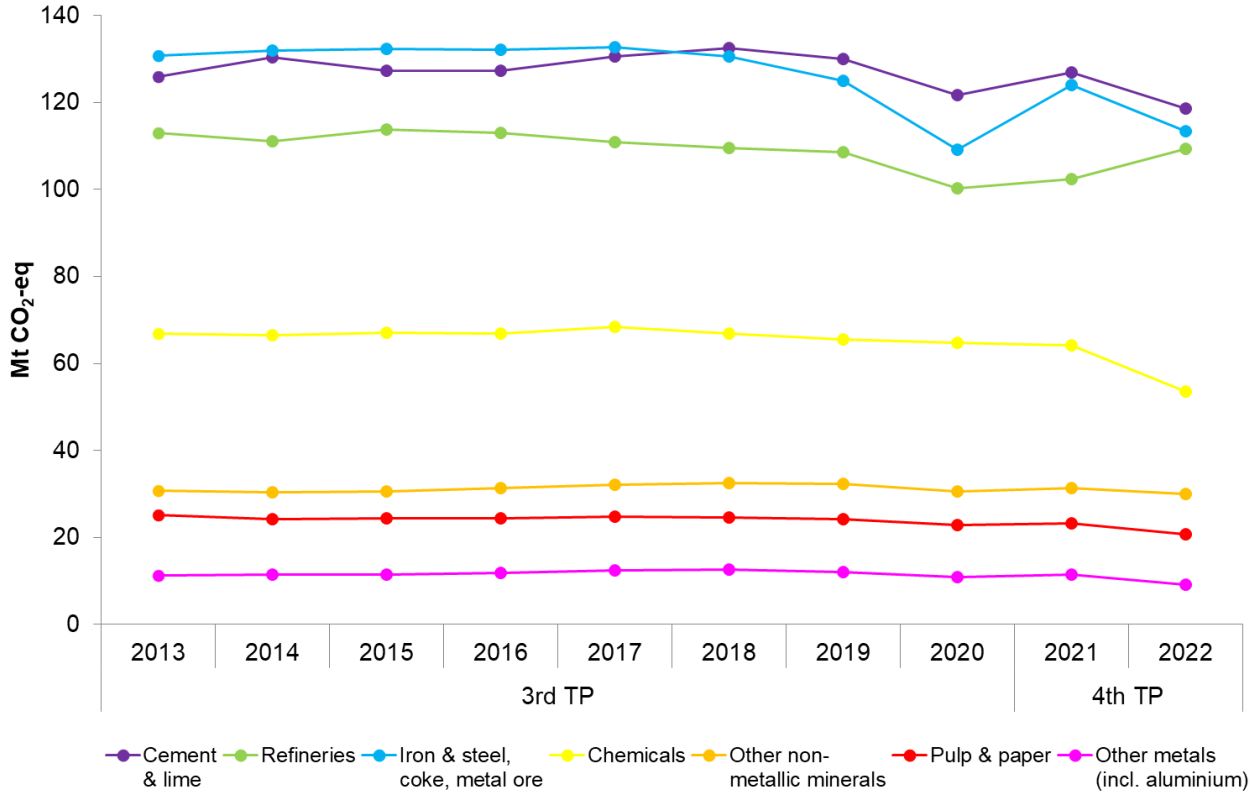
Values in brackets show the ranking from the previous year

Sources: EU (2023a) based on methodolgy from ETC/CME (2021)

1.1.2.2 Industry

Since 2013 emissions have been more or less constant in industrial sectors (Figure 1-5). In 2020 emissions decreased due to the Covid-19 pandemic and rebounded in 2021. Due to the high energy prices for natural gas in the year 2022 substantial emission reductions in industrial sectors were observed (-31 Mt CO_2 or -6% compared to year 2021) and emissions in industrial sectors have reached a level similar to the year 2020 [(4)]. The reduction in 2022 compared to 2021 was highest in the chemicals sector (-17%) and other metals (-20%). Only in the refinery sector did emissions increase, by 7% (+7 Mt CO_2). In absolute terms the following sectors contributed most to emission reductions: iron and steel (-11 Mt CO_2), chemicals (-11 Mt. CO_2) and cement and lime (- 9 Mt CO_2).

Figure 1-5 EU ETS emissions by main industrial activity in the EU-27



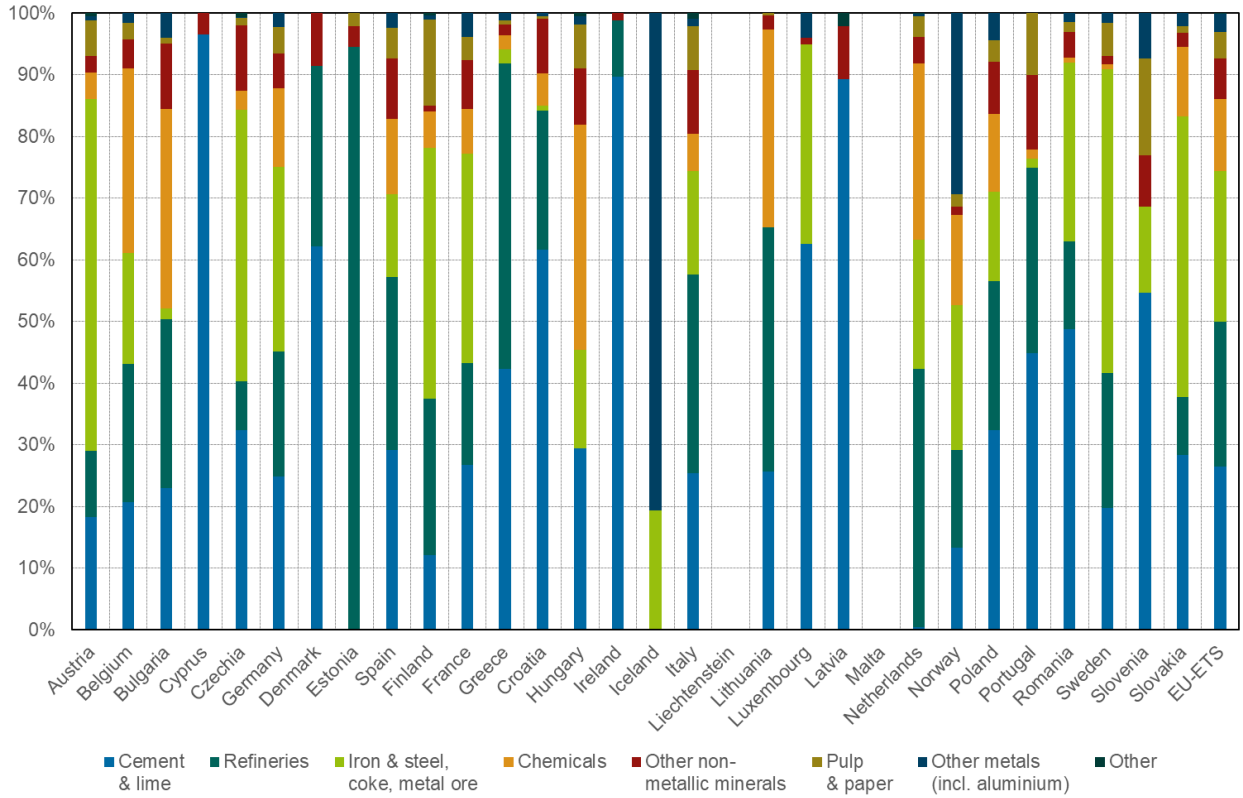
Note: ETS activity codes have been aggregated for certain sectors (refer to Table A1.1).

Source: Own matching based on EEA (2023a)

Figure 1-6 shows the distribution of EU ETS industrial emissions by country in 2022. While no EU ETS emissions could be attributed to industry in Liechtenstein and Malta in 2022, the cement and lime sector is present in most countries and accounts for a large share of emissions in all of them. Refineries account for a large share of industrial emissions, particularly in Estonia, Greece and the Netherlands. Iron and steel are dominant in Austria and the Czech Republic. The chemical industry also has a large share in Belgium, Bulgaria, Hungary, Lithuania, and the Netherlands.

(4) For long-term trends since 2005 see ETC/CM (2022).

Figure 1-6 EU ETS industrial emissions by sector in 2022



Note: No EU ETS Emissions from Indusytry in Liechtenstein and Malta

Source: own matching based on EEA (2023a)

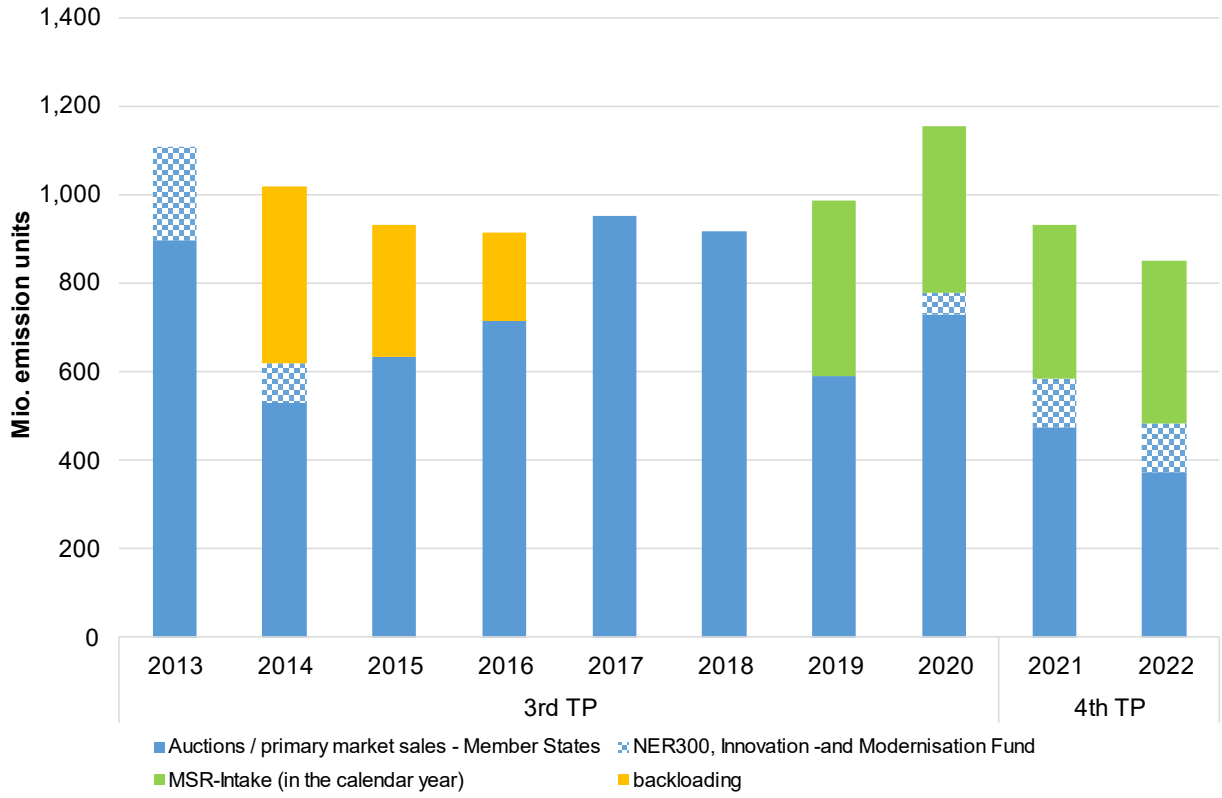
1.1.3 Supply of allowances

The supply of allowances in the EU ETS is determined by free allocation (Figure 1-9) and the auctioning of allowances (Figure 1-7).

