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Trends and projections in the EU ETS in 2021

The EU Emissions Trading System in numbers

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Executive summary

About this report

This report analyses recent, current and future emissions trends under the European Union (EU) Emissions Trading Scheme (ETS). It also analyses the balance between supply and demand of allowances on the market.

This report is based on data and information provided by the European Commission and Member States (as of July 2021). The data on verified emissions and compliance of operators under the EU ETS for the years up to 2019 are based on an extract from the EU Transaction Log of 1 July 2021. As in previous years, this report is divided into three parts: Recent Trends, Long-Term Trends and Projected Trends.

Main findings

The EU ETS is a 'cap and trade system', whereby a cap (i.e. a determined quantity of emission allowances) is set on the emissions from the installations covered by the system. The cap decreases gradually in order to achieve emission reductions over time. Installations can trade emission allowances ([1]) with one another, which ensures that emission reductions take place where it costs least.

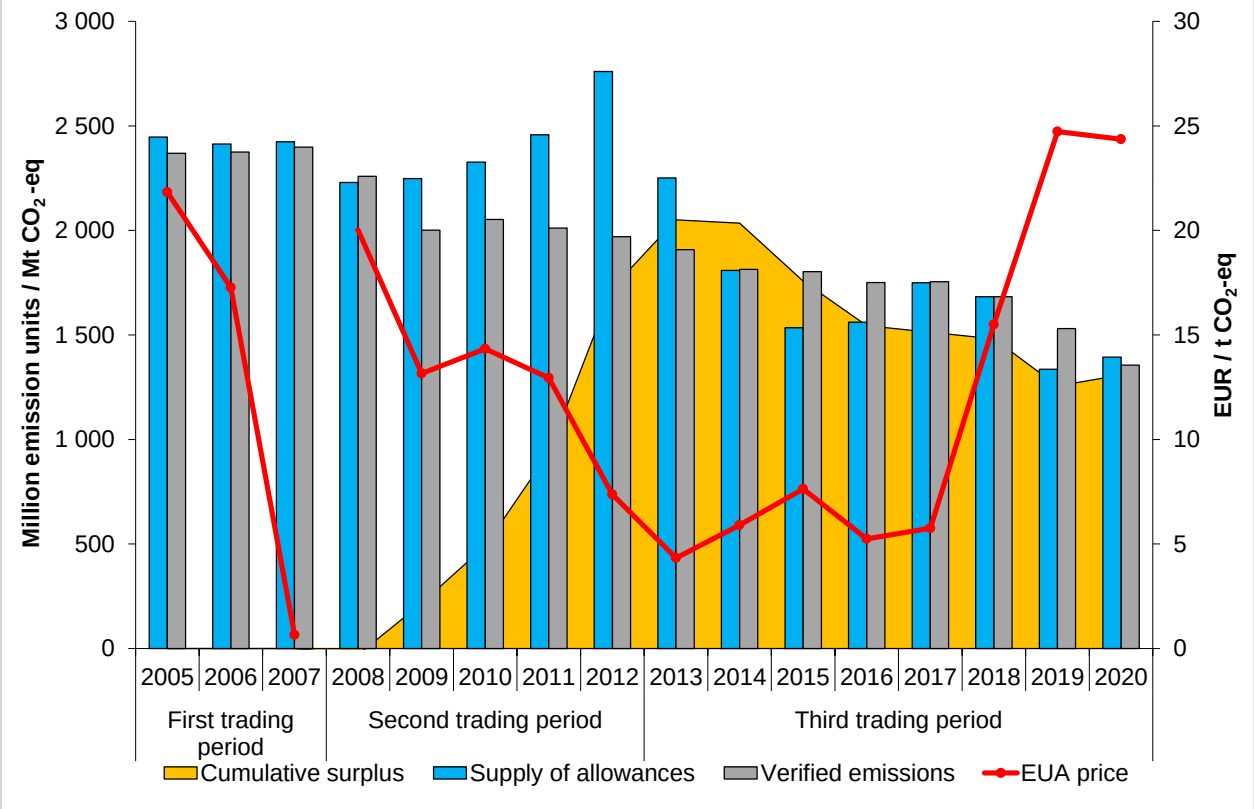
The current Covid 19 pandemic had a strong impact on emissions trading in 2020, with overall emissions down 11.4% in the stationary sector and 63.5% in the aviation sector compared to 2019. This is mainly related to the decrease in demand in electricity consumption, industrial production and lower travel.

Between 2009 and 2013, the number of allowances available exceeded the demand for allowances (related to total emissions in the EU ETS). A surplus of allowances accumulated during this period, which resulted in lower prices for emission allowances and limited the incentive to invest in clean, low-carbon technologies (Figure ES.1). This ran the risk of a 'carbon lock-in', with firms investing in carbon intensive technologies that could make the achievement of emission reductions more challenging in the longer term.

In response to this situation, a number of allowances originally planned to be allocated through auctioning between 2014 and 2016 (corresponding to 900 million allowances in total) were not allocated. As a result of this so-called 'backloading' measure, the overall number of allowances available to operators has declined considerably. In 2017 and 2018 the supply of allowances and verified emissions were more or less on par. In 2020 the supply of allowances exceeded the verified emissions.

([1]) Article 3(a) of the EU ETS Directive EU (2003) defines the emission allowance as being 'an allowance to emit one tonne of carbon dioxide equivalent during a specified period, which shall be valid only for the purposes of meeting the requirements of this Directive and shall be transferable in accordance with the provisions of this Directive.'

Figure ES.1 Emissions, allowances, surplus and prices in the EU ETS, 2005-2020



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. It also accounts for net demand from aviation during the same time period.

Sources: Point Carbon, (2012); EEA (2021b), EEX (2021), ICE (2021)

In 2020, the third trading period of the EU ETS ended. Overall, 29% of emissions were saved in the stationary sector between 2013 and 2020. This is 37% compared to 2005([2]). The power sector remains the strongest driver for emission reductions in the EU ETS. Industrial emission trends have been more variable, which mirrors the economic developments observed in Europe over the last three trading periods. Emissions from aviation continue to increase every year.

Emissions from combustion plants (mainly power plants) were down 38%, while emissions from industrial installations decreased by 9% in the 3rd Trading Period.

Already in 2014, the target of an emission reduction of 20% - set for 2020 – was achieved. To a large extent, this reduction is 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 increasing CO2 price has put further pressure on carbon-intensive fuels. Lignite and hard coal-fired power plants (many situated in Germany and Poland), however, remain the top-emitting installations in the EU ETS.

([2]) The emission reduction between 2005 and 2020 is estimated based on the scope of the EU ETS in the third trading period (incl. UK).

Emissions in the largest industrial sectors (iron and steel, cement and lime and refineries) have also been reduced substantially since the beginning of the EU ETS, although not to the same extent as in electricity generation. Emissions in industrial sectors experienced a sharp drop following the financial and economic crisis of 2008 and 2009 and have remained at lower levels since. Other factors, such as improvements in energy efficiency and the increased use of biomass and waste as energy sources in production, may have further contributed to lower emission levels. Emissions and production output for industrial installations have been relatively flat since the beginning of the third trading period up until 2015, after which, certain sectors such as cement have started to increase their emissions and production output again while other sectors such as iron and steel have experienced a slight decline in both their emissions and production output.

Since aviation was included in the EU ETS, emissions from this sector have continued to increase year on year throughout the third trading period with exception of 2020 due to the Covid 19 pandemic. This primarily reflects the increasing demand for air travel. In each year, the demand for allowances from aviation exceeded the amount of aviation allowances available, meaning that the aviation sector had to buy additional allowances from the stationary sector (without 2020).

The impact of the Covid19 pandemic led to such an unexpected drop in emissions in 2020 that the latest projections do not yet fully reflect it. A comparison of the historical values for 2020 with the projected values for 2030 is therefore subject to error and would not show any structural changes. Therefore, only projected values are used for the comparison between the year 2020 and 2030.

By September 2021, all EU ETS countries except Germany and Liechtenstein have submitted GHG projections under EU legislation. Stationary ETS emissions with existing measures will result in a reduction of 41.1 % by 2030 compared to 2005. With the proposed further measures, EU ETS emissions will fall by 48.2 % compared to 2005, just reaching the current reduction target of -43%.

To achieve the European Green Deal the EU Commission has published a proposal to reform the EU ETS for the fourth trading period until 2030. For the stationary ETS the main new feature is a gradual replacement of free allocation by a carbon border adjustment mechanism (CBAM). Under the CBAM imports from third countries will need to pay a carbon price to ensure a level playing field with installations covered by the ETS. The Commission also proposes to include sea-borne shipping into the ETS covering all intra-EEA activities but also 50 % of emissions on routes to and from the EEA. A separate ETS for road transport and buildings is also part of the proposal. This ETS is supposed to be based on fuel suppliers and not fuel consumers due to practical reasons.

1 Recent trends

- Between 2019 and 2020, total emissions from the European Union (EU) Emissions Trading Scheme (ETS) for stationary installations decreased by 11.4%.
- This decrease in verified emissions is attributable to combustion plants (mainly power plants; down 19.9% compared to 2019) and mirrors the impact of the Covid-19 crisis, as well as the increased CO_2 price and the resulting fuel switch from coal to gas power plants. Emissions from industrial plants decreased by 7.3% on average ([3]). The top 30 emitting power plants and industrial installations, which are responsible for roughly a quarter of their respective sector's emissions, experienced emissions reductions in the same percentage range.
- In 2020, the supply of EU allowances (EUAs) increased by 6% compared to the previous year. This is mainly due to the United Kingdom auctioning withheld 2019 allowances after the suspension of trading in 2019
- Verified emissions from aviation dropped by 63.5% between 2019 and 2020 due to the impact of the Covid-19 crisis. For the first time, the number of EU Aviation Allowances (EUAAs) allocated was higher than the sector's emissions, such that there was no demand for additional allowances from the stationary sector.
- With EUR 24.36 the average certificate price in 2020 was slightly lower than in 2019 due to a sharp fall in prices at the beginning of the year. Prices, however, recovered and exceeded EUR 30 per certificate by the end of the year.

In this section, developments for stationary installations and aviation are presented separately, focussing first on emission trends between 2019 and 2020 and then on their effects on the balance of the supply and demand for allowances. Since aircraft operators can buy allowances from stationary installations, there is some interaction between stationary installations and aviation, which is discussed where applicable. From 2021 onwards, these two allowance types become fully fungible (EC, 2011b).

([3]) This is the average decrease by ETS activity codes 21-99, which cover specific industries, and do not include the industrial installations without specific ETS activity, which are covered under combustion (ETS activity code 20). Data on verified emissions and compliance by operators under the EU ETS for the years up until 2020 are based on an extract of the EU Transaction Log from July 1st 2021.

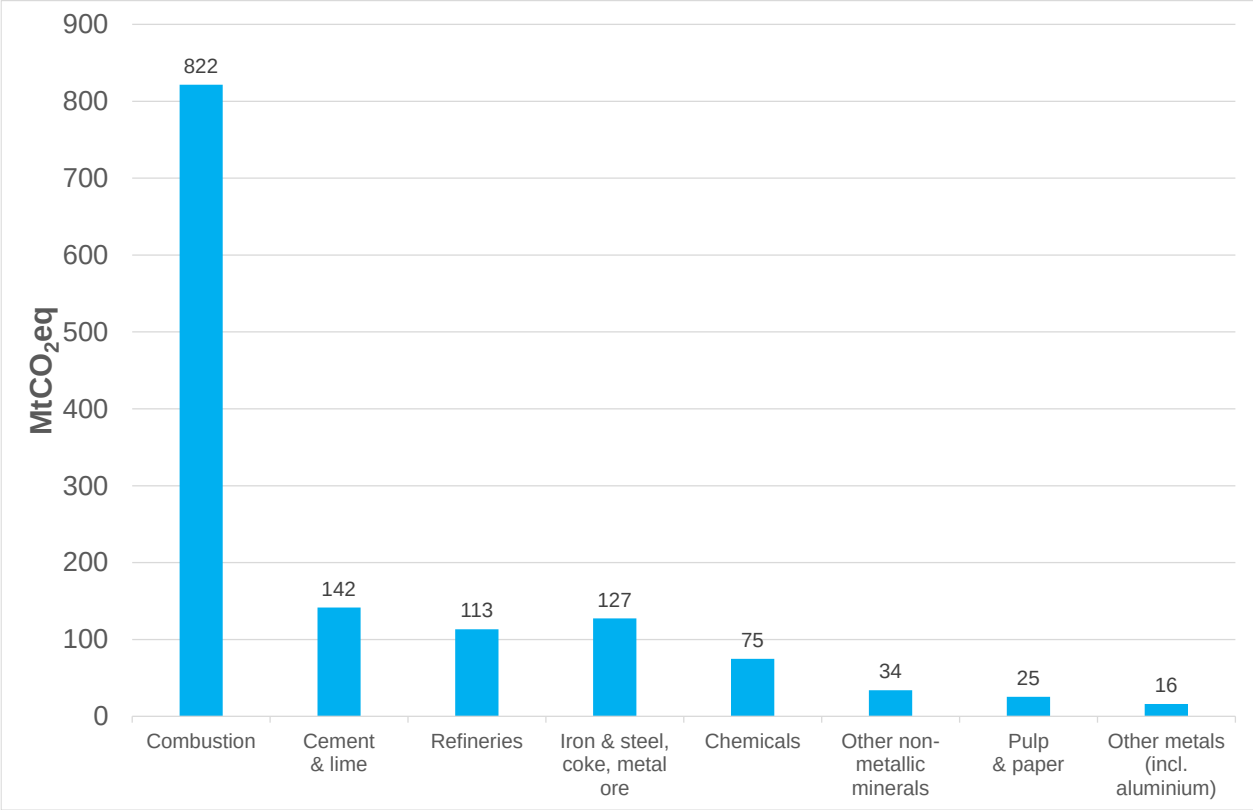
1.1 Stationary installations

1.1.1 Emission trends

Status in 2020

Combustion plants ([4]) are the main source of emissions under the EU ETS. In 2020, these installations accounted for 61% (822 Mt CO_2-eq) ([5]) of total verified emissions in the stationary part of the EU ETS (Figure 1.1). Cement and lime installations accounted for 10% (142 Mt CO_2-eq.), followed by iron and steel ([6]) (9%; 127 Mt CO_2-eq.), refineries (8%; 113 Mt CO_2-eq.) and chemical installations (6%; 75 Mt CO_2-eq.).