1.1.3.1 Auctioned allowances and MSR-intake

The following graph shows auctions in the EU ETS for the stationary sector since 2013. In the year 2022, total auctions equalled 481 million allowances (including the Modernisation and Innovation fund). The number of allowances auctioned in the EU ETS depends on the MSR. The auctions are reduced by the MSR each year depending on the surplus (of the Total Number of Allowances in Circulation - TNAC). In 2022 the intake of the MSR was 369 million allowances. This illustrates that the MSR had a significant impact on the supply of allowances in the EU ETS.

Figure 1-7 EUA auction quantities and MSR-intake since 2013



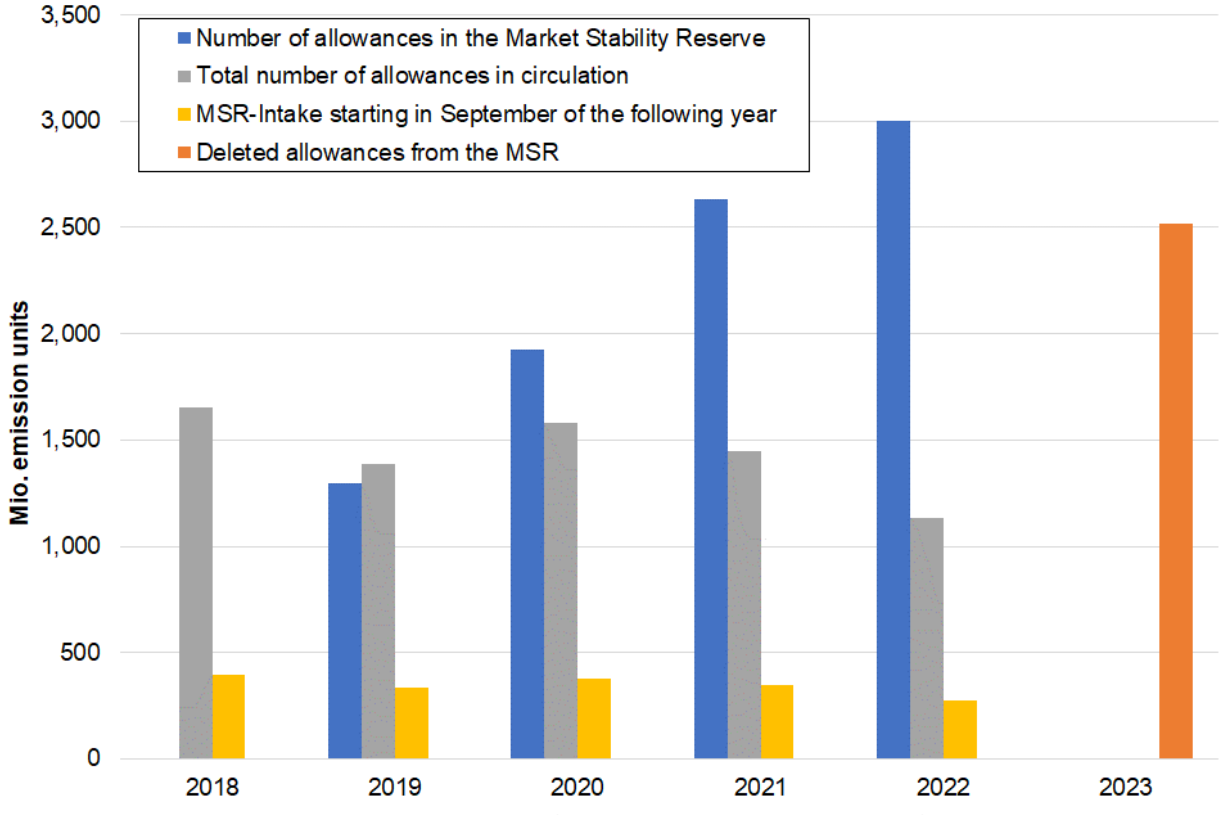
Note : MSR intake that has actually happened in the respective calendar years

Source: EEX (2023), ICE (2021)

Figure 1-8 shows the development of the TNAC since the start of the MSR. The TNAC is published in mid-May for the previous year. Initially the TNAC declined from 1.65 billion allowances in 2018 to 1.38 billion allowances in 2019. However, an increase in the TNAC to 1.58 billion allowances occurred in 2020 due to both the impact of the Covid-19 pandemic reducing the demand for allowances as industrial output declined, and the UK auctioning two years of its supply in 2020 (UK did not auction in 2019). The TNAC at the end of 2022 amounts to EUA 1.14 billion allowances (EC 2023b). The MSR will absorb 24% of this TNAC (272 million EUA), and the auction volumes will be reduced accordingly in the period from 1 September 2023 to 31 August 2024.

Since the beginning of 2023 the amount of emission allowances in the MSR is limited. In 2023 the limit corresponds to the quantity of auctions in year 2022. From 2024 onwards, following the review of the EU ETS, this quantity will be reduced to 400 million. Quantities exceeding the limit are deleted from the MSR. The first deletion from the MSR-1 took place in January 2023 with a volume of around 2.5 billion allowances (EC 2023b).

Figure 1-8 **Key indicators about the MSR**



Note: MSR intake that has actually happened in the respective calendar years

Number of allowances in the MSR and TNAC for 2023 is not yet available and will be published in May 2024

Source: EC (2023b) and previous TNAC publications

1.1.3.2 Free allocation

In the EU ETS, auctioning was introduced for electricity generation in 2013, with the exception of a transitional free allocation for the modernisation of the electricity system under Article 10c of the EU ETS directive (yellow bars in Figure 1-9). For other installations there is a free allocation based on historical production and product benchmarks. As can be seen in Figure 1-9 the overall amount of free allocations has decreased significantly over the years. While free allocations for existing installations have decreased by only 1-3% each year, the share of transitional free allocation under Article 10c of the EU ETS Directive in particular has decreased in the third trading period. To ensure a level playing field between new entrants and incumbents, a New Entrants Reserve (NER) of 480 million [(5)] allowances was set aside at the start of the third trading period for new installations [(6)] and existing installations with a 'significant' increase in capacity [(7)].

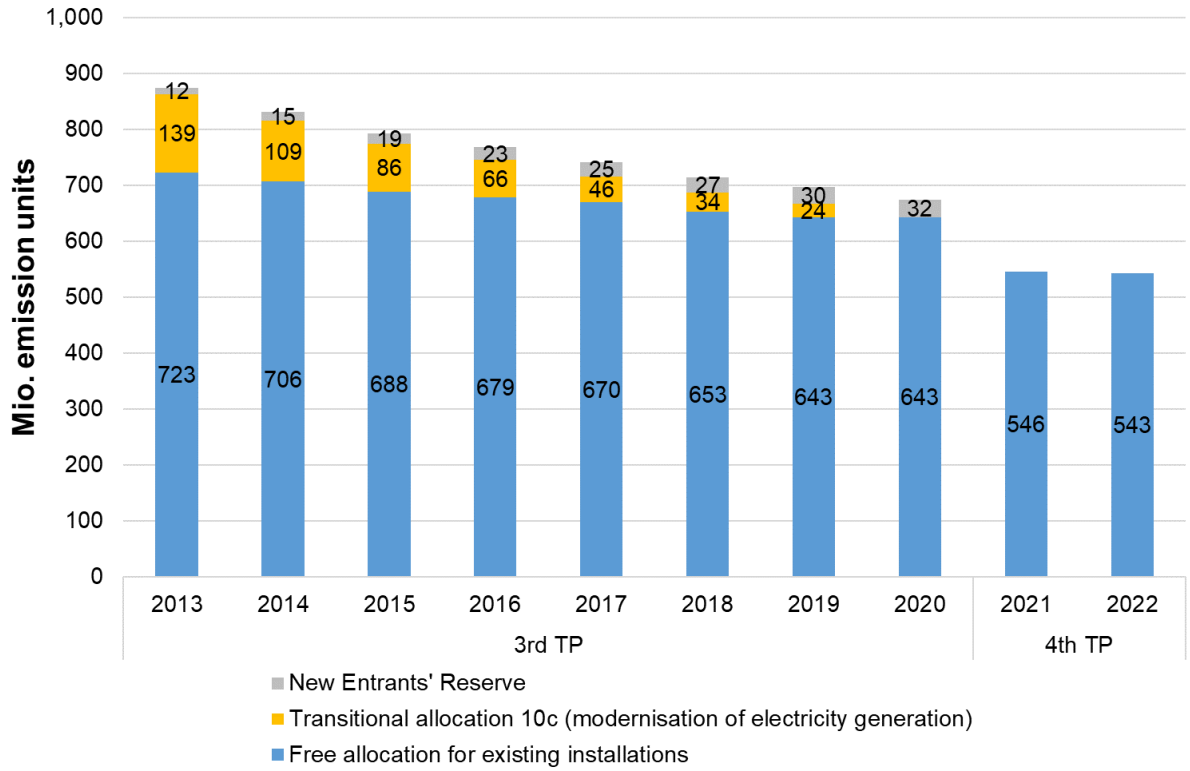
(5) The original amount was 780 million allowances, from which 300 million were deducted for the NER 300 funding programme. NER 300 aims to establish a demonstration programme comprising the best possible projects on carbon capture and storage and renewable energy sources and involving all Member States.

(6) Namely obtaining a permit for the first time after 30 June 2011 or any installation carrying out an activity included in the EU ETS for the first time.

(7) Significant capacity extension means a significant increase in a sub-installation's initial installed capacity of at least 10 %, resulting in a significantly higher activity level ((EC 2011).

By the end of the third trading period out of these 480 million allowances 183 million allowances were used (38%). From the remaining allowances 200 million allowances will be put in the fourth trading period NER (see EC 2020) and the rest has been placed into the MSR. The number of allowances allocated for free from the New Entrants' Reserve, on the other hand, has increased over time (from 12 million allowances in 2013 to 32 million allowances in 2020). So far, no stationary plants have received allocations from the NER in the fourth trading period. In 2022 free allocation was 543 million allowances.

Figure 1-9 Free allocation of emissions allowances from 2013 to 2022



Source: EEX (2023), ICE (2021)

Article 10(c) of the ETS Directive provides a derogation from the general rule that allowances should no longer be allocated for free to electricity generation. This derogation applies to ten eligible Member States [8]. During the fourth trading period, eligible countries can allocate a maximum of 40% of their regular allowances to article 10c derogation. Of the eligible countries only Bulgaria, Hungary and Romania will continue to apply article 10c, while the other eligible countries chose to either auction these allowances or transfer them to the Modernisation Fund (EC 2022a). No allowances under article 10c have been issued within the fourth trading period so far, as the respective countries still need to establish national frameworks.