Figure 1.1 EU ETS emissions by main activity type in 2020



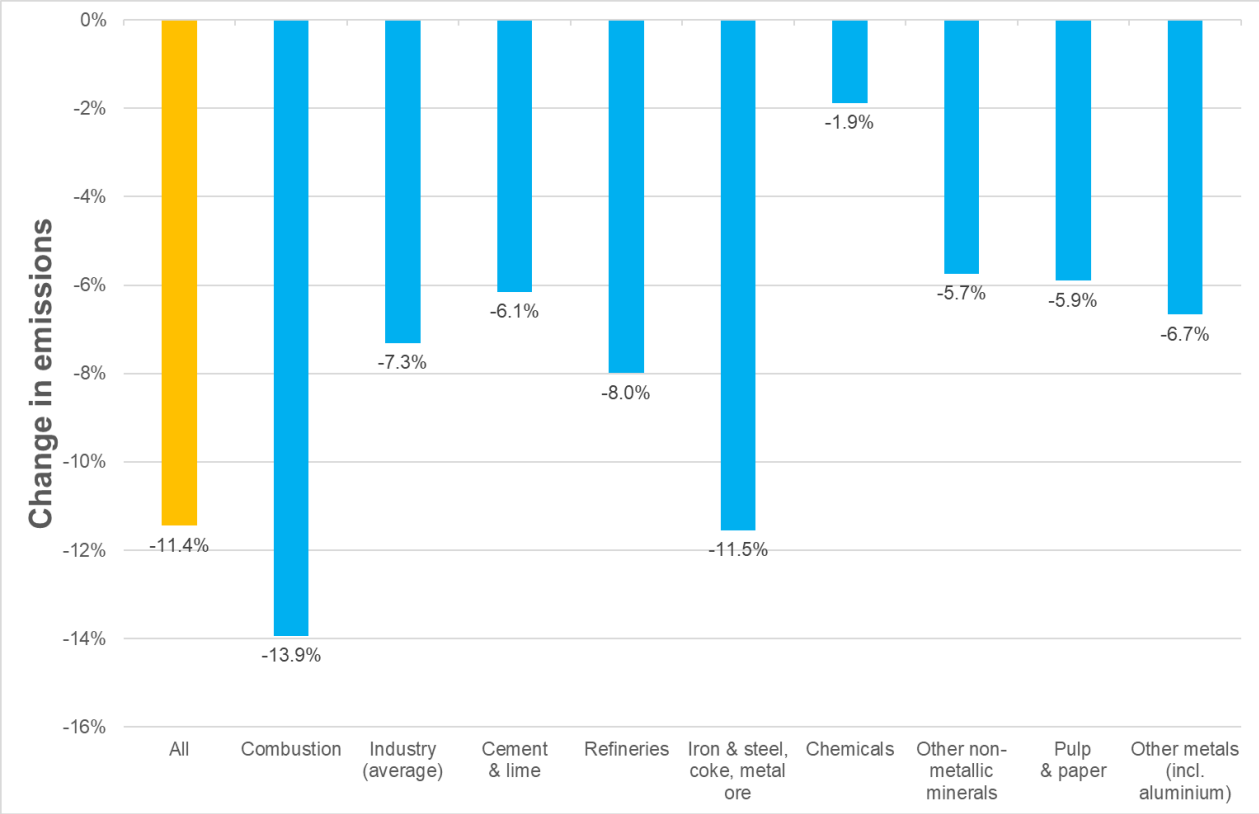
Note: Numbers cover all 31 countries that currently participate in the EU ETS.
EU Transaction Log (EUTL) activity codes have been aggregated for certain sectors throughout the report (refer to Table A1.1).
According to EUTL attribution, emissions originating from the combustion of blast furnace gases are included in the sector 'combustion'.

Source: EEA (2021b).

([4]) Combustion installations are defined as those carrying out any oxidation of fuels, regardless of the way in which heat, electricity or mechanical energy produced by this process is used, and any other directly associated activities, including, for example, waste gas scrubbing EC (2010).
([5]) Mt CO_2e refers to million tonnes of carbon dioxide equivalent.
([6]) The verified emissions for iron and steel, coke and metal ore are based on the ETS activity classifications. In some cases, installations using waste gases from the production of iron and steel (e.g. blast furnace gas) are classified as ETS activity combustion.

In 2020, all sectors have lower verified emissions than in 2019 (see Figure 1.2). The overall emissions in the EU ETS for stationary installations decreased from 1530 Mt in 2019 to 1355 Mt in 2020, representing a drop of 11.4 %. The strongest decrease in verified emissions took place in the combustion sector with 13.9% relative to 2019. On average, verified emissions in the remaining (industrial) sectors declined by 7.3% relative to 2019. This decrease in emissions is accompanied by a decrease in the annual output of EU-28 manufacturers of 8.2 % ([7]) on average compared to the previous year (Eurostat, 2021b)(see Figure 2.4 in Section 2.1.1).

Figure 1.2 Change in EU ETS emissions by main activity, 2020 vs. 2019



Source: EEA (2021b).

The strong decline in the combustion sector is mainly caused by emission reductions in electricity generation. These reductions were caused by the impact of the Covid-19 pandemic reducing electricity consumption in the EU-27 significantly by -112 GWh or -4.4% (see Eurostat, 2021a) and by the continuing decline of coal-fired power generation in Europe due to higher carbon prices and national coal exit strategies (see also below). Despite an overall reduction in electricity generation, generation from renewables continues to increase (Table 1.1). The largest absolute decrease in coal-fired power was observed in Germany, followed by Poland and Spain. In contrast to the previous year, no structural fuel switch to natural gas was observed.

([7]) Manufacturing is reported under code C of NACE rev. 2, the statistical classification of economic activities in the European Community. The change in production output for manufacturing for the EU-28 is calculated based on the annual average of the monthly index values for both 2019 and 2020.

Table 1.1 Change in electricity generation between 2020 and 2019

	Change in emissions 2020 vs. 2019*	Consumption 2020 vs. 2019 [TWh]	Net electricity generation [TWh]								
			Total	of which							Net Import
				Thermal	of which**		Nuclear	Hydro	Wind	Solar	
					Coal	Gas					
EE	-34%	0.1	-1.4	-1.7	-	-	-	0.0	0.1	0.1	0.4
GR	-22%	-3.1	-2.0	-3.8	-4.7	1.7	-	-0.6	2.0	0.4	3.4
LV	-19%	-0.2	-0.7	-1.2	-	-1.1	-	-0.5	0.0	-	0.2
ES	-19%	-13.9	-10.1	-22.4	-0.2	-13.7	-0.1	-6.9	0.1	-5.4	-4.2
BG	-18%	-0.5	-3.0	-3.3	-3.5	0.1	0.1	0.0	0.2	0.1	2.0
FI	-16%	-5.2	0.2	-4.9	-2.6	0.1	-0.6	-3.3	-1.7	0.1	0.1
PT	-13%	-1.7	0.6	-2.1	-2.9	0.4	-	-3.8	-1.4	0.4	6.1
FR	-13%	-21.6	-35.4	-4.6	-0.7	-3.7	-44.0	-5.2	-5.6	-2.3	-5.2
CZ	-13%	-2.0	-5.0	-5.0	-6.2	1.0	-0.2	-0.3	0.0	0.0	0.8
SE	-12%	-4.6	-5.7	-2.9	-0.3	-0.4	-17.1	-6.6	-7.7	-	-8.9
DE	-12%	-21.7	-34.3	-35.2	-33.9	0.9	-10.1	-0.6	-6.3	-5.2	15.8
NL	-11%	-2.4	1.1	-5.5	-9.7	1.8	0.2	0.0	-3.8	-2.6	-5.0
GB	-11%	-	-	-	-	-	-	-	-	-	-
RO	-11%	-1.9	-3.2	-3.2	-3.7	0.5	0.2	-0.3	-0.2	0.0	4.1
IT	-11%	-16.8	-10.7	-11.4	-	-	-	-1.0	-1.5	-1.3	-5.7
DK	-10%	-0.9	-1.2	-1.6	-0.3	-0.8	-	-0.0	-0.2	-0.2	0.6
SK	-9%	-1.3	0.2	0.0	-0.7	0.7	-0.1	-0.2	-0.0	-0.1	2.0
AT	-9%	-2.4	-1.6	-2.3	-1.0	-1.4	-	-0.5	-0.5	-	-5.8
LU	-8%	-0.2	0.4	0.1	-	-0.0	-	-0.2	-0.1	-0.1	0.3
BE	-7%	-1.3	-2.6	-1.5	-0.6	-2.1	-8.7	-0.1	-3.2	-1.4	-19.2
PL	-7%	-6.8	-5.8	-7.9	-9.8	-1.3	-	-0.3	-0.6	-1.2	4.9
IE	-6%	-1.3	1.9	-0.3	-0.2	-0.2	-	-0.1	-2.1	-	-0.6
CY	-4%	-0.2	-0.2	-0.3	-	-	-	-	-0.0	-0.1	-
NO	-4%	-2.1	19.5	-0.7	-	-0.5	-	-15.8	-4.4	-	-20.5
HU	-3%	0.0	-0.7	-0.0	-0.3	-0.4	-0.2	-0.0	-0.1	-1.0	-1.8
HR	-3%	-0.8	-0.6	-0.5	-0.4	-0.9	-	-0.1	-0.3	-0.0	-0.7
SI	-3%	-0.6	-1.1	-0.1	-0.1	-0.0	-0.5	-0.6	-0.0	-0.0	-0.1
IS	-2%	-	-	-	-	-	-	-	-	-	-
LT	1%	-0.4	-1.3	-1.2	-	-1.1	-	-0.1	-0.1	-0.0	-0.3
XI***	2%	-	-	-	-	-	-	-	-	-	-
MT	10%	-0.1	-0.1	-0.0	-	-0.0	-	-	-	-	-0.0
LI	203%	-	-	-	-	-	-	-	-	-	-

Notes: * 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 Iceland (IS), Liechtenstein (LI), Great Britain (GB) and Northern Ireland (XI) available.

Sources: EEA (2021b), Eurostat (2021a).

Top 30 emitters (power)

The 30 power plants with the highest emissions covered by the EU ETS emitted about 16% less in 2020 compared to 2019. With annual emissions of 218 Mt CO_2 these power plants are responsible for 23% of total combustion emissions (see Table 1.2). Individual installations with the highest emissions in the EU ETS are lignite-fired power plants, situated mainly in Poland or Germany. The largest emitter of all EU ETS installations is the lignite-fired power plant in Bełchatów, Poland, which emitted 30.1 Mt CO_2 in 2020. This represents a 8 % decline in emissions compared to 2019 and is due to the retirement of the oldest unit in 2019. On the list of top emitters, Bełchatów is followed by two German lignite-fired power plants that have also been shut down or transferred to a security reserve of power plant units in October 2019: Neurath and Jänschwalde. In total, ten German power plants were included in the top 30 emitters in 2020 and accounted for 45 % of the emissions from the top 30. Polish power plants, including Kozienice (hard coal), Turów (lignite), Rybnik (hard coal), Opole (hard coal), and Połaniec (hard coal), as well as Bełchatów, account for 29 % of the emissions from the top 30.

16 out of the 30 highest emitting power plants in 2020 were lignite-fired (Table 1.2). Lignite-fired power plants have higher specific emissions than hard coal- or natural gas-fired power plants. The CO_2 intensity of all lignite-fired power plants in the top 30 in 2020 averaged 1 123 g CO_2/kWh. The emission intensity of hard coal-fired power plants ranges between 712 and 1 527 g CO_2/kWh (Table 1.2). Several hard coal-fired plants also use additional fuel inputs. The Aboño hard coal power plant in Spain, for example, uses several other fuels, including fuel oil, diesel and the excess gases produced by the ArcelorMittal Asturias (Gijón) steel mill.

Table 1.2 Top 30 emitters in 2020 (power plants)

Company					Installed capacity 2020	Verified emissions 2020		Electricity generation 2020		Emission intensity 2020	
EUTL ID	Company		Power plant	Fuel	MW	$MtCO_2$	vs. 2019	TWh	vs. 2019	t CO_2/ MWh	vs. 2019
PL 1	PGE	PL	Bełchatów	Lignite	5,050	30.1	-8%	35.2	15%	0.9	-20%
DE 1606	RWE	DE	Neurath	Lignite	3,918	18.7	-17%	17.2	-19%	1.1	1%
DE 1456	LEAG	DE	Jänschwalde	Lignite	2,000	13.6	-23%	11.7	-26%	1.2	5%
DE 1649	RWE	DE	Niederaußem	Lignite	2,789	11.9	-36%	10.2	-37%	1.2	3%
DE 1607	RWE	DE	Weisweiler	Lignite	2,363	11.5	-14%	9.7	-9%	1.2	-5%
PL 4	ENEA	PL	Kozienice	Hard Coal	2,919	10.5	0%	11.6	2%	0.9	-2%
DE 1459	LEAG	DE	Schwarze Pumpe	Lignite	1,510	10.3	-2%	9.1	-3%	1.1	1%
PL 2	PGE	PL	Opole	Hard Coal	3,332	9.70	38%	11.3	14%	0.9	21%
DE 1454	LEAG	DE	Boxberg Werk IV	Lignite	1,470	8.7	-21%	8.2	-22%	1.1	1%
DE 1460	LEAG	DE	Lippendorf	Lignite	1,782	8.3	-8%	8.4	-10%	1.0	3%
DE 1453	LEAG	DE	Boxberg Werk III	Lignite	1,000	6.6	-13%	5.6	-13%	1.2	0%
PL 3	PGE	PL	Turów	Lignite	1,488	5.8	5%	5.2	2%	1.1	3%
BG 9	Contour Global Maritsa East	BG	TEC ContourGlobal Maritsa East 3	Lignite	908	5.3	-7%	4.8	-14%	1.1	8%
PL 5	Enea Elektrownia Połaniec	PL	Połaniec	Hard Coal	1,862	4.6	-33%	6.4	-25%	0.7	-9%
CZ 124	Elektrarna Pocerady, a.s.	CZ	CEZ, a. s. - Elektrarna Pocerady	Lignite	918	4.6	-3%	4.4	-5%	1.0	2%
BG 50	TPP	BG	Maritsa East 2	Lignite	1,604	4.3	-45%	3.8	-43%	1.1	-5%
HU 142	RWE	HU	Mátrai Eromu ZRt.	Lignite, Natural Gas	613	4.2	-7%	0.9	-4%	4.9	-3%
DE 1380	Großkraftwerk Mannheim	DE	Mannheim	Hard Coal	1,971	4.2	-15%	4.2	-16%	1.0	1%
FR 988	ENGIE THERMIQUE FRANCE	FR	ETF - CENTRALE DK6	Natural Gas	796	3.9	-16%	4.1	-5%	0.9	-12%
BE 750	Electrabel	BE	Electrabel - Knippegroen	Blast Furnace Gas	315	3.9	-24%	2.0	-15%	2.0	-11%
GR 15	ΔΕΗ AE	GR	Dimitrios	Lignite	1,456	3.9	-43%	2.3	-47%	1.6	6%
IT 439	ENEL	IT	Torrevaldaliga Nord	Hard Coal	1,845	3.8	-15%	3.7	-20%	1.0	6%
BG 152	AES-3C Maritza East 1	BG	TPP AES-3C Maritza East 1	Lignite	686	3.8	-10%	3.3	-16%	1.2	7%
SI 4	TERMOELEKTRARNA SOSTAN	SI	Termoelektrarna Sostanj d.o.o.	Lignite, Natural Gas	1,072	3.8	-1%	3.7	-2%	1.0	1%
GB 1102	RWE Generation UK Plc	GB	Pembroke Power Station	Natural Gas	2,245	3.8	-12%	6.9	-5%	0.5	-8%
CZ 129	CEZ, a. s.	CZ	CEZ, a. s. - Elektrarna Tusimice 2	Lignite	728	3.7	-13%	3.9	-18%	1.0	6%
IT 521	ENEL	IT	Brindisi Sud	Hard Coal	2,420	3.7	-19%	3.6	-16%	1.0	-3%
ES 201	EDP	ES	Aboño 1	Hard Coal, Blast Furnace Gas	878	3.6	-27%	2.4	-20%	1.5	-8%
PL 31	TAMEH Polska Sp. z o. o.	PL	Zaklad Wytwarzania Nowa	Blast Furnace Gas	180	3.5	7%	nA		nA	
DE 1205	Uniper Kraftwerke GmbH	DE	Kraftwerk Scholven	Hard Coal	690	3.4	-15%	2.3	-21%	1.5	8%