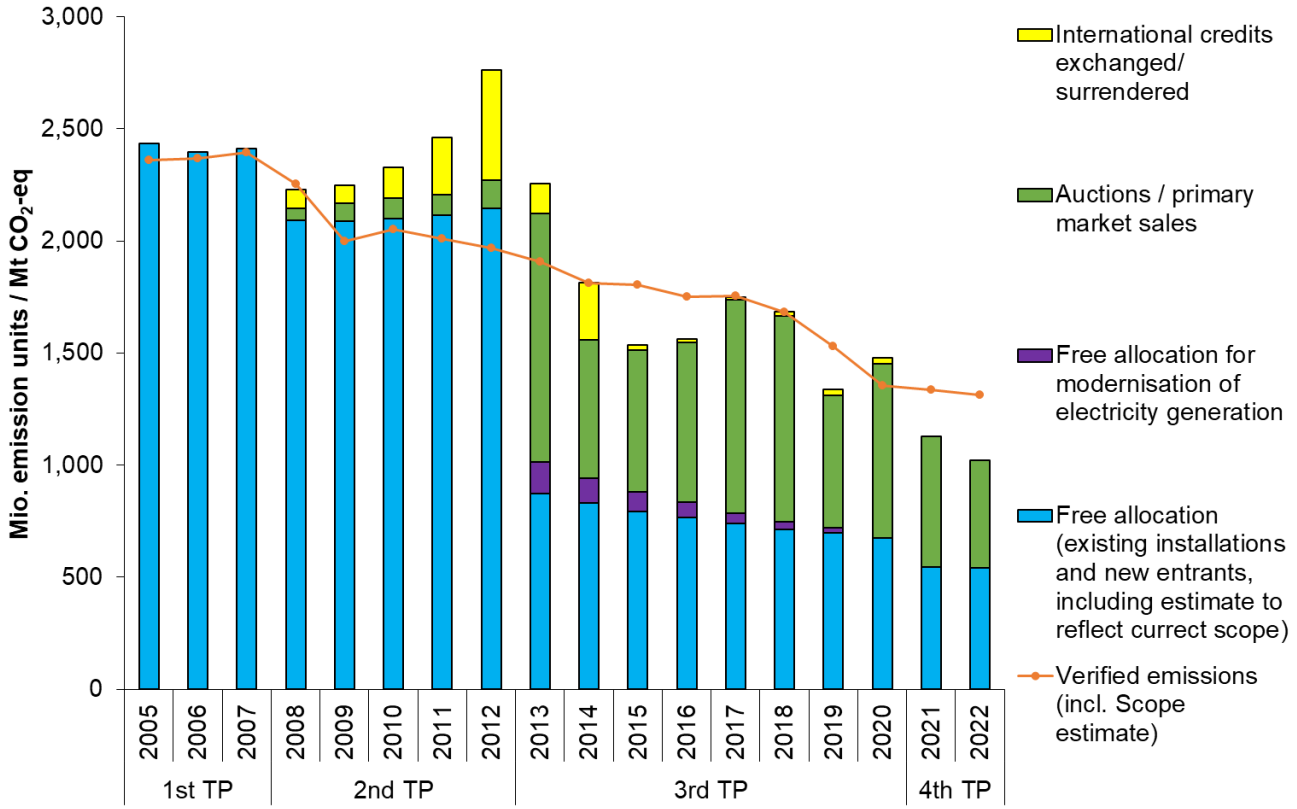
1.1.3.3 Supply and demand for allowances and impact on the allowance price

Figure 1-10 shows the supply and demand for allowances between 2005 and 2022 and the impact on the allowance price. In previous trading periods, the allowance price has been low as a consequence of the surplus

[8] Bulgaria, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland and Romania.

of allowances that developed over the second trading period following the economic crisis of 2007/08 and the EU ETS was not at the time designed to be resilient to such an external shock. Subsequent reforms to the EU ETS were adopted in order to address the surplus of allowances ranging from the backloading of allowances to eventually the establishment of the MSR (see previous publications for a more detailed explanation of these historical developments).

Figure 1-10 Supply and demand balance for stationary installations (2005-2022)



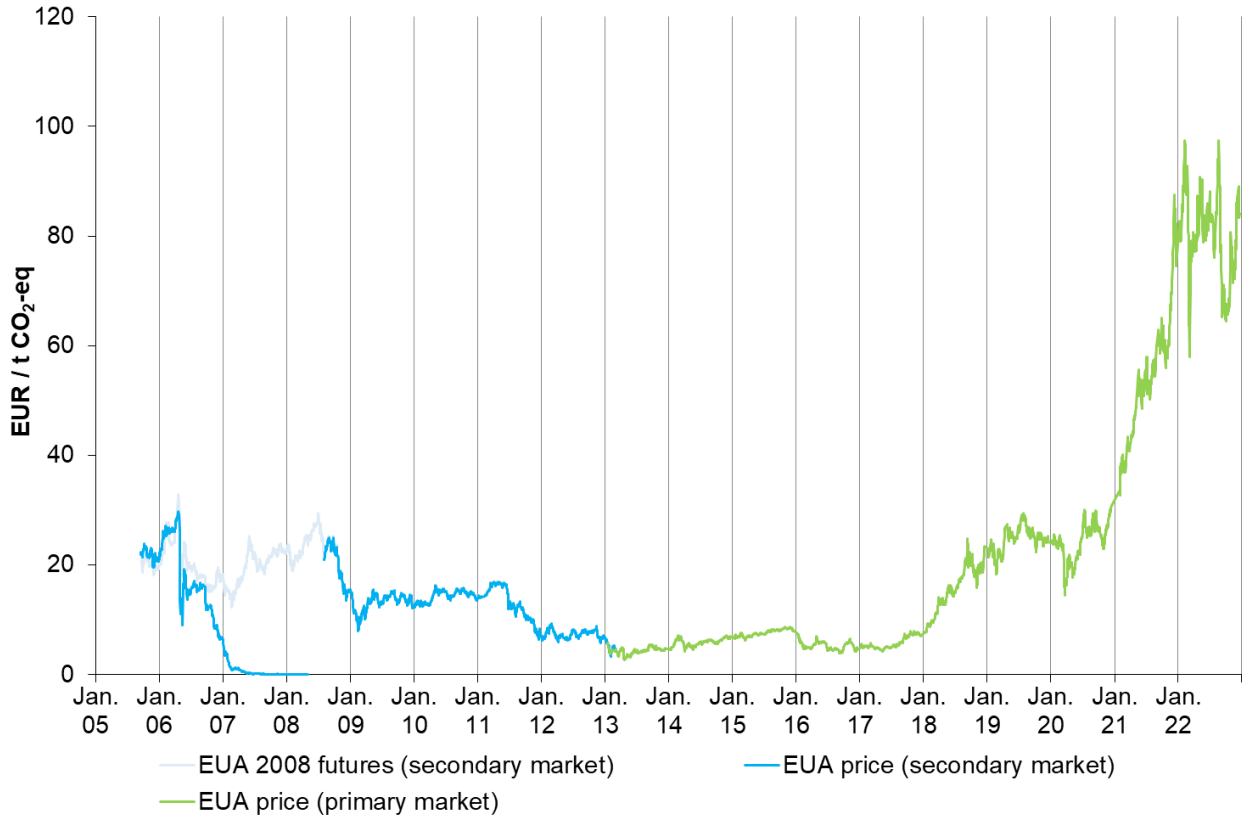
Note: including UK until 2020

Source: EEA (2023a)

In 2019, verified emissions exceeded the amount of allowances made available to the market, reflecting a reduced auction supply as the MSR became operational and took allowances off the market, as well as the suspension of auctions on behalf of the UK. In 2020, the level of verified emissions was again slightly lower than available allowances, as emissions were affected by the Covid-19 pandemic and auctioned allowances increased as the UK withheld 2019 allowances from the market.

Following the revision of the ETS Directive for the fourth trading period in 2018, the allowance price increased rapidly and had exceeded EUR 20 per EUA by the end of December 2018. At the start of the Covid-19 pandemic, the EUA price temporarily fell to EUR 14.60, but during the course of 2020, it returned to the previous year's level (Figure 1-11). With the beginning of the war in Ukraine the EUA price temporally dropped to EUR 58 but in total remained at a high level with an average price of EUR 80 in 2022. The price increase reflects the currently high fuel switch costs from coal to gas and the expectation that the supply of allowances will be reduced in the long-term, confirmed by the reduced cap adopted in the revised EU ETS directive (EU 2023b).

Figure 1-11 Price trends for allowances and certified emission reductions (2005-2022)



Sources: Point Carbon (2012), EEX (2023), ICE (2021)

1.2 Aviation

1.2.1 Overview

The EU ETS also covers the aviation sector. In 2022, aviation emissions increased significantly compared to the previous year. As shown in Table 2-4, emissions increased by 76% to 48.7 Mt CO_2-eq. This increase was expected as the aviation industry recovers from the Covid-19 pandemic. On the other hand, the total supply of allowances decreased slightly in 2022. Ryanair has caused by far the most emissions among the flight operators within the EU ETS (see Table 1-5). In the overall ranking, Ryanair is even in 12th place among all EU ETS entities and the biggest entity that is not a coal-fired power plant. The 10 biggest airlines are responsible for 61% of all aviation emissions reported in the EUTL in 2022. In 2022, 15% of the total cap for the aviation sector was auctioned, the rest was allocated for free.

Table 1-4 EUAA demand, supply and price (aviation operators), 2020-2021

	2021	2022	Change
Total demand (Mt CO_2-eq.)	27.7	48.7	**75.9%**
Aviation emissions	27.7	48.7	**75.9%**
Total supply (millions of EUAAs)	27.4	26.4	**-3.5%**
Aviation free allocation	23.3	22.4	**-3.7%**
Aviation free allocation (NER)	0.3	0.2	**-2.2%**
Average auctioned amounts	3.8	3.7	**-2.3%**
Annual supply-demand balance (millions of EUAAs)	-0.3	-22.3	-
Swiss Verified Emissions for aircraft operators (Swiss Linking) (Mt CO_2-eq)	0.28	0.50	**-82.6%**
Allocation Switzerland (Swiss Linking)	0.38	0.36	**-3.9%**
EUAA price* (EUR)	53.30	79.79	**49.7%**

Notes: NER, New Entrants Reserve.

*Average price. Due to the Covid-19 pandemic, fluctuations were wider than usual.

w/o UK = The majority of the EU ETS accounts of aviation companies that were previously allocated to the British national authority have been transferred to other national authorities within the EU.

Sources: EC (2023b), EEA (2023a), EEX (2023)

Table 1-5 illustrates how free allocation is distributed to the aviation companies. In 2022, free allocation was equal to 40% of aviation emissions. Free allocation is based on historic activity data, so fast-growing airlines must buy a higher share of allowances to cover their emissions.

At the beginning of 2020, the EU ETS was linked to the Swiss ETS. Since then, companies that are subject to emissions trading have been able to use Swiss equivalents in addition to the EUAs and EUAAs to fulfil their obligations. As all allowances are fully fungible between both systems, Swiss allowances can be used in the EU ETS and vice versa. The Swiss ETS has only a comparatively small volume, and therefore the impact on the EU ETS is very small (see ICAP 2021). Flights from the EEA to Switzerland are covered by the EU ETS and flights from Switzerland to the EEA are covered by the Swiss ETS. Aircraft operators operate under a “one-stop shop”. This means an aircraft operator is administered by one single competent authority, be it an EU ETS Member State or Switzerland. Aircraft operators only need one operator holding account for both schemes. In 2022, aircraft operators administered by an EEA Member State received free allocation from the Swiss ETS equal to 0.36 M. These aircraft operators reported emissions equal to 0.50 Mt CO_2-eq for flights that were covered by the Swiss ETS. The “one-stop-shop” works in both directions. In 2022 aircraft operators administered by Switzerland reported aviation emissions equal to 0.75 Mt CO_2-eq for flights covered by the EU ETS (EC 2023a). Free allocation for these flights was 0.39 M EUAA. Emissions from flights covered by the EU ETS from aircraft operators administered by Switzerland are not included in the analysis in this chapter.

Table 1-5 Free allocation to the top 10 emitters in aviation in 2022

	Verified Emissions EU ETS Mt CO_2-eq	Allocated EU ETS millions of EUAAs	Verified Emissions Swiss ETS Mt CO_2-eq	Allocated Swiss ETS millions of EUAAs
Total Aviation	48.7	22.4	0.50	0.36
Ryanair	9.4	3.5	0.00	0.00
EasyJet	3.2	1.8	0.07	0.06
Lufthansa	3.1	2.0	0.03	0.02
Wizz Air	2.2	0.6	0.00	0.00
Air France	2.0	1.5	0.03	0.02
Vueling Airlines	1.9	0.6	0.02	0.02
KLM	1.4	0.7	0.03	0.02
SAS	1.3	1.2	0.02	0.02
Norwegian	0.9	0.8	0.00	0.00
British Airways	0.8	0.5	0.00	-
Other	19.2	9.5	0.31	0.19

Source: EU (2023a)

The scope of the flights covered by the EU ETS has changed over time. In 2012 a "full scope" was applied. From 2013 onwards only intra EEA (European Economic Area) flights were covered. Since 2021, after Brexit, flights within the UK and from the UK to the European Economic Area (EEA) are no longer covered by the EU ETS but are covered by the UK emissions trading system. Flights from the EEA to the UK continue to be covered by the EU ETS. The EU ETS also covers flights from the European economic area to Switzerland (compare Table 1-5).