Notes: All installations are power plants reporting under the activity code combustion in the EUTL.
Installed capacity is net for German plants and gross in most other countries.
No electricity generation avaiable for PL31.

Sources: EEA (2021b), ENTSO-E (2021), Platts (2014).

Six plants are no longer among the top 30. Of these plants, the Moorburg power plant in Germany, which was only connected to the grid in 2015, is the most interesting. In 2019, this power plant was still ranked 21st among the largest power plant emitters and fell to 105th place in 2020. Thus, verified emissions fell from 4.7 Mt CO_2 to 1.6 Mt CO_2 and generation from 5.8 TWh to 1.9 TWh in this period. Apparently, this power plant can no longer be operated economically due to falling electricity wholesale market prices and rising CO_2 prices. The operator, Vattenfall, took part in the first tendering procedure for the reduction of electricity generation from hard coal plants and small-scale lignite plants under the German Coal Electricity Generation Abandonment Act (Kohleverstromungsbeendigungsgesetz) and received financial compensation for taking the power plant off the grid in 2021.

Five of the new plants in the Top 30 list were already in the follow-up places last year. The biggest leap was made by the Zaklad Wytwarzania Nowa power plant (PL 31), which provides energy for ArcelorMittal Poland S.A. Unit in Dąbrowa Górnicza.

Top 30 emitters (industry)

The 30 industrial installations with the highest emissions in 2020 that are not power plants ([8]) emitted 21 % of total industrial emissions (about 123 Mt CO2 eq.) (see Table 1.3). These industrial installations are spread across Europe, with no single country dominating the list. The five largest industrial emitters all belong to the iron and steel sector. Overall, this sector accounted for 67.9% of the total emissions of the 30 largest industrial installations ([9]), followed by refineries (26.8%), chemicals (2.4%) and cement clinker (2.2%).

Three new installations entered the top 30 emitters list in 2020: NL 96 (refinery), SE 495 (steelworks) and BE 203830 (chemicals). The SE 495 steelworks increased its emissions by 74%. A closer look at this plant reveals that the blast furnace power plant (SE 178) belonging to the steelworks no longer reported any emissions in 2020. The combined emissions of these two plants were at a slightly lower level in previous years than of the SE 495 plant in 2020. This is presumably related to the fact that the previously under SE 178 reported emissions are now reported under the SE 495 installation due to the new Direct Reduced Iron process that has been in use for a short time.

Table 1.3 Top 30 emitters in 2020 (industrial plants, excluding combustion)

EUTL ID	Company	Installation	Activity code	Verified Emissions 2020	
				$MtCO_2$	vs. 2019
AT 16	Voestalpine Stahl Gmbh	Voestalpine Stahl Linz	24	8,6	-3%
DE 69	Thyssenkrupp Steel Europe Ag	Integriertes Hüttenwerk Duisburg	24	6,8	-13%
GB 325	Tata Steel Uk Limited	Port Talbot Steelworks	24	6,1	-6%
FR 956	Arcelormittal France	Arcelormittal France- Dunkerque	24	5,9	-22%
FR 628	Arcelormittal Mediterranee	Arcelormittal Mediterranee	24	5,8	-24%
IT 575	Sarlux Srl	Impianti Di Raffinazione	21	5,8	-6%
NL 144	Tata Steel Ijmuiden B.V.	Tata Steel Ijmuiden Bv Bkg 1	24	5,7	-9%
IT 515	Arcelormittal Italia S.P.A.	Arcelormittal Italia Spa - Stabilimento Di Taranto	24	4,8	-18%
GB 321	British Steel Limited	Scunthorpe Integrated Iron & Steel Works	22	4,7	4%
SK 150	U. S. Steel Košice, S.R.O.	U. S. Steel Košice, S.R.O.	24	4,4	-13%
NL 99	Shell Nederland Raffinaderij B.V.	Shell Nederland Raffinaderij B.V.	21	4,1	-5%
DE 53	Hüttenwerke Krupp Mannesmann Gmbh	Glocke Duisburg	24	4,0	-23%
ES 212	Arcelormittal España, S.A.	Arcelormittal España, S.A.	24	3,9	-23%
RO 44	Sc Liberty Galati Sa	Liberty Galati Sa	24	3,9	-7%
DE 43	Salzgitter Flachstahl Gmbh	Glocke Salzgitter	24	3,7	-9%
BE 127	Total Raffinaderij Antwerpen	Total Raffinaderij Antwerpen	21	3,6	-9%
DE 52	Rogesa Roheisengesellschaft Saar Mbh	Roheisenerzeugung Dillingen	24	3,6	-14%
DE 19	Pck Raffinerie Gmbh	Pck Raffinerie Glocke Schwedt	21	3,5	3%
BE 203912	Arcelormittal Belgium	Arcelormittal Gent 1	24	3,5	-20%
FI 445	Ssab Europe Oy	Raahen Terästehdas	24	3,3	1%
SE 495	Ssab Emea Ab	Ssab Luleå	24	3,1	74%
BE 203830	B.A.S.F. Antwerpen	Basf Antwerpen - 127A	42	3,0	28%
CZ 114	Třinecké Železárny, A. S.	Třinecké Železárny	24	2,8	7%
DE 4	Ruhr Oel Gmbh	Ruhr Oel Gmbh - Werk Scholven - Co2-Glocke	21	2,8	-7%
AT 26	Omv Downstream Gmbh	Raffinerie Schwechat	21	2,7	-2%
PL 490	Górażdże Cement Spółka Akcyjna	Górażdże Cement Spółka Akcyjna	29	2,7	2%
FI 533	Neste Oyj	Porvoon Jalostamo	21	2,7	-10%
NL 96	Esso Nederland B.V.	Esso Raffinaderij Rotterdam	21	2,6	11%
DE 11	Mineralölraffinerie Oberrhein Gmbh & C	Werk 1 Und Werk 2	21	2,6	-1%
PL 362	Polski Koncern Naftowy Orlen S.A.	Rafineria	21	2,6	-8%

Note: A list of activity codes can be found in Annex 1 Table A1.1.
Sources: EEA (2021b), EU (2021).

([8]) In this report, industrial installations are understood to be 'non-combustion' installations, even though some industrial installations are included under the ETS activity code for combustion. In fact, most installations classified under 'combustion' are not electricity generators.

([9]) This relatively high proportion reflects the emission-intensive nature of iron and steel production (i.e. the smelting of iron ores in blast furnaces to produce molten steel).

1.1.2 Balance of allowances

Supply and demand

The total supply of allowances in 2020 increased by 6 % compared to the year 2019, amounting to 1 422,7 million allowances. This amount includes free allocation, auctioned allowances and the exchange of international credits (Table 1.4). The supply of allowances allocated for free (without transitional allocation for the modernisation of electricity generation) was 4.3 % lower than in 2019. Free allocation to existing installations is being reduced every year, reflecting the linear reduction factor and the cross-sectoral correction factor, as well as the carbon leakage status relevant for allocation ([10]). Furthermore, some of the free allowances normally allocated to existing installations (Article 10(a)(1) of the ETS Directive) were not allocated as a result of installation closures or a reduction in production levels ([11]). Under Article 10(c) of the ETS Directive allowances could be allocated for free as a transitional measure to electricity generators in eligible Member States in order to support decarbonisation measures. This transitional period ended in 2019 and thus decreased to 0 EUAs in 2020. Eligible countries may again issue free allocations under Article 10c in the 4th trading period. Of the 10 eligible countries, Bulgaria, Hungary and Romania have opted for this.

The number of allowances auctioned in 2020 was 24 % higher than during the previous year[12]. The main reason for this increase are additional amounts auctioned by the UK compensation for withheld amounts in the context of suspended trading in the UK in 2019 due to the Brexit negotiations. Trading was resumed for 2020 (EC, 2020e). From 2021 onwards, the UK and its installations no longer participate in the EU ETS.

The use of international credits decreased by 2 % in 2020 compared to 2019 and remains at a low level overall with 26.5 million allowances. This is due to the fact that the overall limit for the use of international credits has almost been reached (cf. Figure 2.10). From 2021 onwards, international credits can no longer be used in the EU ETS.

While the demand for allowances from stationary installations exceeded the supply by 225.8 million allowances in 2019 due to the UK suspension in 2019, in 2020 the supply of allowances exceeded the demand by 38.3 million allowances.

The average certificate price in 2020 was at a similar level as in 2019. However, the average price masks large fluctuations throughout the trading year. Due to the first lockdown following the Covid-19 pandemic, the EUA price fell to 14.60 EUR in March 2020, but rose to 30.92 EUR by the end of the year.

([10]) Since 2013, power generators have been required to buy all their allowances, with exceptions made for some countries. Manufacturing industry received 80 % of the benchmark allocation free of charge in 2013. This proportion will decrease gradually year on year, down to 30 % in 2020. Sectors and subsectors deemed to be exposed to a significant risk of carbon leakage, continue to receive 100 % of their benchmark allocation free of charge, subject to the cross-sectional correction factor.

([11]) This reduction in allocated allowances was to an extent offset by an increase (in absolute terms rather small) in the number of free allowances allocated to new entrants to the ETS and existing installations with 'significant' capacity extensions (see Article 10(a)(7) of the ETS Directive).

([12]) Number of allowances does not include allowances that are allocated to the Innvations Fund.

Table 1.4 EUA demand, supply and price (stationary installations), 2019-2020

	2019	2020	Change
Verified emissions (Mt CO_2-eq.)	1530,3	1355,1	**-11%**
Combustion emissions	954,6	821,5	**-14%**
Industrial emissions	575,7	533,6	**-7%**
Total supply of allowances (millions of EUAs)	1336,3	1422,7	**6%**
Free allocation (incumbents, new entrants)	696,6	667,8	**-4%**
To existing installations	667,2	638,4	**-4%**
To new entrants and capacity extensions	29,3	29,3	**0%**
Transitional free allocation to electricity generation	24,1	0,0	**-100%**
Auctioned amounts/primary market sales	588,5	728,5	**24%**
International credits exchanged	27,0	26,5	**-2%**
Supply/demand balance (millions of EUA)			
Balance stationary installations only	-194,0	38,3	**-120%**
Net demand in EUAs from aviation	-31,8	13,8	**-143%**
Annual balance all ETS	-225,8	52,1	**-123%**
EUA price (EUR)	24,72	24,36*	**-1%**

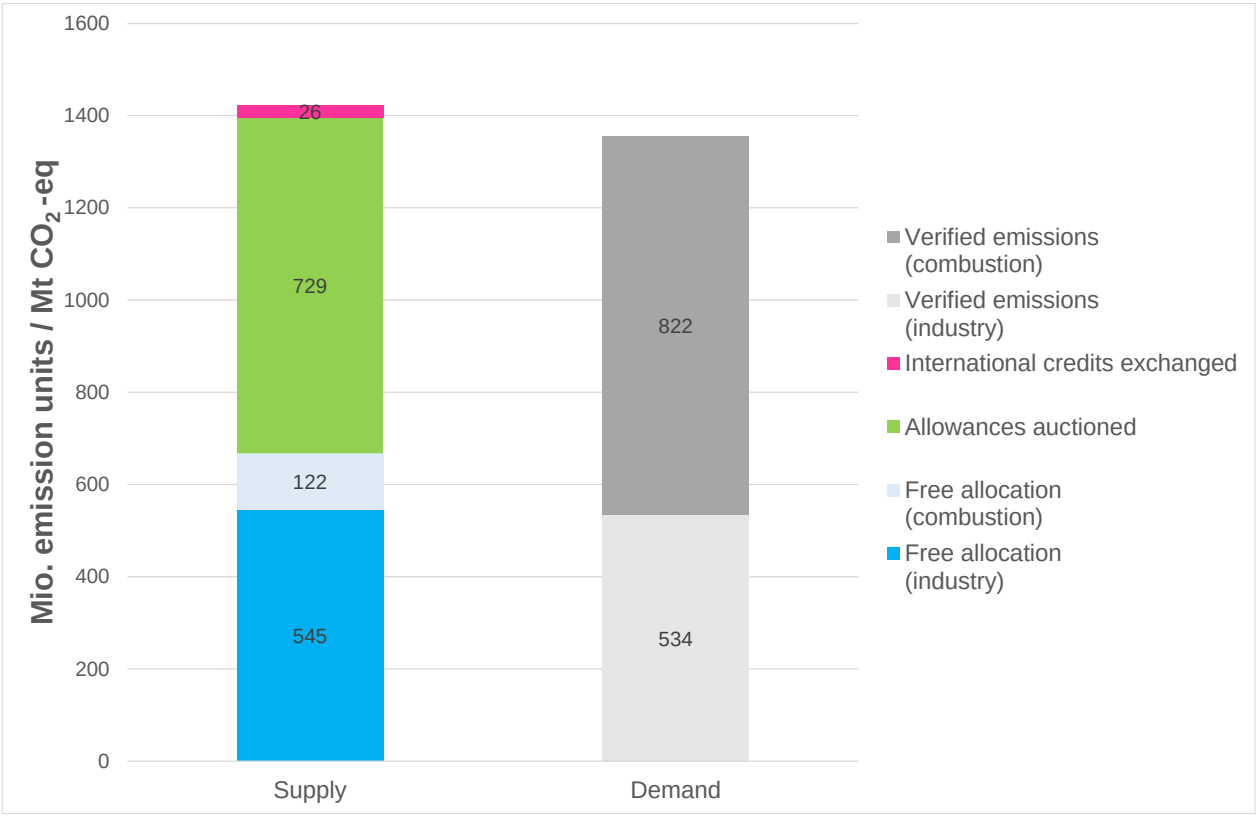
Notes: Based on data from July 1st 2021
The distinction between combustion (activity code 20) and industrial emissions (activity code 21 and above) is based on the EUTL classification of activities and does not take into account waste gas transfers from the production of iron and steel or cross-boundary heat flows.
*Average price. Due to the Corona pandemic, fluctuations were wider than usual and ranged from EUR 14.60 to EUR 30.92.