1.2.2 Trend of emissions

In 2022, aviation emissions from operators reporting their emissions under the EU ETS amounted to 48.7 Mt CO_2, an increase of 76% compared to the previous year (Table 1-6). Although this is a significant increase, it is still below pre-pandemic levels. With 9.4 Mt CO_2, Ryanair has caused by far the most emissions among the flight operators within the EU ETS. In the overall ranking, Ryanair is even in 12th place among all EU ETS entities and the biggest entity that is not a coal-fired power plant.

Table 1-6 Total aviation emissions and the top 10 emitters in aviation between 2012 and 2022 reported in the EUTL

	Verified emissions (Mt CO_2-eq)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total Aviation	84.0	53.5	54.8	57.1	61.5	64.4	67.5	68.2	24.9	27.7	48.7
Ryanair	7.5	6.6	6.6	7.4	8.4	9.2	9.9	10.5	4.2	4.9	9.4
EasyJet	5.1	4.5	4.6	4.9	5.3	5.7	6.3	6.6	1.9	1.5	3.2
Lufthansa	4.9	4.4	4.0	3.8	3.8	4.0	4.4	4.4	1.4	1.7	3.1
Air France	3.8	2.6	2.4	2.4	2.3	2.4	2.4	2.5	1.2	1.4	2.0
SAS	3.6	2.3	2.4	2.4	2.4	2.5	2.5	2.4	0.9	0.9	1.3
British Airways	2.5	2.5	2.5	2.6	2.7	2.7	2.7	2.6	0.9	0.3	0.8
Wizz Air	1.1	1.1	1.3	1.5	1.8	2.1	2.3	2.4	1.2	1.2	2.2
Vueling Airlines	1.3	1.3	1.6	1.8	2.0	2.0	2.2	2.2	0.6	1.0	1.9
KLM	1.9	1.5	1.6	1.6	1.6	1.8	1.8	1.9	0.8	1.0	1.4
Norwegian	1.7	1.8	2.1	2.0	1.4	1.2	1.3	1.3	0.4	0.5	0.9
Other	45.6	20.3	21.2	21.7	24.3	25.2	25.5	24.9	9.5	11.8	19.2

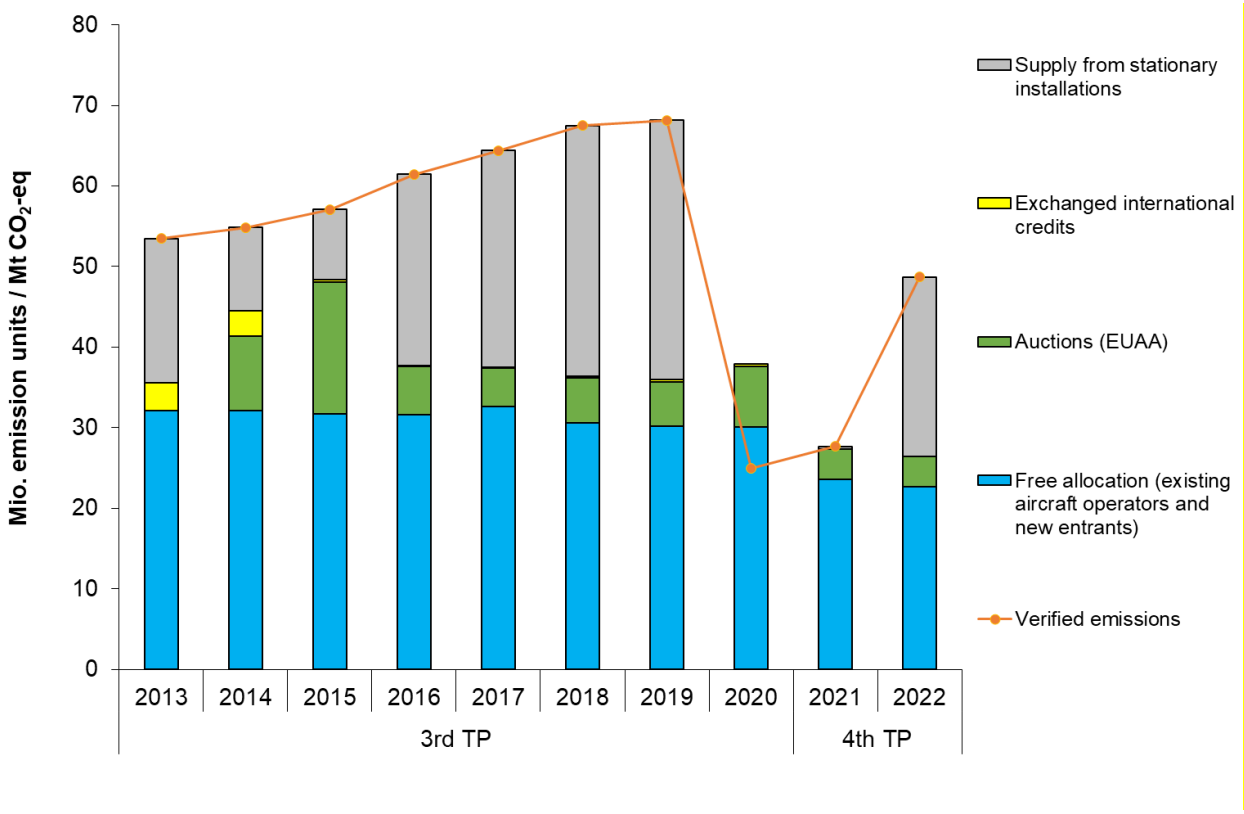
Note: The scope has changed over time

Source: EU (2023a)

1.2.3 Supply and demand for allowances and impact on the allowance price

Historically the aviation sector has been a net buyer of allowances from the stationary sector. Due to the Covid-19 pandemic, the year 2020 was an exemption as there was a surplus of 11 million EUAAs. In 2021 the demand and supply of the aviation sector was balanced. In 2022 the aviation sector is back as a net buyer of allowances (Figure 1-12). Overall, the aviation sector imported 22 million EUAs from the stationary sector in 2022 (refer back to Table 1-4).

Figure 1-12 Demand and supply balance for aviation allowances (2012-2022)



Notes: Auctions of aviation allowances were suspended after the 'stop the clock' decision taken in 2012. The allowances attributable to 2013, 2014 and 2015 were all auctioned in 2015. The volume of aviation allowances effectively released to the market in 2015 was equal to 16.4 million EUAAs.

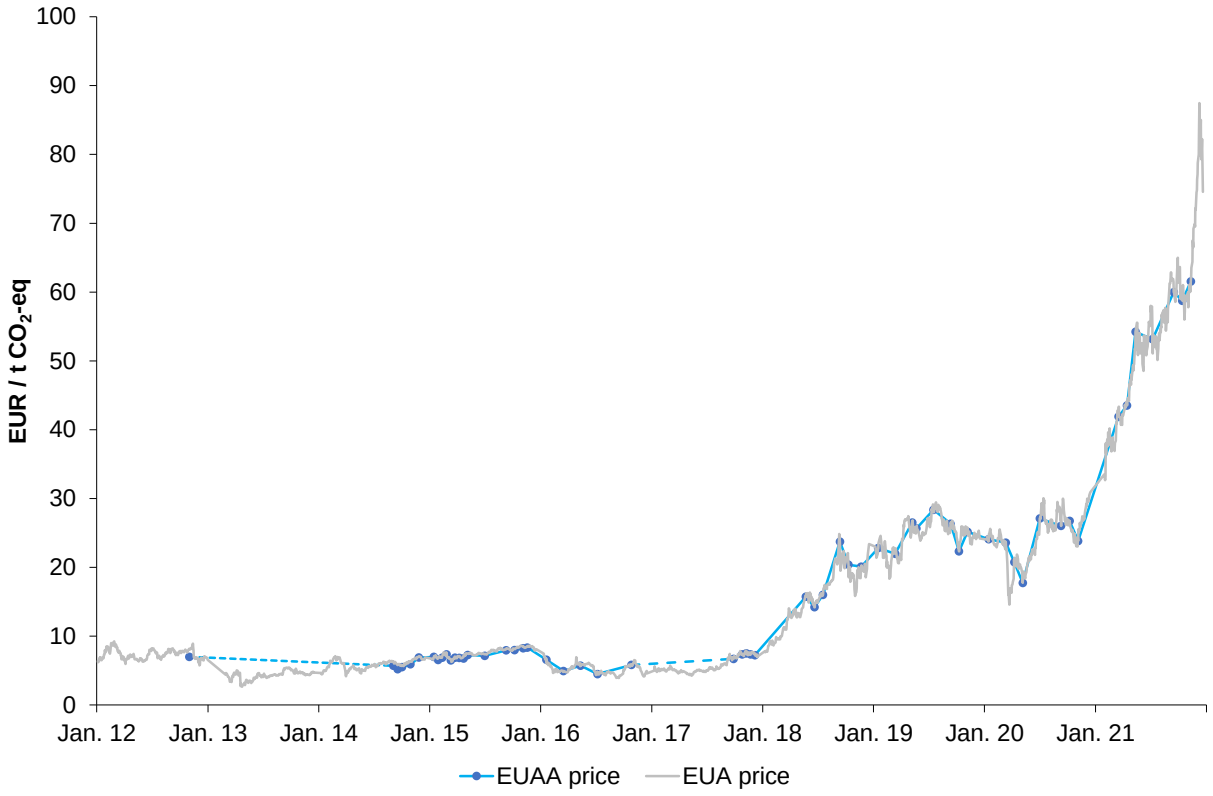
International credit use by aircraft operators in the third trading period is not reported. The European Commission reports that operators of stationary installations and aircrafts, together, have exchanged international credits equal to 99% of their total entitlements in 2020. Numbers shown in this figure assume that aircraft operators as a group have also used up 99 % of their entitlements by 2020. Amounts from 2015 onwards are so small that they are hardly visible in the figure (< 0.3 million per annum).

Sources: EC (2021), EEA (2023a)

Figure 1-13 shows the price trend of EUAAs since 2012. Following the reduction in the volume of aviation activities covered by the EU ETS between 2012 and 2013, the auction calendar was revised, resulting in no EUAAs being auctioned in 2013. A further delay in the 2017 auction, due to the extension of the stop-the-clock decision [(9)], led to another gap in EUAA price data in the same year. Similar to the EUA price, the EUAA price has been on a steep upward trend since the beginning of 2018. Auctions of EUAAs are less frequent than auctions of EUAs. For example, there have been seven auctions of EUAAs in 2022. At the beginning of 2022, the highest price was 97 EUR/EUAA. For the whole of 2022, the average price was 80 EUR/EUAA.

(9) The 'stop-the-clock' decision, which covered the period 2013-2016, excluded flights to and from outermost regions and third countries, while flights between EEA airports remained fully covered.

Figure 1-13 Price trends for EUAAs compared with EUAs (2012-2021)



Note: The EUA price represents historical spot price data from the secondary market in 2012. In the third trading period, the EUA price refers to primary market auctioning data from the EEX and ICE trading platforms. This trend is compared with the shorter time series of EUAA prices from primary market sales at the EEX and ICE trading platforms.

Sources: Point Carbon (2012), EEX (2023), ICE (2021)

2 Outlook until 2030 and 2050

With the latest revision of the ETS Directive, which entered into force in May 2023, the cap has been adjusted to enhance the contribution of the EU ETS to the more ambitious overall GHG net reduction target of 55% compared to 2005. Instead of a reduction of 43% compared to 2005, the target has now been set to 62%. In addition, emissions of maritime transport have been included, the amount of free allowances will be reduced and further changes to the ETS-1 system have been introduced or are under scrutiny. A new and separate upstream ETS-2 will start in 2027 and a Carbon Border Adjustment Mechanisms (CBAM) will be in place from 2026 onwards.