Sources: EEA (2021b), EEX (2021), ICE (2021)

Supply and demand by main activity type

In 2020, combustion plants had to buy most of the allowances to cover their emissions through auctions, from other market participants or by purchasing international credits (Figure 1.3). Electricity generators make up the bulk of emissions from combustion installations. From the third trading period onwards, allowances are generally no longer allocated free of charge to electricity generators with some exceptions, e.g. for transitional free allocation to generators located in eligible Member States with a goal to modernise their electricity sector (cf. Section 2.1.5) ([13]). Industrial installations received a larger number of free allowances ([14]). However, the balance between allowances allocated for free and verified emissions varies across individual industrial sectors.

Figure 1.3 Balance of supply and demand for combustion and industry in 2020



Note: Industry refers to those EUTL activities (21-99) that specifically refer to certain industrial activities. In addition to power plants, the sector combustion (20) covers industrial installations without a specific ETS activity.

Source: EEA (2021b).

Based on EUTL activity classifications, Figure 1.4 shows that in 2020 free allocation to the iron and steel sector exceeded its verified emissions by around 36 million. It is important to note, however, that the balance between free allocation and verified emissions depends upon the way in which waste gases are

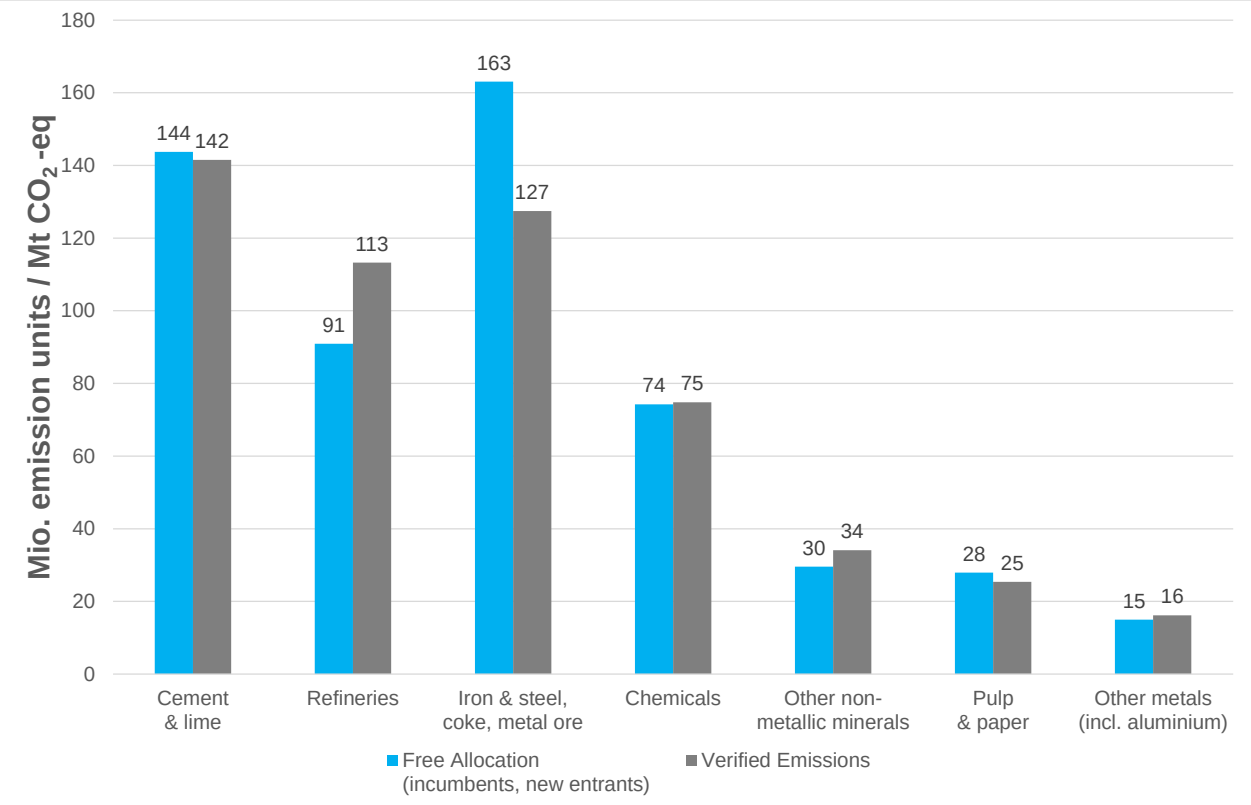
([13]) While free allocation was still made to electricity generation during the first and second trading periods, it ceased with the beginning of the third trading period, because a general consensus emerged that this sector can pass on costs to consumers (and made windfall profits while receiving free allocation). Under Article 10(a)(4) of the ETS Directive, however, electricity generators are still eligible for free allowances for heat production only. Furthermore, the sector combustion (activity code 20) contains some industrial installations not classified elsewhere, which may also receive free allocation.

([14]) The higher share of free allocation to industry reflects concerns about the exposure of industrial sectors to international competition. Free allocation to industrial installations under Article 10(a)(1) of the ETS Directive are distributed by applying harmonised allocation rules based on EU ETS-wide benchmarks and historical production levels, as well as the 'carbon leakage status' of the installation.

reported under the EU ETS. This is particularly relevant for the iron and steel sector, where allocation for the combustion of waste gases is made to the installation producing the waste gas (i.e. the iron and steel plant), while emissions from their combustion is counted toward an installation typically included in the combustion sector. Refineries are the only sector where verified emissions exceeded free allocation by a substantia amount (22 Mt or 20% of verified emissions). For all other sub-sectors including cement and chemicals, free allocation generally covered or even exceeded verified emissions (one exception are other non-metallic minerals) where the shortfall amounted to 4 Mt or about 10% of verified emissions.

The situation in 2020 is therefore different than in 2019 where the majority of industrial sectors did not receive freely allocated allowances sufficient to cover verified emissions. One likely reason is the economic downturn associated with the Covid-19 pandemic (see Figure 2.4)Added to this, the tightening cap on emissions governed by the linear reduction factor, which reduces the amount of allowances available free of charge in each year. The amount available for free allocation is further influenced by the cross-sectoral correction factor ([15]). Emissions have not been declining at the same pace. At the same time, since the market had been oversupplied for most years of the second and third trading periods, a substantial surplus of allowances has been built up, which can be used to cover excess emissions (see Figure 2.5).

Figure 1.4 Balance of free allocations and emissions, industrial sectors, 2020



Note: ETS activity types have been aggregated for certain sectors (Table A1.1). As per EUTL classification, the overall allocation presented here for the iron and steel sector includes allowances for emissions that are actually reported under combustion installations, for example if blast furnace gas is burnt in power plants. Likewise, albeit to a lesser extent, the allocations presented for the pulp and paper sector and the chemicals sector include allowances related to emissions reported under combustion installations, for example, if paper production or chemical facilities buy heat from other installations. In other words, allowances are allocated to these sectors, whereas corresponding emissions are reported under combustion.

Source: EEA (2021b).

([15]) Cross-sectoral correction factor value for 2019 was 79.65%. See EC (2017a).

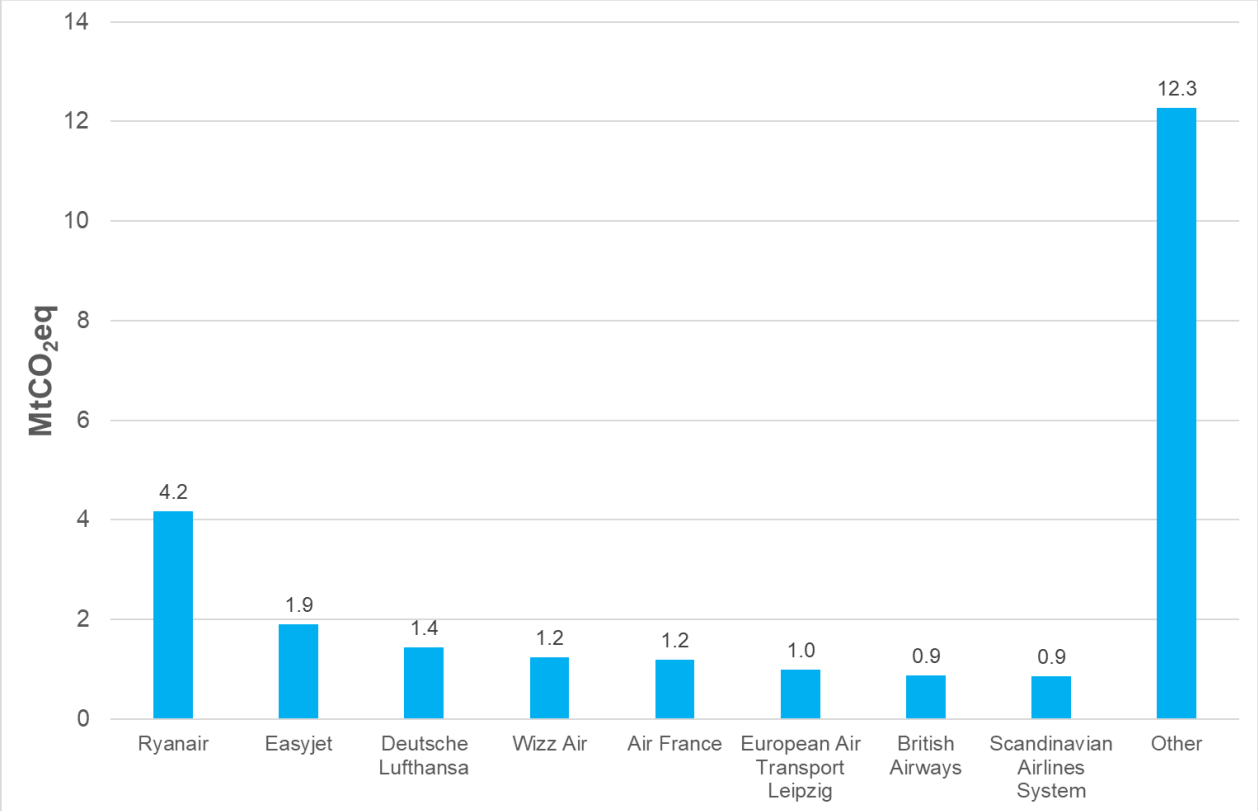
1.2 Aviation

1.2.1 Emission trends

Status in 2020

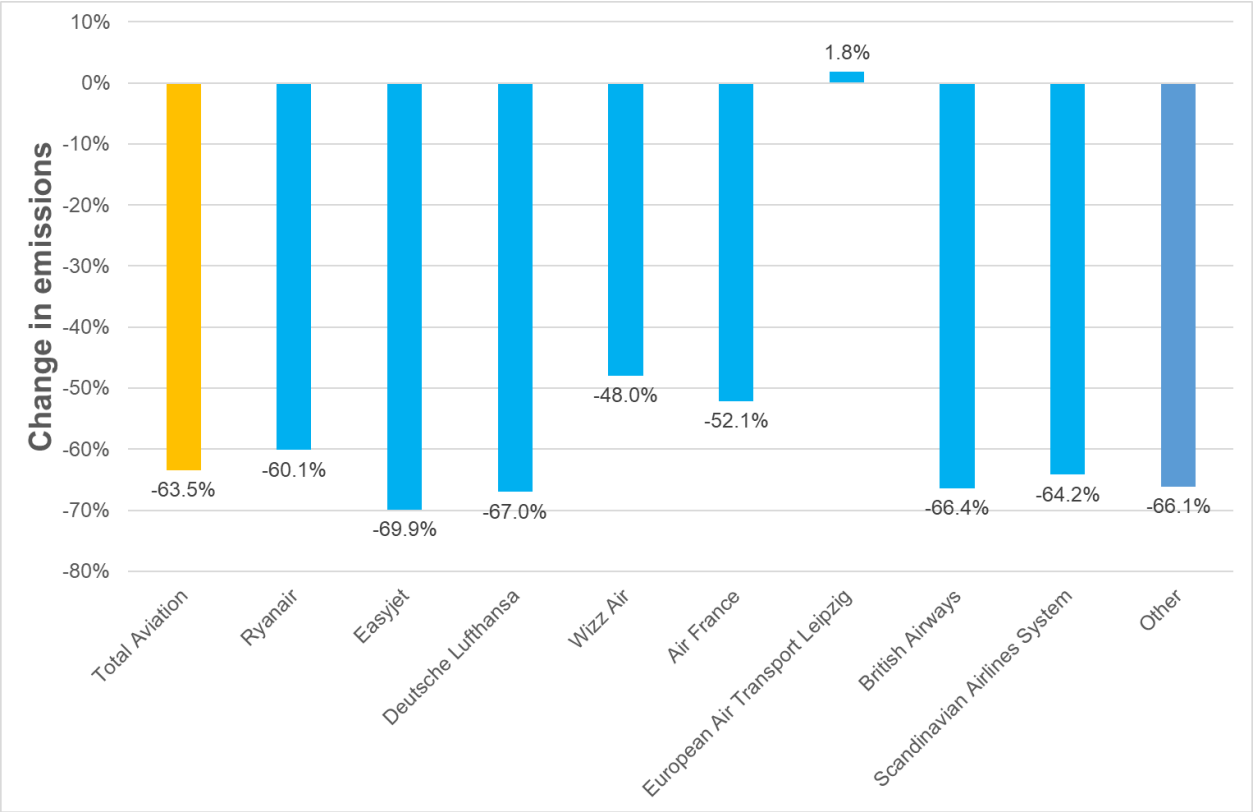
In 2020, aviation emissions covered by the EU ETS amounted to 24.9 Mt CO_2–eq, which represents a decrease of 63.5 % compared to the previous year. This sharp decline is mainly driven by the decrease in air traffic due to the Covid-19 pandemic. The eight largest aircraft operators were responsible for 51 % of total emissions. Ryanair and EasyJet were responsible for the largest share of EU ETS-covered emissions in 2020, accounting for around 4.2 Mt CO_2-eq. and 1.9 Mt CO2-eq. respectively (Figure 1.5). The Deutsche Post subsidiary "European Air Transport Leipzig" is new in the list of the top 8 aviation emitters. Under these top emitters it was the only one which increased its emissions in 2020 compared to 2019, as it wasn't affected by the declining passenger transport as a cargo operator (Figure 1.6).

Figure 1.5 Aviation emissions by carrier, 2020



Source: EEA (2021b).

Figure 1.6 Relative change in ETS aviation emissions, 2020 vs. 2019



Source: EEA (2021b).

1.2.2 Balance of allowances

Supply and demand

In 2020, aviation emissions covered by the EU ETS decreased by 63.5 % compared to the previous year (Table 1.5). The supply of EU aviation allowances (EUAA) increased by 6.6% mainly due to the resumed auctions in the UK in 2020 which were suspended in 2019 due to Brexit. In general, the supply of EUAAs is relatively stable, because the emission cap for aviation is the same for each year of the third trading period (in contrast to stationary installations, where the cap declines). 82 % of allowances are distributed for free, while 15 % of allowances auctioned and the remaining allowances held in a reserve for distribution to fast-growing aircraft operators and new entrants to the market (EC, 2018a).

7.5 million aviation allowances were auctioned in 2020, 36.4 % more than in the previous year(an increase of 2 million EUAAs of which 1.7 million EUAAs were auctioned by the UK where no auctions took place in 2019). Free allocation amounted to 30.1 million allowances (including 0.8 million allowances from the New Entrants Reserve). 0.3 million of international credits are estimated to have been exchanged for EUAAs (Table 1.5). In contrast to the previous year, net demand from aviation is now negative, as supply exceeded demand by 13.8 million EUAAs (see also Figure 1.7). Similar to EUA prices, the average EUAA price level in 2020 is nearly identical to 2019.

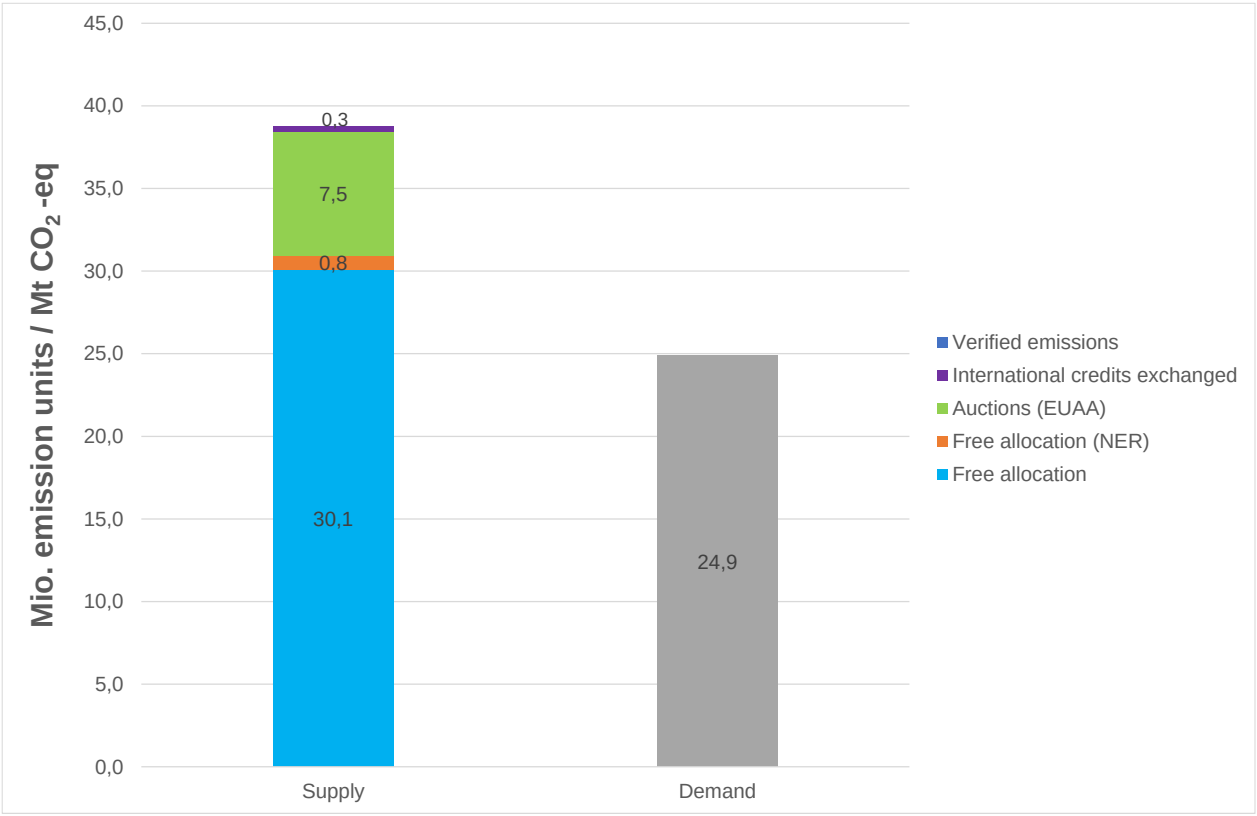
With the beginning of 2020, the EU ETS was linked to the Swiss emissions trading system. Since then, companies that are subject to emissions trading can also use the Swiss equivalents in addition to the EUAs and EUAAs to fulfil their obligations. The Swiss ETS has only a comparatively small volume, and therefore the impact on the EU ETS is very small (see ICAP, 2021).

Table 1.5 EUAA demand, supply and price (aviation operators), 2018-2019

	2019	2020	Change
Total demand (Mt CO_2-eq.)	68,2	24,9	**-63,5%**
Aviation emissions	68,2	24,9	**-63,5%**
Total supply (millions of EUAAs)	36,4	38,7	**6,6%**
Aviation free allocation	29,7	30,1	**1,4%**
Aviation free allocation (NER)	0,8	0,8	**-2,4%**
Average auctioned amounts	5,5	7,5	**36,4%**
Estimated international credits exchanged	0,3	0,3	**-2,2%**
Annual supply-demand balance (millions of EUAAs)	-31,8	13,8	**-143,5%**
Verified emissions Switzerland (Swiss Linking)	-	0,5	
Allocation Switzerland (Swiss Linking)	-	0,3	
EUAA price (EUR)	24,89	23,73*	**-4,7%**

Notes: NER, New Entrants Reserve.
*Average price. Due to the Corona pandemic, fluctuations were wider than usual.
Sources: EEA (2021b), EEX (2021), ICE (2021).

Figure 1.7 Supply and demand balance for aviation in 2020



Note: International credits exchanged (aviation) estimated based on total CER/ERUs exchanged (cf. Figure 2.11).
Sources: EC (2021d), EEA (2021b).

2 Long-term trends

- Between the start of the EU ETS in 2005 and 2020, emissions from stationary installations decreased by 43 %. This decrease is mainly driven by emission reductions in power generation, as electricity generation from hard coal and lignite has been largely replaced by generation from renewables over the course of the past fifteen years.
- Emissions in the largest industrial sectors (iron and steel, cement and lime and refineries) have also been substantially reduced since the beginning of the EU ETS, although not to the same extent as in electricity generation.
- Overall, emissions and production volumes for industrial sectors were relatively flat from the start of the third trading period in 2013 up until 2016. Since then, certain sectors such as cement and lime have increased their production output whilst other sectors such as iron and steel have experienced a decline in production output. This is also reflected in verified emissions. Due to the Covid19-pandemic the year 2020 is a special case, though.
- Aviation emissions have increased year on year during the third trading period, reflecting the large growth in passenger numbers. In each year, the demand for allowances from aviation exceeded the amount of aviation allowances available, meaning that the aviation sector had to buy additional allowances from the stationary sector. This does not apply to 2020 due to the Covid19-pandemic where a strong decline in emissions can be observed.
- The number of allowances allocated for free has decreased over time. The largest drop occurred between the second and third trading periods, as electricity generators are generally no longer eligible for free allocation. An exception are generators located in eight Member States entitled to hand out transitional free allocation to support the modernisation of their power sector. The impact of the transitional free allocation on diversification of the fuel mix is unclear. From the fourth trading period onwards, stricter rules are planned to ensure a reduction in emission intensity.
- In general, the share of allowances auctioned (rather than given out for free) has increased steadily since the start of the EU ETS. The largest increase was observed between the second and third trading period (see above). However, a number of individual effects has led to variations in the amount of allowances auctioned since the start of the third trading period. Member States revenues from auctioning have increased significantly due to the rise in CO_2 prices.
- While lingering at low levels until 2017, allowance prices showed a sharp increase from 2018 on. In 2020, the Covid 19 pandemic caused a brief drop in the price. However, it recovered and rose to new highs by the end of the year. Price drivers likely are the MSR, the political agreement to further strengthen the EU ETS from the fourth trading period onwards and ongoing discussions about an increase in EU climate policy ambition.

This section discusses stationary installations and aviation separately, focussing first on trends between 2005 and 2020, then deriving implications for the balance of supply and demand of allowances. As the 2020 marks the end of the 3rd trading period, this chapter also provides a summary of emission trends and the balance of supply and demand during this period.

Two different caps are set for stationary installations and aircraft operators. However, aircraft operators can purchase EUAs, which is why the interaction between stationary installations and aviation is highlighted wherever applicable.

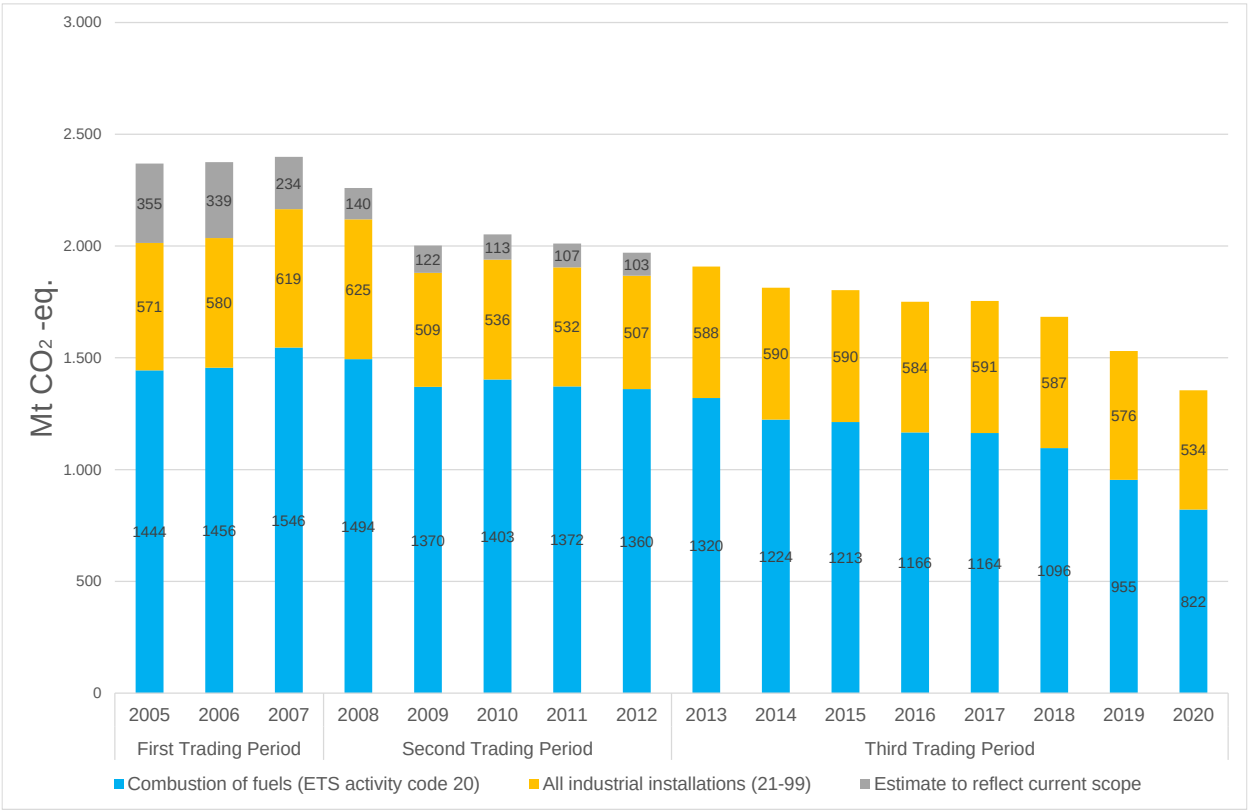
2.1 Stationary installations

2.1.1 Emission trends

Total EU ETS emissions

By the end of the second trading period in 2012, EU ETS emissions had fallen to 17 % below 2005 levels (Figure 2.1). At the end of the third trading period in 2020, emissions are now 43 % below 2005 levels. This decrease in emissions is higher than the 21 % stipulated in the 2020 Climate and Energy Package and already nearing the 43 % cut in emissions originally foreseen for the ETS sectors until 2030 (as part of the Climate and Energy Framework). The EU has since increased its emission target for 2030 to a reduction of 55% below 1990 until 2030. As part of the "Delivering the European Green Deal" the EU Commission proposed in June 2021 to translate this into a reduction target for ETS sectors of 61-62% below 2005 levels until 2030 (EC, 2021a).

Figure 2.1 Verified emissions disaggregated by combustion and industry sectors, including an estimate to reflect the scope of the third trading period



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.

Source: EEA (2019), EEA (2021b).

Changes in emissions depend on both changes in activity levels and the emission intensity of production, influenced by EU and international policies and a wide range of other factors. This makes it challenging to ascertain the extent to which emission reductions are directly attributable to the EU ETS.