2023 is a mandatory reporting year for GHG emission projections following Article 18 of the Governance Regulation. All countries participating in the EU ETS, apart from Liechtenstein and Northern Ireland reported updated emission projections. These show a considerable increase of ambition compared to the previously reported emission projections. For the first time, these projections cover the timespan until the year 2050.

EU ETS stationary emissions of ETS-1 are projected to decrease until 2030 by 55% compared to 2005 after a short-term increase of emissions. If reported additional measures are also taken into account, emissions in stationary EU ETS sectors are projected to decrease by 59% compared to 2005. This is not sufficient for the targeted reduction of 62% for the overall EU ETS-1, which also includes increasing emissions of aviation.

At the EU level, the difference between scenarios (with existing and with additional measures) is stable after 2030. If additional measures are considered, the total reduction until 2050 for ETS-1 stationary installations adds up to 71% compared to 2005. This is not in line with the availability of ETS certificates and with the EU climate neutrality target in 2050. Some Member States even project increasing ETS emissions after 2030.

Aviation emissions are projected to recover from the Covid-19 pandemic until 2025, with a considerable increase in domestic aviation emissions. After this year, total aviation emissions are projected to increase steadily until 2050. This development is not compatible with the ReFuelAviation Regulation, which aims to reduce aircraft CO_2 emissions by around two-thirds compared to a 'no action' scenario.

2.1 Revised EU ETS Directive

With the more ambitious GHG target for 2030 of a net reduction of 55% compared to 1990 levels, the ambition of the two instruments that are designed to support the achievement of the target, the Effort Sharing Regulation and the EU ETS, had to be raised too. The revised EU ETS directive (EU) 2023/959 was published in May 2023 (EU 2023b).

With this revision, the reduction target of the EU-ETS-1 has significantly increased, from -43% compared to 2005 to -62% by 2030, including the stationary sector, aviation and shipping. This target is to be achieved by increasing the linear reduction factor (LRF) from 2.2% to 4.3% from 2024 and to 4.4% from 2028 [10]. Furthermore, an additional reduction of the cap will be implemented at two points in time (2024 and 2026) (rebasing). In 2024, the cap will be reduced by 90 million allowances and in 2026 by 27 million allowances (Art. 9 of the European Emissions Trading Directive 2003/87/EU).

The scope of the EU ETS-1 is to be extended to maritime transport. This increases the cap by 78.4 million EUAs in 2024 (74.5 million EUAs after application of the linear reduction factor) (European Comission 2023). There will be a phase-in period in 2024 and 2025. From 2026 onwards, operators will have to surrender allowances for 100% of their verified emissions (Art. 3gb). Following Article 30(7) of the revised EU ETS Directive, the inclusion of emissions from waste incineration under the EU ETS-1 is planned to take place from 2028 onwards, while monitoring will already start in 2024. For the first time the EU ETS will also cover methane emissions, as

(10) The LRF describes the steepness of the cap and indicates the reduction rate of the annual amount of allowances.

these are included under the activity of maritime transport from 2026 onwards. If the waste sector is included, methane and nitrous oxide emissions of landfill sites might also be considered in this sector.

Free allocation will also be reduced: For maritime transport all allowances will be auctioned, for aviation the share of auctioning is increased and will reach 100% by 2026. For the stationary sector a carbon border adjustment mechanism (CBAM) will be introduced from 2026 onwards. It mainly covers base materials such as e.g. imports of steel, aluminium, cement and electricity. For sectors covered by the CBAM, the free allocation is to be gradually reduced from 2026 to zero in 2034.

The architecture of the Market Stability Reserve (MSR-1) generally remains in place. The doubled uptake rate of 24% will be extended beyond 2023 until 2030. Threshold effects in the uptake of allowances will be avoided in the future. The quantity of allowances in the MSR-1 will be capped at 400 million and air and maritime transport will be included in the calculation of the quantity in circulation.

From 2027 onwards, a separate EU-wide fuel emissions trading system, ETS-2, is to be introduced, which will cover the sectors buildings, road transport as well as small installations in the energy sector and industry. In contrast to the ETS-1, the ETS-2 will be designed as an upstream regulation, regulating fuel suppliers instead of households and car drivers. Initially, there are no plans to link the two emissions trading systems.

2.2 Stationary installations

This chapter discusses expected developments of emissions from stationary installations, covered by the EU ETS-1. For this purpose, the latest projections from the ETS countries submitted under Article 18 of the Governance Regulation are taken into account. As 2023 is a mandatory year for the reporting of GHG projections, all countries except for Liechtenstein and Northern Ireland have submitted projections. For Liechtenstein no projections from previous years exist and no ETS-emissions are reported since 2021, so no gap filling is carried out. For Northern Ireland, no previous projections exist either. The latest ETS-emissions of five installations in this country add up to 3 Mt CO_2 eq. In the context of gap filling, it was assumed that emissions in Northern Ireland fall in parallel to the EU ETS emissions of the EU 27.

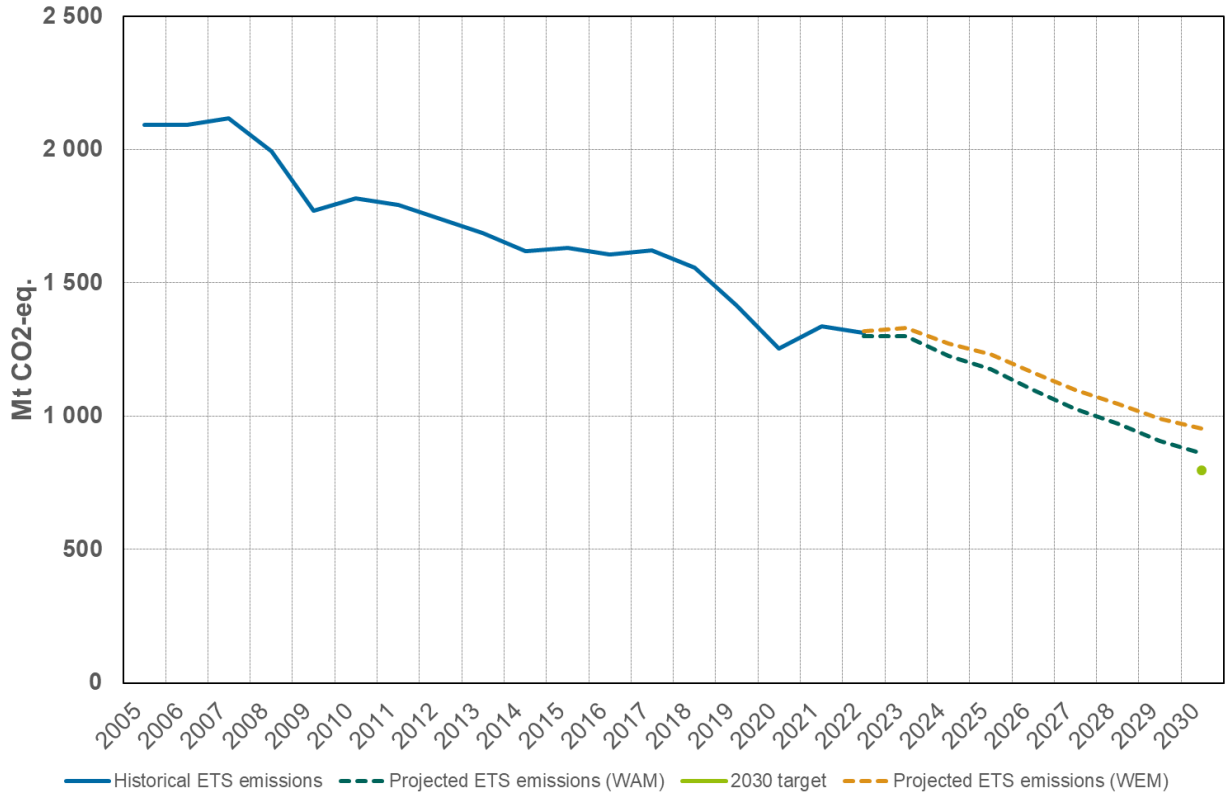
These projections are the first that should have taken into account the EU-wide GHG target of a net 55% reduction by 2030 compared to 1990 levels. The proposal for a revised EU ETS has been published by the European Commission in 2021 and trilogue discussions took place during the year 2022, with a provisional political agreement in December 2022. This means, emission projections partly take into account the latest revision of the EU ETS in the additional measures scenario, even though the revision only entered into force mid-2023. Recommended parameters for energy prices and CO_2-prices have been made available by the European Commission in April 2022 (EC 2022b). While not mandatory, Member States are encouraged to use them in the elaboration of their projections. These parameters considered higher gas prices especially in 2022 and 2023 due to the Russian invasion of Ukraine and the associated turmoil on global energy markets. This effect as well as the recovery from the Covid-19 pandemic lead to higher uncertainties, especially for earlier projected years. The CO_2-price proposed for 2030 was 80 €/EUA, for both the With Existing Measures (WEM) and the With Additional Measures (WAM) scenario. In the WEM scenario this price increases to 160 €/tCO_2 in 2050 and in the WAM scenario this price increases to 410 €/EUA in 2050. GHG projections extend until the year 2050 for the very first time, except for the projections of Norway, which only cover the timeframe up to 2035 [(11)]. For the reason of gap-filling, emissions of Norway decrease in parallel to EU ETS emissions of EU 27 from 2036 on.

(11) The analysis is based on projections of EU ETS emissions under the WEM and WAM scenario, reported by EU Member States, Norway and Iceland, following the structure and format provided by the Implementing Regulation (EU) 2020/120. The projections were compiled, assessed and quality checked by the EEA and its European Topic Centre for Climate Change Mitigation (ETC/CM). Liechtenstein and Northern Ireland did not submit a GHG projection.

2.2.1 Emission trends by sector

Since 2005 emissions in the EU ETS have been reduced by 37% until 2022 (Figure 2-1). If only the existing policies and measures are considered, this reduction increases to 55% until 2030 compared with 2005 levels as estimated for the EU ETS emissions in projections submitted by EU-27 Member States, Norway and Iceland. This is considerably more than the reduction of 41% as shown in previous projections. Main effects of policies and measures take place in the sector of energy industries. With the additional policies and measures reported by some Member States, emissions are projected to decrease by 59% until 2030 compared with 2005 under the more ambitious WAM scenario. This would still not be sufficient to reach the revised EU target of a reduction of EU ETS emissions of 62% below 2005 levels until 2030. Annual emission reductions achieved in the next eight years need to be 65 Mt CO_2e to reach the ETS target in 2030, while those have been 46 Mt CO_2e since 2005 on annual average.