Combustion-related emissions, which accounted for 61 % of total EU ETS emissions in 2020, and have been the main driver of the decline in emissions under the EU ETS, depend directly on primary energy consumption levels and the fuel mix:

- Primary energy consumption depends on the demand for energy by end users (electricity consumption by households and industry) and transformation efficiency. The demand for energy in turn depends – amongst others – on economic activity, climatic factors and attitudes and behaviours towards energy consumption. Some of these factors are themselves influenced by policies (e.g. those promoting energy efficiency).
- The fuel mix used to transform primary energy into electricity or heat is also a determinant. It depends on energy infrastructure and is affected by relative variations in fuel prices. Energy policies also play a key role in modifying fuel mixes, for example by promoting the deployment of renewable energy sources (EEA, 2014) or the phase-out of fossil fuels.

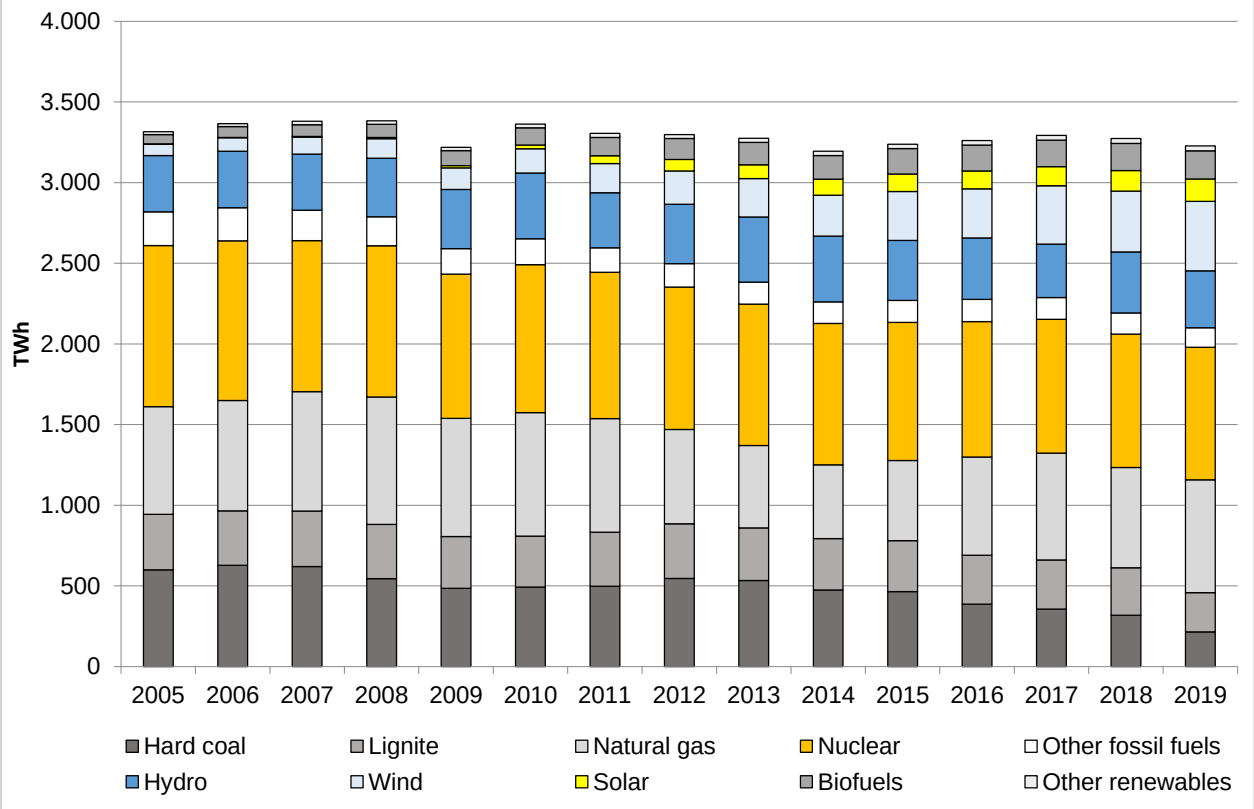
Emissions from activities other than combustion are generally more strongly linked to economic activity/production levels than are combustion-related emissions (EEA, 2015). However, improvements in efficiency levels also play an important role, and the EU ETS encourages this through the free allocation of allowances using benchmarks. A product benchmark is set on the basis of the average GHG emissions of the top 10% of installations.

Energy sector

The decline in verified emissions in the combustion sector over recent years is a consequence of considerable changes to the fuel mix. Between 2005 and 2019([16]), electricity generation for the EU-27+UK from hard coal, lignite and nuclear power declined by 64 %, 29 % and 18 %, respectively (Figure 2.2). The reductions in electricity generation from these sources were offset by an increase in gross electricity generation from renewables such as wind, solar and biomass over the same period. The Renewable Energy Directive along with national policies and programmes have encouraged the uptake of renewables, which has also been driven by reductions in technology costs. In recent years, many Member States have decided or already begun the active phase-out of coal-fired generation. The reduction in emissions may also have benefited from improvements in transformation efficiency for thermal electricity generation, which means that less primary energy was needed to generate the same quantity of electricity.

([16]) 2019 are the most recent data available at Eurostat for the production of electricity as of July 2021

Figure 2.2 Gross electricity generation by fuel in the EU-28



Source: Eurostat (2021c).

Industry sector

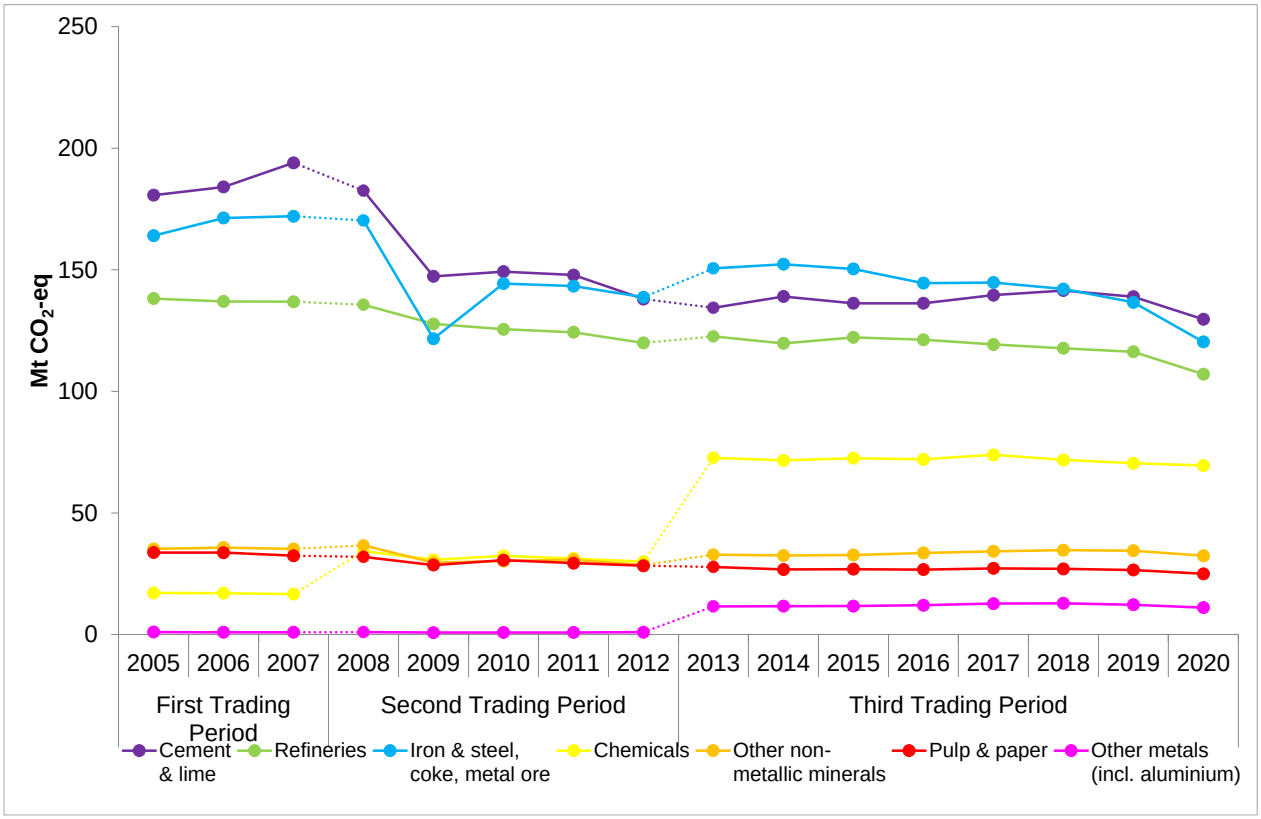
Overall, emissions from the three largest industry sectors (i.e. cement and lime, iron and steel and refineries) have been reduced by 26 % since 2005 when looking at the EU-25 (Figure 2.3) ([17]). The relatively lower abatement by industrial compared to combustion installations reflects both higher abatement costs per unit of output and relatively lower output levels in previous years, which have somewhat reduced the need for abatement in the short term.

Three sectors dominate industrial emissions in the EU ETS: iron and steel, cement and lime and refineries. While ETS emissions from refineries have exhibited a slow and steady decline since the beginning of the EU ETS, the trend of emissions is more variable for steel and cement. During the first trading period (2005-2007), the verified emissions of installations in the cement and steel sector increased by 7 % and 5 %, respectively. All industrial activities covered by the EU ETS for the EU-25 experienced a decline in their verified emissions during the second trading period. The steel and cement sectors experienced a sharp drop in verified emissions of 29 % and 19 %, respectively, in a single year (2009). During the third trading period, verified emissions in the cement sector have decreased by 3 % and by 20 % in the steel sector. However, a major contributor here is the Covid19 pandemic, which caused an unusually strong decline in 2020. Therefore, emissions are expected to rise from 2021 onwards.

([17]) Verified emissions are shown for only the EU-25 (including the UK) to provide a consistent number of Member States during the period 2005-2018.

Since the beginning of the third trading period additional activities and gases fall within the scope of the EU ETS. This is most important for the sectors "Chemicals" and "Other metals" ([18]).

Figure 2.3 EU ETS emissions by main industrial activity in the EU-25 (2005-2020)



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

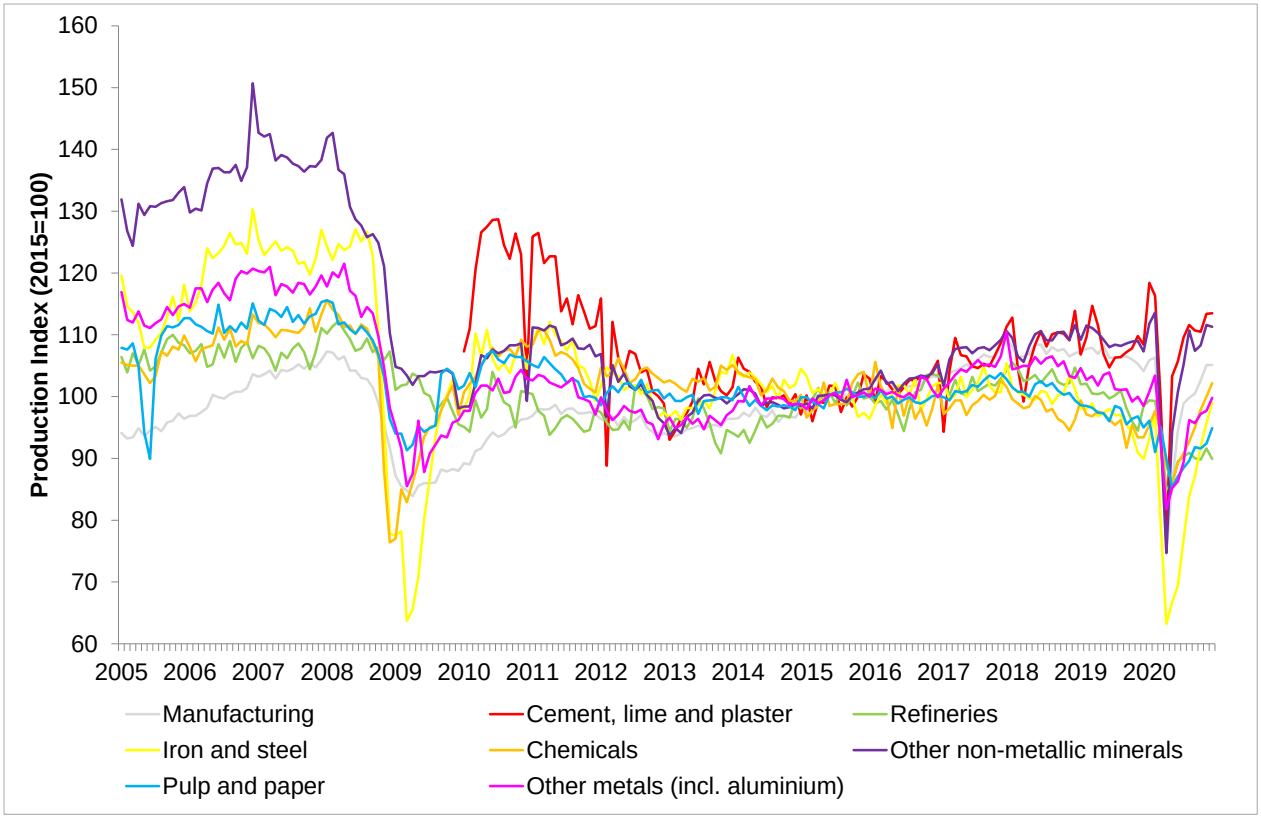
Source: EEA (2021a), EEA (2021b).

The emission reductions of industrial installations since the start of the second trading period are primarily due to lower levels of output following the financial and economic crisis of 2008 and 2009 (Figure 2.4). After this drop, production never returned to pre-crisis levels. Secondary explanatory factors, such as improvements in energy efficiency and the increased use of biomass and waste as energy sources in production, likely further contributed to lower emissions levels ([19]). The development in emissions observed during the third trading period (Figure 2.3) follows trends in production volumes (Figure 2.4) Between 2013 and 2015 those were relatively flat. Since 2015, the cement sector and other non-metallic minerals have generally exhibited upward trends in production, while in other sectors production has trended downwards, notably in the steel and chemical sectors. At the beginning of 2020 a sharp drop can be observed in the production index for all sectors as a result of the Covid-19 pandemic and measures taken to reduce the spread of the virus. All sectors were affected with the sharpest drop exhibited by the iron and steel sector. Production in all sectors has since picked up again significantly, nearing or even exceeding pre-crisis levels, with the refineries production index remaining at a slightly lower level.

([18]) Since 2013, the EU ETS covers non-CO_2 gases along with CO_2 emissions: nitrous oxide (N_2O) emissions from the production of nitric acid, and adipic acid and glyoxylic acid production, as well as perfluorocarbon (PFC) emissions from the production of aluminum.

([19]) Attributing changes in emissions to individual driving factors requires a detailed assessment taking into account simultaneity and overlaps between different factors. Such an analysis is beyond the scope of this report.

Figure 2.4 Monthly volume index of production by main activity in the EU-27 (2005-2020)



Note: Volume index of production (seasonally and calendar adjusted data for the EU-27 as Eurostat only offes no aggregate for EU25).

Source: Eurostat (2021b)

Emission reductions by trading period

The 3rd trading period of the EU-ETS ended in 2020. Table 2.2 provides an overview of the emission reductions between the first and last years of the trading periods for the different sectors. Since the scope of the EU-ETS increased over time as additional countries gases and sectors joined the scheme, reductions are shown for the EU-25 (including the UK) in order to make a comparison possible. During the third trading period, the overall stationary verified emissions decreased by 29%. The combustion sector accounts for the largest share of this decline with -38%.

Table 2.1 Emission reductions between first and last year of each trading period

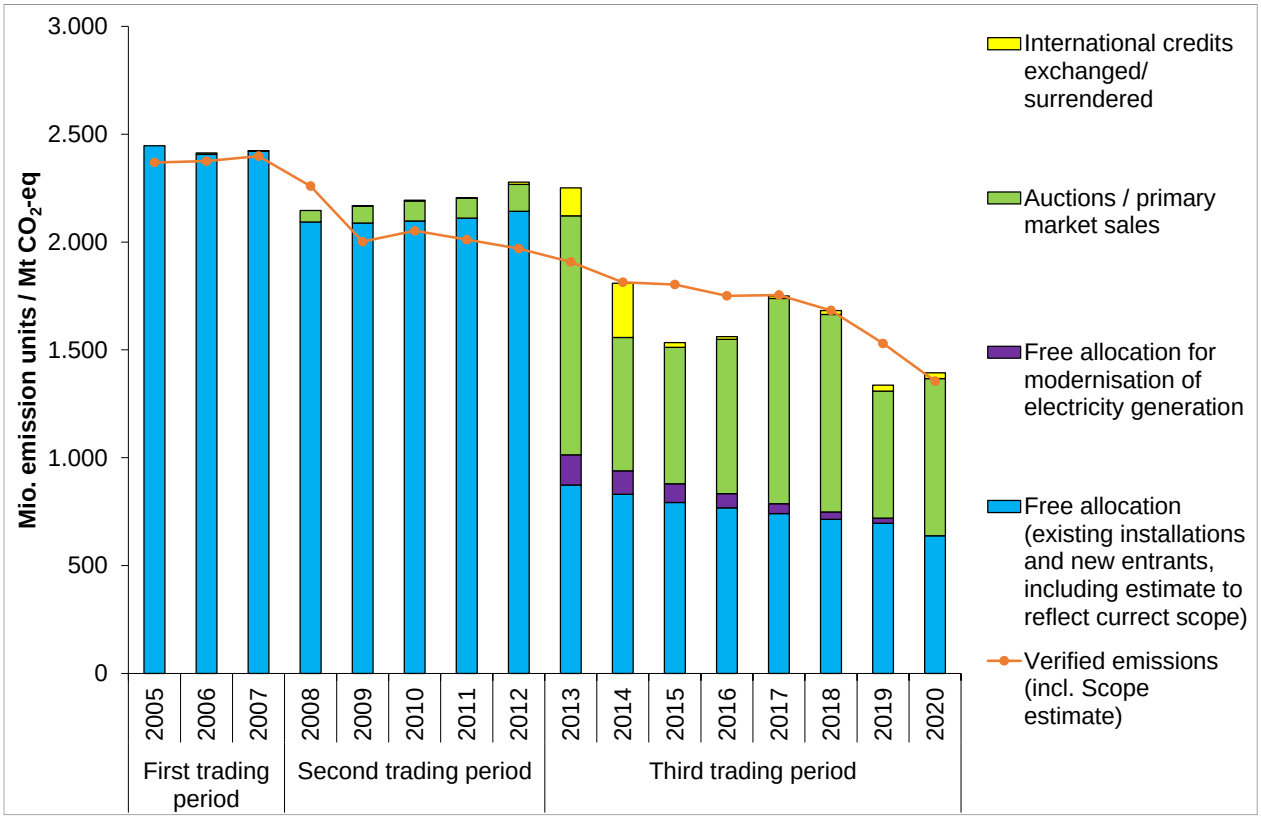
Sectors	*1st Trading Period EU25*	*2nd Trading Period EU25*	*3rd Trading Period EU25*	**3rd Trading Period EU28**
All	*2%*	*-12%*	*-30%*	**-29%**
Combustion	*2%*	*-9%*	*-38%*	**-38%**
Industry (average)	*3%*	*-18%*	*-10%*	**-9%**
Cement & lime	*7%*	*-24%*	*-3%*	**-2%**
Refineries	*-1%*	*-12%*	*-13%*	**-12%**
Iron & steel, coke, metal ore	*5%*	*-19%*	*-20%*	**-19%**
Chemicals	*-3%*	*-13%*	*-4%*	**-4%**
Other non-metallic minerals	*0%*	*-22%*	*-1%*	**-0,5%**
Pulp & paper	*-4%*	*-11%*	*-10%*	**-10%**
Other metals (incl. aluminium)	*-8%*	*-4%*	*-4%*	**-1%**

Notes: EU-25 to provide a consistent number of Member States since 2005.
Sources: EEA (2021b).

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

During each year of the first trading period (2005-2007), verified emissions fell just short of the total number of EUAs supplied by governments (mainly allocated for free) (Figure 2.5). Amid uncertainties about the level of verified emissions, the price of allowances climbed to EUR 30 per EUA (Figure 2.6) at the beginning of 2006, but dropped abruptly when the first release of verified emissions data in April 2006 showed that the number of allowances available exceeded verified emissions. Since it was not possible to 'bank' surplus allowances into the second trading period, allowance prices began a decline and remained close to zero until the end of the first trading period.

Figure 2.5 Supply and demand balance for stationary installations (2005-2020)



Source: EEA (2021a), EEA (2021b)

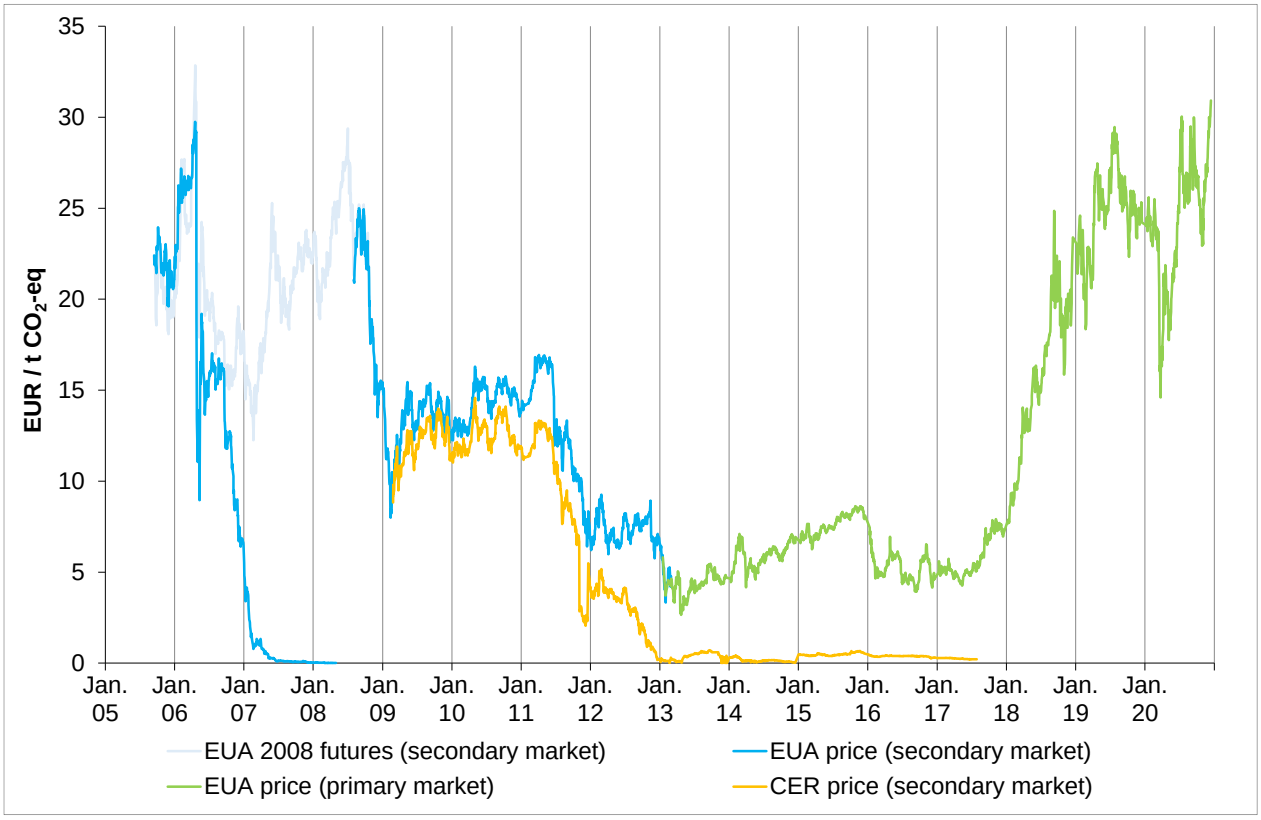
After a more stringent cap was set for the second trading period, verified emissions exceeded the supply of allowances in 2008, pushing allowance prices to around EUR 20 per EUA. Allowance prices climbed to EUR 29.38 per EUA before starting a renewed decline after it became apparent that the financial and economic crisis would severely affect industrial output in the EU. In fact, reduced activity meant that the supply of allowances exceeded verified emissions in each year between 2009 and 2012. Given that the supply of allowances (set by the EU ETS cap) was fixed in advance, this put downward pressure on the allowance price, which declined to around EUR 7 per EUA by the end of the second trading period. The number of allowances available to operators was further increased by the extensive use of international credits, especially between 2010 and 2012. Since many of these credits could no longer be used during the third trading period (cf. Section 2.1.6), they traded at less than EUR 1 per unit by the end of the second trading period (Figure 2.6).

At the start of the third trading period, the supply of allowances continued to exceed verified emissions. In response, the backloading of allowances was implemented between 2014 and 2016 (a postponement in the overall quantity of allowances to be auctioned in a certain year) and this had an impact on the supply and demand balance, reducing the number of allowances available to operators, and, as a consequence, the allowance price started to rise gradually. The sharp reduction in the use of international credits also contributed to further reducing the supply of allowances, as, from 2015 onwards, emission reductions from the first commitment period of the Kyoto Protocol (2008-2012) could no longer be used for compliance. In 2017 and 2018, verified emissions were on par with available allowances. In 2019, verified emissions exceeded the amount of allowances supplied to the market, reflecting a reduced auctioning supply as the Market Stability Reserve (MSR) started operating and took allowances off the market, as well as the halted auction on behalf of the UK. In 2020, the level of verified emissions was again a little lower than available allowances as emissions were affected by the Covid-19

pandemic (see also above) and auctioned allowances increased as the UK supplied with held 2019 allowances to 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 in the course of 2020, it returned to the previous year's level and rose to an all-time high of over EUR 30. The price increase reflects the expectation that the supply of allowances will be reduced in the long-term. On the one hand, as the EU had already agreed on more stringent measures for the fourth trading period, including a mechanism for cancelling a number of surplus allowances stored in the MSR. On the other hand, it had become clear that the EU would increase its long-term climate targets in a bid to fulfil its commitment to the Paris agreement. At the end of 2020 the EU's 2030 target was increased to 55% with a goal to reach net zero emissions by 2050. In June 2021, the European Commission has published a whole range of proposals as part of its 'Fit for 55' package, including a proposal for increasing ambition in the EU ETS in line with the 55% reduction target (EC, 2021b).

Figure 2.6 Price trends for allowances and certified emission reductions (2005-2020)



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

2.1.3 Auctioned allowances and auctioning revenues

Under the EU ETS, allowances to be auctioned are distributed to Member States based on Article 10(1) of the ETS Directive. It stipulates that 88 % of the allowances to be auctioned during the third trading period are distributed based on their share in historical emissions, a further 10 % are distributed to the least wealthy Member States, while 2 % are distributed as a 'Kyoto bonus' for achieved emission

reductions before 2005.([20]) Member States are, in turn, responsible that their share of allowances is made available for auction, at present allowances are made available at auction either at the European Energy Exchange AG (EEX) or ICE Futures Europe (ICE).