Figure 2-1 Historical and projected emissions in stationary installations under the EU Emissions Trading System

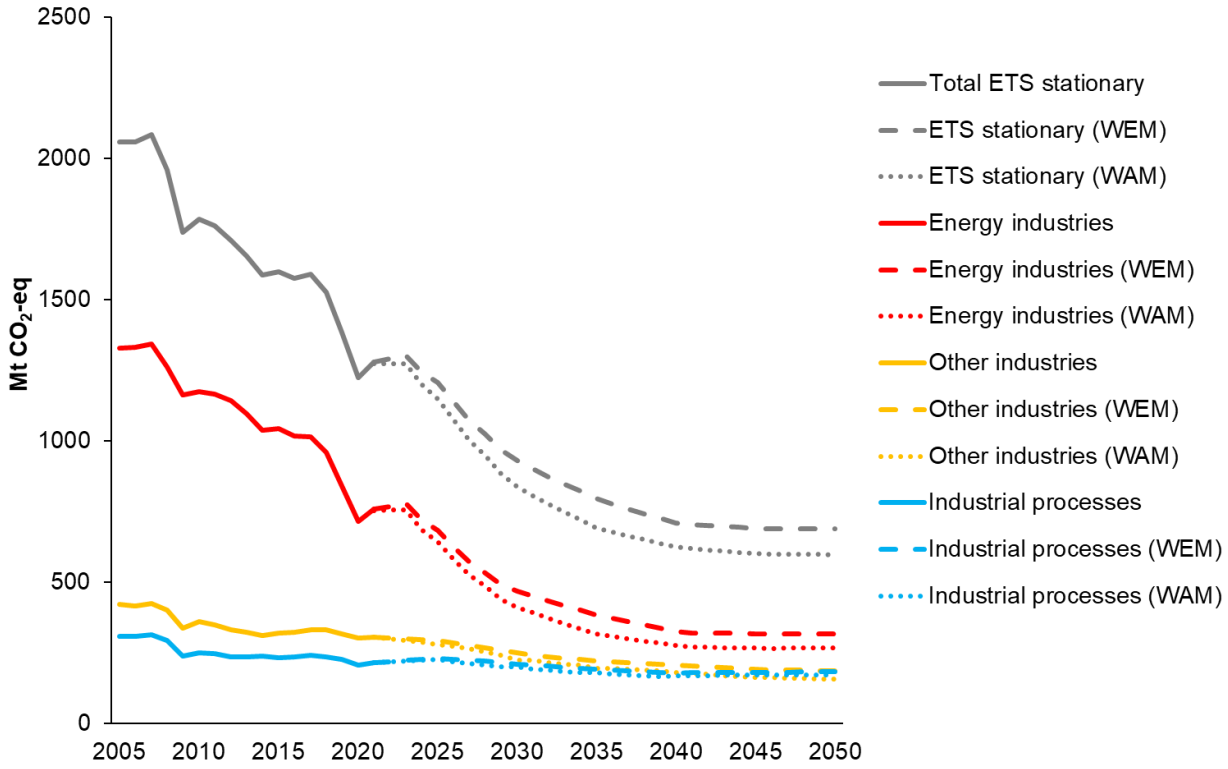


Sources: EEA (2023a), projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

With the projected development of EU ETS emissions in EU 27 after 2030 from the aggregated Member State projections, the emission decrease falls short of what is needed to achieve the EU wide climate neutrality goal in 2050. If the linear reduction factor is unchanged after 2030, the cap would be reduced to zero before the year 2039, meaning that emissions after 2039 are only possible when banked allowances or allowances from the MSR are used. Obviously, Member States did not yet take into account the reduced availability of certificates and the necessary changes in technologies (e.g., the German WAM scenario uses a CO_2 price of 160 €/t CO_2 in 2050 as in the WEM).

Projections submitted by EU-Member States, Norway and Liechtenstein start in 2021. Aggregated sectorial results of EU ETS emissions are displayed in Figure 2-2.

Figure 2-2 EU ETS historic and projected emissions between 2005 and 2030 for EU-27, by inventory category



Notes: Solid lines represent historical greenhouse gas emissions up to 2022. Dashed lines represent projections under the 'with existing measures' WEM scenario. Dotted lines represent projections under the 'with additional measures' (WAM) scenario. This figure refers to EU ETS emissions of EU-27 only. Historic emissions by sector were estimated based on the attribution of GHG emissions, reported by source categories in GHG inventories. 'Energy industries' cover CRF categories 1A1, 1B2 and 1C. 'Other industries' are related to CRF category 1A2 while 'industrial processes' are related to CRF category 2. The estimate of the share of ETS emissions in these sectors is based on relevant assumptions in national GHG projections.

Sources: EEA (2023b) projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

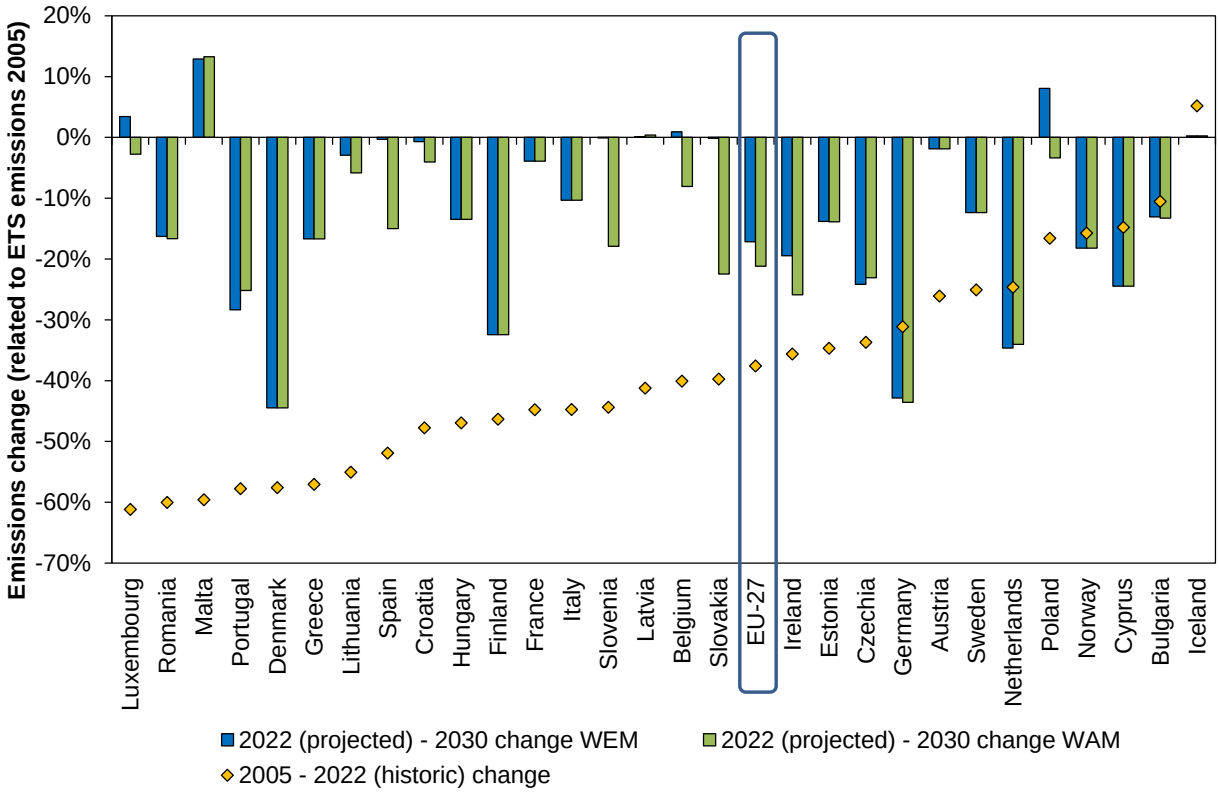
EU ETS emissions in the sector of energy industries are expected to recover after the Covid-19 pandemic and to reach their peak in the year 2023. From there on, emissions are projected to decrease considerably until 2030. After 2030, the emission decrease in this sector is much lower with nearly no further change of emissions after 2040. EU ETS emissions from industrial processes are projected to slightly increase until 2025 with a very small downward trend until 2030 and close to no change afterwards. Emissions from manufacturing and construction installations, shown as 'other sectors', are projected to decrease with a nearly linear trend but at a slower pace than in historical years until 2050.

2.2.2 Emission trends by country

In this chapter EU ETS emissions development from 2005 until 2030 is discussed at the country level. In Figure 2-3 Member States, Norway and Iceland are sorted by historic changes of ETS emissions until 2022 in percent compared to ETS emissions in 2005 (yellow squares), with Luxembourg showing the highest reduction (closure

of the biggest natural gas power station) while Iceland had increasing ETS emissions (new industrial installations such as primary aluminium production).

Figure 2-3 Historic and projected changes until 2030 in EU ETS emissions relative to 2005 emission levels



Note: Emissions of Liechtenstein decreased by 100% from 2005 to 2021 and are zero since then (not displayed)

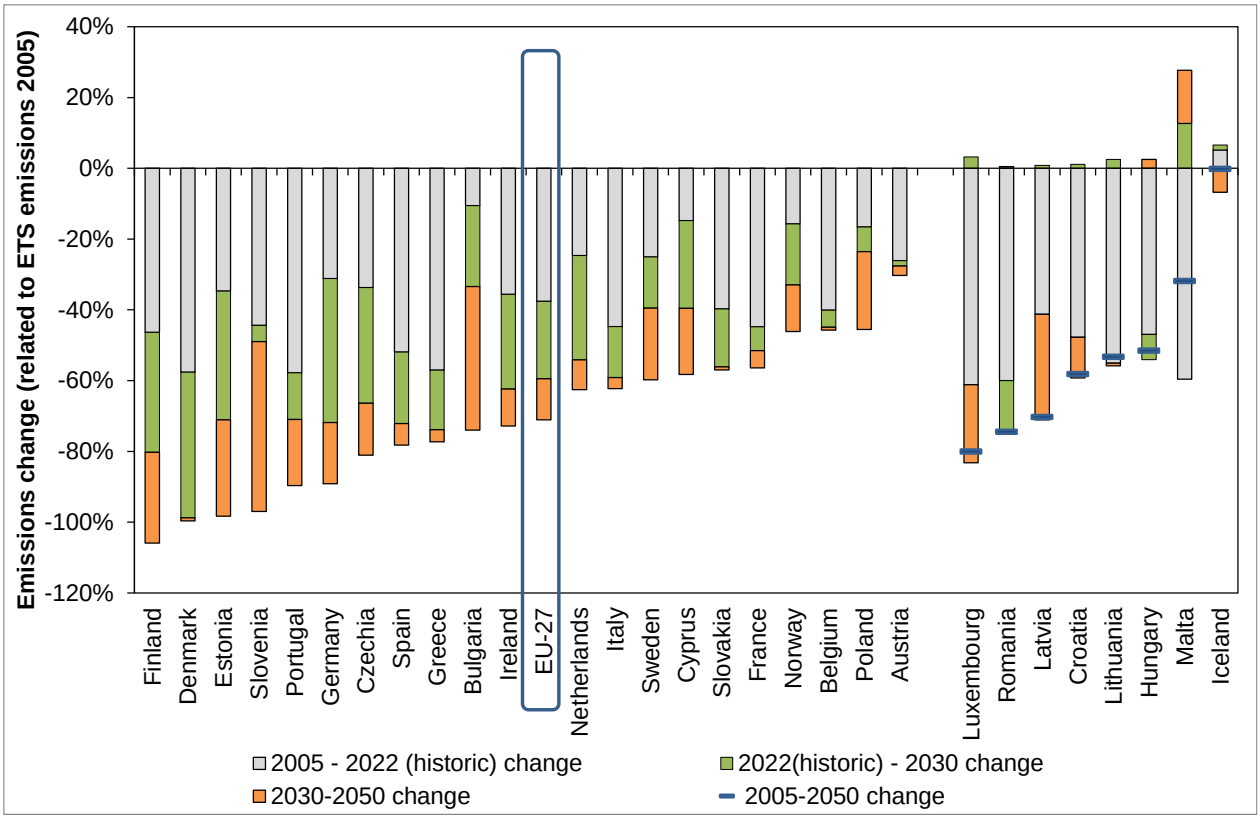
Sources: EEA (2023b) projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

Additionally, the projected emission reductions from 2022 until 2030 is shown (blue and green bars). Under the WEM (With Existing Measures) scenario, EU ETS emissions are expected to decline in most countries until 2030, with reductions ranging from 0.1% for Slovenia to 45% for Denmark. There are six countries who anticipate increases in their EU ETS emissions between 2022 (as projected) and 2030 based upon their WEM projections (Belgium, Iceland, Latvia, Luxembourg, Malta and Poland). These developments are often related to the opening and closure of power plants, but also due to the trend of higher electricity demand. The increasing emissions in Belgium, for example, are related to the phase-out of nuclear power by 2025 and the accompanying increase in emissions from the fossil back-up electricity supply. Three of those countries with increasing ETS emissions under the WEM scenario project to decrease their EU ETS emissions with additional policies and measures (WAM) below their emission level in 2022 (Belgium, Luxembourg and Poland). Malta projected an increase of EU ETS emissions under the WEM scenario and did not submit a WAM scenario. In two Member States (Czechia and the Netherlands) ETS emissions in the scenario with additional measures are higher than in the scenario with existing measures. This effect can be explained with a trend for increased electrification in the transport and buildings sector. If the higher demand for electricity is not accompanied with a respective increase of renewable power supply, fossil power supply might increase.

Figure 2-4 shows the historic development until 2022 as well as the projected development after 2030 in scenarios with additional measures. Austria, Cyprus, Denmark, France, Greece, Hungary, Italy, Malta and

Sweden did not submit a scenario with additional measures. For these Member States, the result of scenarios with existing measures is shown. Norway did not submit projections after 2035 and no scenario with additional measures. For EU-27 the aggregated GHG reduction by 2050 is projected to be 71% below 2005 levels with additional measures. As shown in Figure 2-2 the difference between the scenario with existing and additional measures is not very high and does not increase further after 2030. As a consequence, the difference between reductions in both scenarios until 2050 is similar to the reductions projected for the year 2030, which means that in the scenario with existing measures an emission reduction of 67% below 2005 levels until 2050 is achieved.

Figure 2-4 Historic and projected changes until 2050 in EU ETS emissions relative to 2005 emission levels



Note: In this figure historic ETS emissions 2022 have been used to allow to sum up percentages in periods to total reduction until 2050.

Sources: EEA (2023b) projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

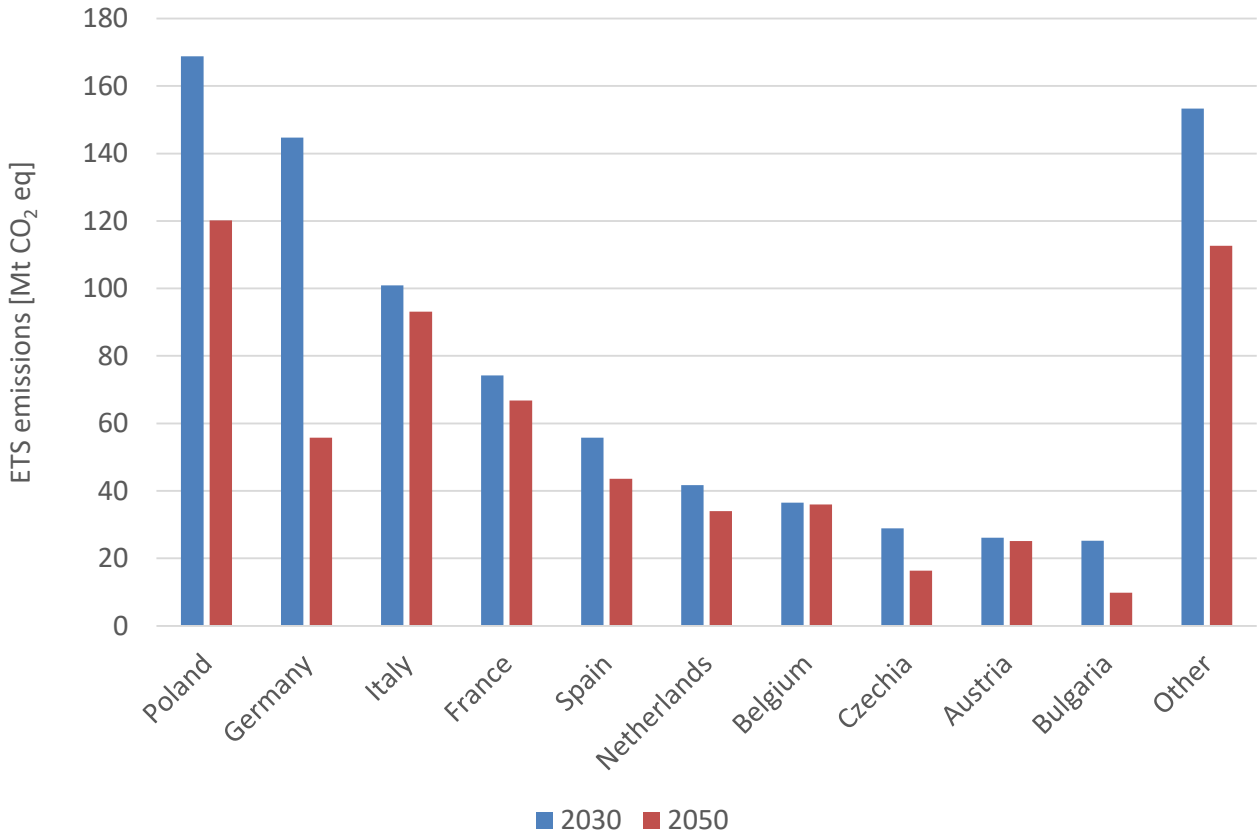
For countries with reductions in all three periods (2005-2022, 2022-2030 and 2030-2050), these can be added so that the aggregated bar in Figure 2-4 shows the total ETS reduction in 2050 compared to 2005. Eight countries show increases in projected ETS emissions after 2022, these are shown on the right-hand side. For these countries, a blue line indicates their level of ETS emissions in 2050 compared to 2005.

Three countries project increasing ETS emissions after 2030 (Hungary, Romania and Malta). The level of ETS emissions in Iceland in 2050 is projected to be similar to 2005 levels (1.8 Mt CO_2 eq.). Finland projects negative ETS emissions through the use of BECCS (Bioenergy with Carbon Capture and Storage) in its scenario with existing measures, no additional measures have been considered for emissions covered under the EU ETS. Denmark, Estonia and Slovenia show emission reductions of more than 90% compared to 2005 until 2050.

Eight countries project high emission reductions above 20 percentage points after 2030: Bulgaria, Estonia, Finland, Latvia, Luxembourg, Poland, Slovenia and Sweden.

Figure 2-5 displays absolute emission projected for 2030 and 2050 (with additional measures) in those ten countries with the highest emissions in 2030 and they are then compared to an aggregation of all other countries. None of the countries with increasing projected emissions are included amongst the ten countries with the highest absolute emissions. The biggest emissions reduction in absolute terms between 2030 and 2050 is projected to take place in Germany, followed by Poland.

Figure 2-5 Absolute projected emissions in the years 2030 and 2050 in the WAM scenario



Note: Emissions of Liechtenstein decreased by 100% from 2005 to 2021 and are zero since then (not displayed)

Sources: EEA (2023b) projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

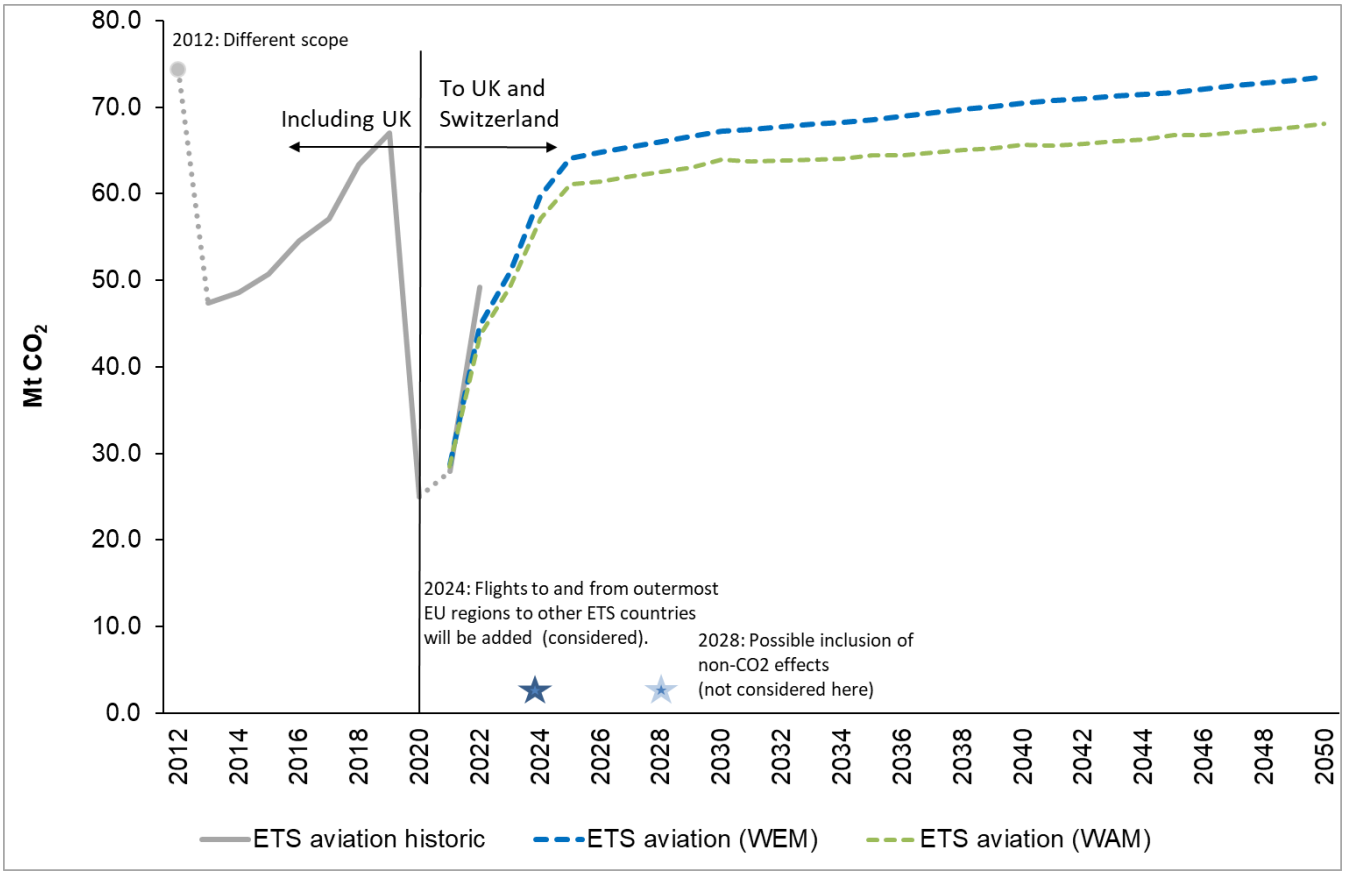
2.3 Aviation

Emissions from aviation activities, as projected by Member States under the WEM and WAM scenario, are expected to rise continuously until 2050 (Figure 2-6). This is not in line with the ReFuelEU Aviation Regulation, which is expected to reduce CO_2 emissions by around two-thirds by 2050 compared to a 'no action' scenario (European Commission 2023). The new rules under this regulation require fuel suppliers to blend sustainable aviation fuels (SAF) with kerosene in increasing amounts from 2025 onwards. Generally, continuously increasing emissions in this sector are also not in line with the overall EU wide GHG target to achieve climate neutrality in 2050.

By 2019, historical ETS aviation emissions were significantly higher than projections because GHG projections no longer include emissions of the United Kingdom. In 2020, emissions (still including the United Kingdom) dropped significantly due to the Covid-19 pandemic and the resulting decrease in aviation. Projections are aligned to aviation emissions in the year 2021, but a slower recovery from the pandemic was expected.

The ETS aviation emissions depicted in Figure 2-6 are calculated by the application of ETS shares on projected domestic and international aviation emissions. For domestic aviation emissions, a full inclusion into the EU ETS is assumed, while for international aviation the historic share of 28% has been used for the first years. With the inclusion of flights from outermost countries to other EEA countries, emissions covered under the EU ETS will increase, a respective increase of the ETS share has been considered, based on Umwelt Bundesamt (2023). At the end of 2027 the European Commission shall publish a proposal if and how non-CO_2 aviation effects shall be included under the EU ETS (Article 14 (EU) 2023/959). A respective increase of the ETS share has not though been considered here.

Figure 2-6 EU ETS emissions for aviation between 2012 and 2050



Notes: The sharp drop in aviation emissions from 2012 to 2013 reflects a change in the scope of aviation activities covered by the EU ETS. ETS aviation emissions can't be separated by countries, this is why for GHG projections the figure refers to all countries covered by the EU ETS in respective years.

Latest GHG projections no longer include the United Kingdom, which results in a systematic different level of projected ETS aviation emissions compared to historic emissions shown in this figure.

Sources: EEA (2023b) projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation (ETC/CM) as of August 2023

3 The introduction of the CBAM and the impact on the EU ETS

3.1 Main findings

The 'Fit for 55' package has enhanced the climate ambition of the EU by setting a GHG reduction target of at least 55% below 1990 levels by 2030. In order to address the carbon leakage concerns raised from industry, the Commission proposed to amend the EU ETS directive and proposed a regulation to establish a Carbon Border Adjustment Mechanism (CBAM) on the 14 July 2021 [(12)]. The CBAM regulation officially entered into force on 16 May 2023. The revised EU ETS directive (EU) 2023/959 was published in May 2023 (EU 2023b).

The CBAM will only cover primary products such as e.g. electricity, cement, iron and steel, fertilisers, hydrogen and aluminium. The definitive period of the CBAM will start in 2026. A transitional period of the CBAM started in October 2023, but there will be no need to surrender CBAM certificates in this transitional period. From 2026 onwards it will be necessary for regulated entities to purchase CBAM certificates to account for the embedded emissions from imported products that are covered under the CBAM. There will be a gradual phase in of the CBAM and in 2026 importers need to purchase CBAM certificates for only 2% of their emissions. This will increase to around 50% in 2030 and 100% in 2034. As a consequence, the provision of free allowances to those sectors included with the scope of the CBAM will be phased out gradually between 2026 and 2034 at the same rate as the gradual phase in of the need to surrender CBAM certificates (the price of which will be equivalent to the average closing price of EU ETS allowances at auction for each calendar week).

3.2 Key elements of the CBAM

UBA - Umweltbundesamt (2023) provide an overview of the key elements of the CBAM that is referenced throughout the following sub-sections.

3.2.1 Objective

The main objective of the CBAM is "to prevent the risk of carbon leakage, i.e. the shifting of industrial production, investments and resulting emissions to jurisdictions with lower or no carbon prices" (UBA - Umweltbundesamt 2023). From 2026 onwards, the CBAM will increasingly become an alternative to the measures that are currently applied (i.e. the allocation of free allowances) to limit the risk of carbon leakage.

3.2.2 Scope

The CBAM shall apply to the direct GHG emissions for the products, as classified under the Combined Nomenclature (CN), that are listed under Annex I of the CBAM regulation for the electricity, cement, iron and steel, fertilisers, hydrogen and aluminium sectors (refer to Article 2(1) of the CBAM regulation). Annex I of the CBAM regulation further outlines that CO_2 emissions are covered for these sectors as well as N_2O emissions from the production of certain chemicals and PFC emissions as a result of aluminium production Selected downstream products are also considered within the scope of the CBAM (i.e. such as screws), despite their relatively low level of direct emissions during the final processing steps, as "their exclusion would increase the likelihood of circumventing the inclusion of steel products in the CBAM by modifying the pattern of trade towards downstream products" [(13)].

Electricity use entails indirect emissions, that occurred at the electricity generator. The costs for the EUAs are passed through the value chain and finally reach the electricity user. Indirect emissions will also be covered by

(12) Refer to EUR-Lex - 52021PC0564 - EN - EUR-Lex (europa.eu).

(13) Refer to recital 38 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2023:130:FULL

the CBAM for the electricity, cement and fertiliser sectors (Annex II of the CBAM regulation). This means that in the beginning indirect emissions from iron and steel, aluminium, and hydrogen are not covered by the CBAM. As a consequence, indirect compensation for these sectors will not be affected by the CBAM.

The EU Commission will "evaluate before 2026 whether to further expand the scope of covered goods under the CBAM. For example, to include organic chemicals and polymers and to expand the coverage of indirect emissions to include the iron and steel, aluminium, and hydrogen sectors" (UBA - Umweltbundesamt 2023).

Article 2(6) of the CBAM regulation outlines that countries covered by or linked to the EU ETS are excluded from the application of the CBAM. Indeed, agreements with third countries could be considered as an alternative to the CBAM if "the carbon price paid in the country in which the goods originate is effectively charged on the greenhouse gas emissions embedded in those goods without any rebates beyond those also applied in accordance with the EU ETS" [(14)].

3.2.3 Transitional period

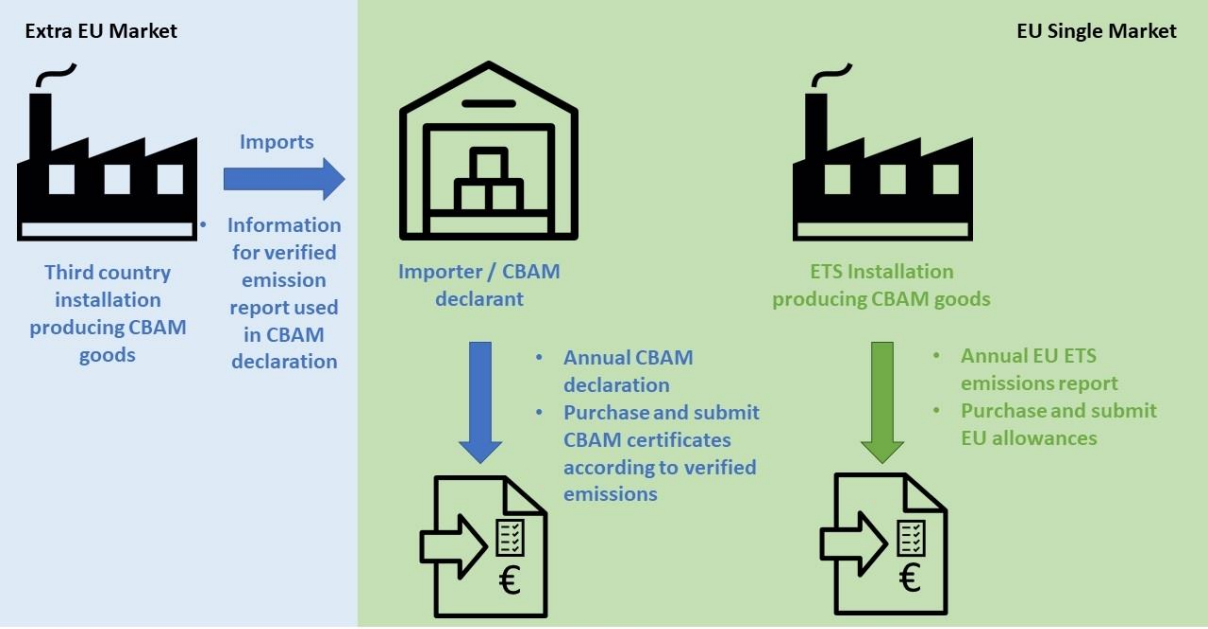
A transitional period without obligations to surrender certificates started from the 1st of October 2023 until the end of 2025. Importers will be required during this period of time to submit a CBAM report each quarter of a calendar year to the EU Commission. The CBAM report shall "include information on the goods imported in terms of volume, embedded direct and indirect emissions and the carbon price due in a country of origin for the embedded emissions in the imported goods, which is not subject to a rebate or other form of compensation on exportation" (UBA - Umweltbundesamt 2023). There will only be "simplified rules for determining embedded emissions and no verification is necessary, however incomplete or incorrect reports might be subject to a correction procedure

3.2.4 How the CBAM works from 2026

The main element of the CBAM is that "importers of certain goods (or their indirect customs representatives) will be required to surrender a number of CBAM certificates corresponding to their total embedded emissions considering a potential carbon price paid abroad and free allocation in the EU" (UBA - Umweltbundesamt 2023). Furthermore, only authorised CBAM declarants may import CBAM goods into the EU from 1 January 2026 onwards. A simplified overview of how the CBAM is expected to function is illustrated below in Figure 3-1.

(14) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2023:130:FULL

Figure 3-1 Overview of the implementation of the CBAM



Source: UBA - Umweltbundesamt (2023)

The EU Commission will establish a CBAM registry, which will be accessible automatically and in real time to customs authorities and competent authorities from Member States. Article 6 of the CBAM regulation outlines further that via the CBAM registry, CBAM certificates will be surrendered by the authorised CBAM declarant based upon their CBAM declaration submitted by the 31st of May each year" [(15)]. CBAM certificates will be sold to authorised declarants at the price of an EU ETS allowance, which will be set as the average of the closing price of EU ETS allowances at auction for each calendar week, via a common central platform that shall be established and managed by the EU Commission.

3.2.5 Calculating the CBAM obligation

The surrendering obligation is calculated as follows:

Surrendering obligation = Embedded emissions – reduction for carbon price paid abroad – adjustment to reflect free allocation within the EU.

Embedded emissions in goods other than electricity shall be calculated based on the actual emissions, which are defined in Annex IV of the CBAM regulation [(16)] as either "simple goods" (i.e. refers to goods produced in a production process requiring exclusively input materials and fuels having zero embedded emissions) or "complex goods" (i.e. refers to all goods other than simple goods).

Default values will be used to calculate embedded emissions in goods other than electricity when actual emissions cannot be adequately determined. These values "shall be set at the average emission intensity of each exporting country and for each of the goods listed in Annex I other than electricity, increased by a proportionately designed mark-up" (see Annex IV, 4.1 of the CBAM regulation), the latter to be subsequently decided upon via an implementing act. If reliable data for the exporting country cannot be applied for a type

(15) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2023:130:FULL

(16) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2023:130:FULL

of goods, the default values shall be instead based on "the average emission intensity of the X per cent worst performing EU installations for that type of goods" [17]. The value of X shall be determined also in a subsequent implementation act.

"Embedded emissions in imported electricity shall be determined based on specific default values that shall be set at the CO_2 emission factor in the third country, group of third countries or region within a third country, based on the best data available to the EU Commission. If those values are not available, the alternative default value for electricity shall be set at the CO_2 emission factor in the EU. The authorised declarant may also choose to determine the embedded emissions based on the actual emissions under particular circumstances." (UBA - Umweltbundesamt 2023)

3.2.6 Adjustment to reflect free allocation in the EU ETS

Article 31 of the CBAM regulation states that the CBAM certificates to be surrendered shall be adjusted to reflect the extent to which EU ETS allowances are allocated free of charge under EU ETS. The allocation of free allowances will be phased out gradually to allow economic operators sufficient time to adjust. The reduction of free allocation will be implemented by the application of a declining factor over time for installations producing CBAM goods (refer to Table 3-1).

Table 3-1 The phasing out of free allocation for CBAM goods

	2026	2027	2028	2029	2030	2031	2032	2033	2034
CBAM factor	97.5 %	95 %	90 %	77.5 %	51.5 %	39 %	26.5 %	14 %	0 %

Source: Article 10a (3) of Directive (EU) 2023/959, Official Journal of the EU 16th May 2023.

Free allocation for the production of goods covered by the CBAM will be phased out from the beginning of the definitive (post-transitional) period in 2026 up until 2034.

3.3 Next steps

The Commission will need to prepare the implementing and delegated acts for the definitive CBAM period. It is expected that the Commission will build upon the methods already developed under the CBAM Implementing Regulation and Annexes that were recently adopted on the 17 August 2023 for the transitional CBAM period. Indeed, the setting of the rules for the definitive CBAM period will take into account data collected during the transitional phase as well as the experiences of key stakeholders.

(17) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2023:130:FULL

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