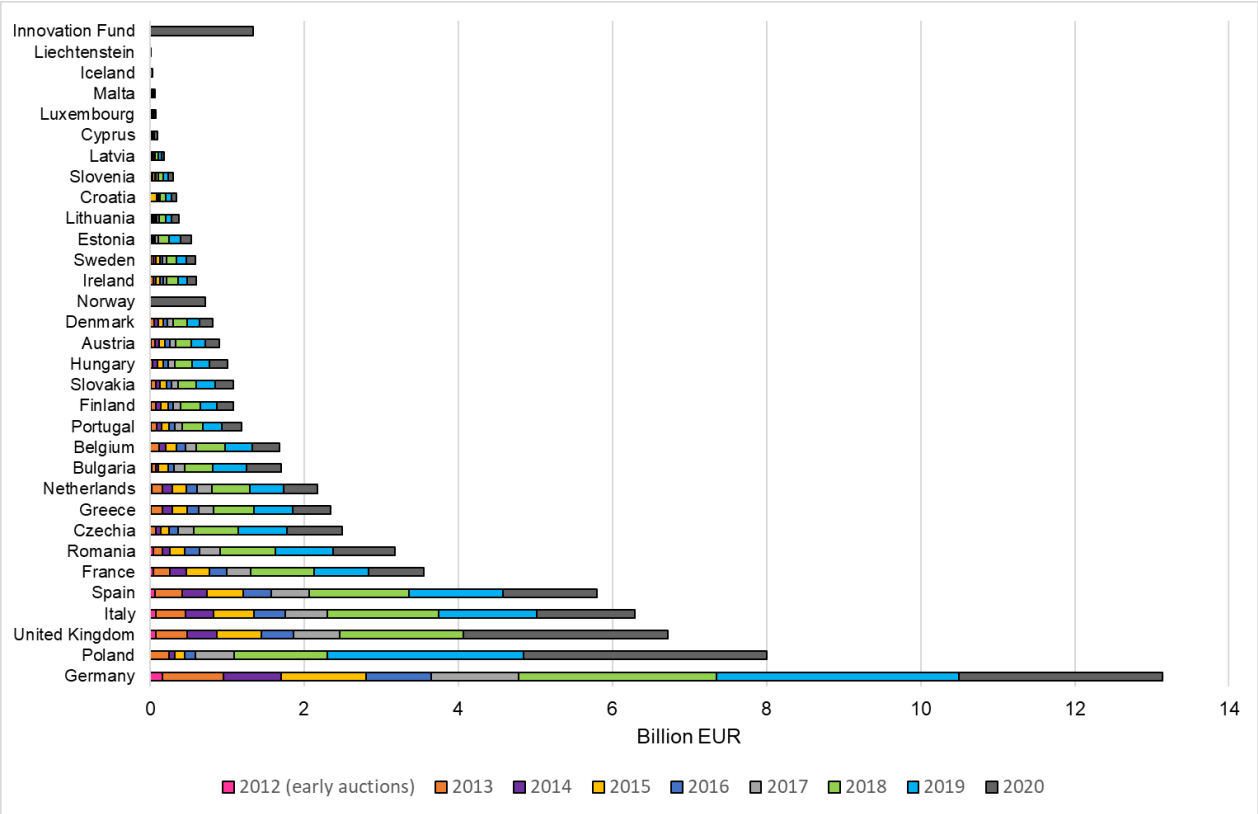
The following effects for 2020 should be noted. In 2020, the UK has resumed the auctions that were suspended in 2019, which is why there is a relatively high share of revenue for 2020. Iceland, Liechtenstein and Norway only started auctioning allocations in June 2019.The designated amounts for 2013-2018 of these three countries are to be spread evenly between 2019 and 2020 (EC, 2020d). This is very noticeable for Norway. Since 2020, part of the revenue from the EU ETS has also been used for the Innovation Fund.

Member States are obliged to report to the Commission information on the use of auction revenues under Article 17 of the Monitoring Mechanism Regulation (EU, 2013) . The EU ETS Directive provides that at least 50 % of the revenues should be used for climate and energy purposes which are specified in Article 10(3) of the Directive and include reducing GHG emissions, increasing the share of renewables in energy generation, measures to avoid deforestation and enhance afforestation and measures to increase energy efficiency. Member States can also implement policies which entail financial support, particularly to developing countries. During the time frame 2013-2019 about 77 % of auctioning revenue has been spent on climate and energy related purposes by Member States (EC, 2020b).

As the country with highest historical emissions and thus the largest auctioning budget, Germany has so far received the highest revenue from auctioning EUAs totalling EUR 13.1 billion during the third trading period, followed by Poland with EUR 8.0 billion and the United Kingdom with EUR 6.7 billion. These three Member States collectively account for around 42 % of the EUA revenue generated so far during the third trading period (including early auctions in 2012). Overall, a strong increase in EUA revenues can be observed in the last three years, mainly due to the rally in allowance prices observed from 2018 to 2020 (Figure 2.7).

([20]) Eligible for the Kyoto bonus are Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia

Figure 2.7 EUA auction revenues in the third trading period, by EU Member State



Note: 2012 (early auctions) refer to amounts that pertain to the year 2013 but had been auctioned a year earlier.
Source: EEX (2021), ICE (2021).

2.1.4 Free allocation to new entrants and for capacity extensions

To ensure a level playing field between new entrants and incumbents, a New Entrants Reserve (NER) of 480 million ([21]) allowances was set aside at the start of the third trading period for new installations ([22]) and existing installations with a 'significant' increase in capacity ([23]).

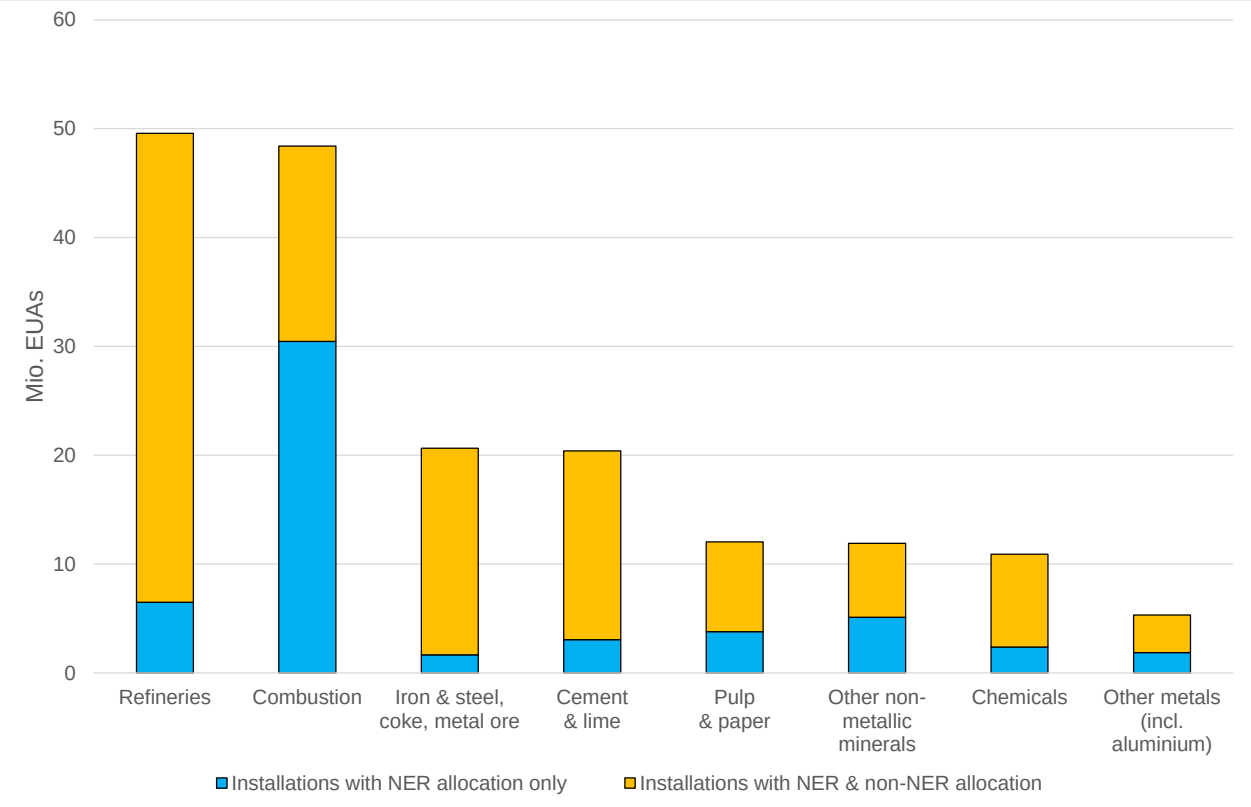
In the combustion sector, 63 % of allocation from the NER during the third trading period (i.e. 30.5 out of 48.4 million) have been used by new entrants (i.e. with NER allocation only). By contrast, Figure 2.8 shows that for industrial activities (excluding combustion), the majority of NER allowances has been used for capacity extensions (i.e. installations with NER and non-NER allocations).

For example, installations with capacity extensions accounted for 87 % of the allocation from the NER to the refinery sector (i.e. 43.1 out of 49.6 million). The majority of these allowances were allocated to refineries in Spain, Greece and Estonia (Figure 2.9). Similarly, the majority of the 20.4 million in allocation from the NER to the cement and lime sector went to installations with capacity extensions, many of which were located in either Italy or Cyprus (Figure 2.9). The iron and steel sector received 19.0 million in

([21]) 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.
([22]) 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.
([23]) 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 (2011a).

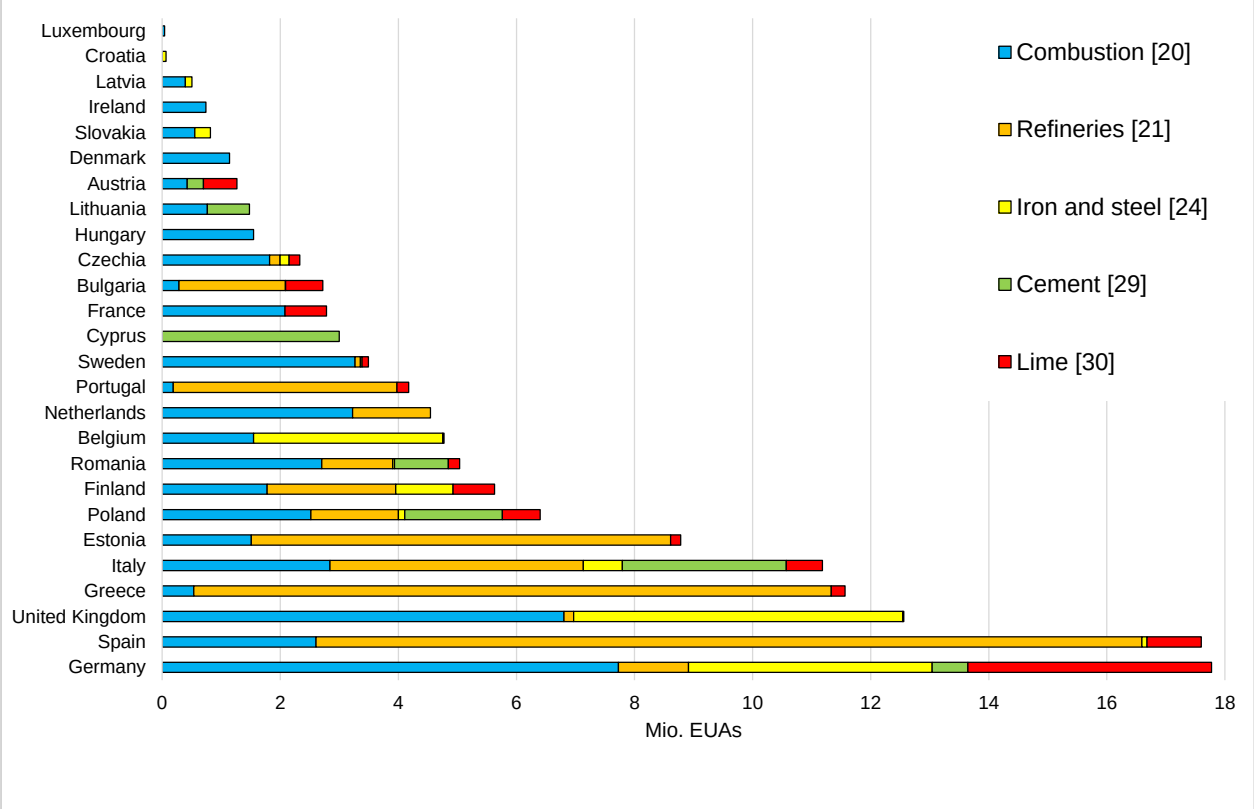
allocation from the NER, again primarily to installations with capacity extensions, this time based in Germany and the United Kingdom.

Figure 2.8 NER allocation (2013-2020) by sector and by eligibility type



Source: EU (2021), own calculations.

Figure 2.9 Cumulative NER allocation (2013-2019) by sector and by country



Note: Covers 79 % of the NER allowances issued between 2013 and 2019. Represents NER allowances provided to EU-28 Member States for five EUTL activities only.

Source: EU (2021), own calculations.

The European Commission publishes an annual status table on the New Entrants Reserve, which shows how many allowances are still available. Unfortunately, no updated table has yet been published for 2020.The latest annual status update for the NER of the European Commission for 2019 states that 35 % of the allowances available in the NER for the third trading period have been allocated to date (EC, 2020a). In absolute numbers, 310.5 million allowances from the NER still remained available in 2020. The allowances that remain unallocated until the end of 2020 are put into the MSR.

2.1.5 Transitional free allocation to modernise electricity generation

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 during the third trading period. This derogation applies to ten eligible Member States, out of which eight chose to make use of this rule.([24]) From their auctioning budget, these Member States can make free allocation available to electricity generation for a transitional period up to 2019, contingent upon the value of these allowances being invested in efforts to modernise the electricity sector and diversify its fuel mix. The exact rules were set out in national plans and cleared by the Commission. An overall budget of 680 million allowances for allocation in 2013-2019 was approved. Free allowances on this basis in the 3rd trading period were only possible for a transitional period until 2019. This means that there are no changes for 2020 compared to the last report (ETC/CME, 2020).

([24]) Bulgaria, Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland and Romania make use of this rule, while Malta and Latvia decided not to.

For the 4th trading period, these free allocations will be continued. Eligible countries can allocate a maximum of 40% of their regular allowances to Article 10c derogation. This are in total 637.8 million allowances (EC, 2021c). These countries have been given the option of either continuing to issue these free allocations, auctioning the allocations in the normal way or transferring the allocation volumes to the modernisation fund. Bulgaria will issue the maximum possible amount of allocations under 10c. Estonia, Latvia and Poland will auction all possible allocations in the normal way. The Czech Republic, Lithuania and Slovakia plan to transfer their allocation quantities to the modernisation fund. The remaining countries Croatia, Hungary and Romania will divide their maximum possible allocation quantities between the different options.

2.1.6 Use of international credits for compliance

During the second and third trading periods, operators are allowed to use international emission credits to comply with part of their legal obligation to surrender allowances equivalent to their verified emissions ([25]). International credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) projects can be used with certain qualitative restrictions ([26]). Since April 2015, emission reductions that occurred in the first commitment period of the Kyoto Protocol (2008-2012) can no longer be exchanged (EC, 2018b). From the fourth trading period onwards, international credits can no longer be used for compliance at all.

Until 2012, international credits were surrendered directly, while from 2013 onwards they have been exchanged for EUAs. The bulk of international credits was surrendered during the second trading period (Figure 2.10). By the end of 2014, entitlements for the use of international credits for compliance were nearly used up (cf. Figure 2.5). From 2015 onwards, only small amounts were exchanged every year.

Since entitlements for the use of international credits are installation-specific, a small amount of international credit entitlements continues to be available, as they are based on verified emissions between 2013 and 2020 for certain installations ([27]).

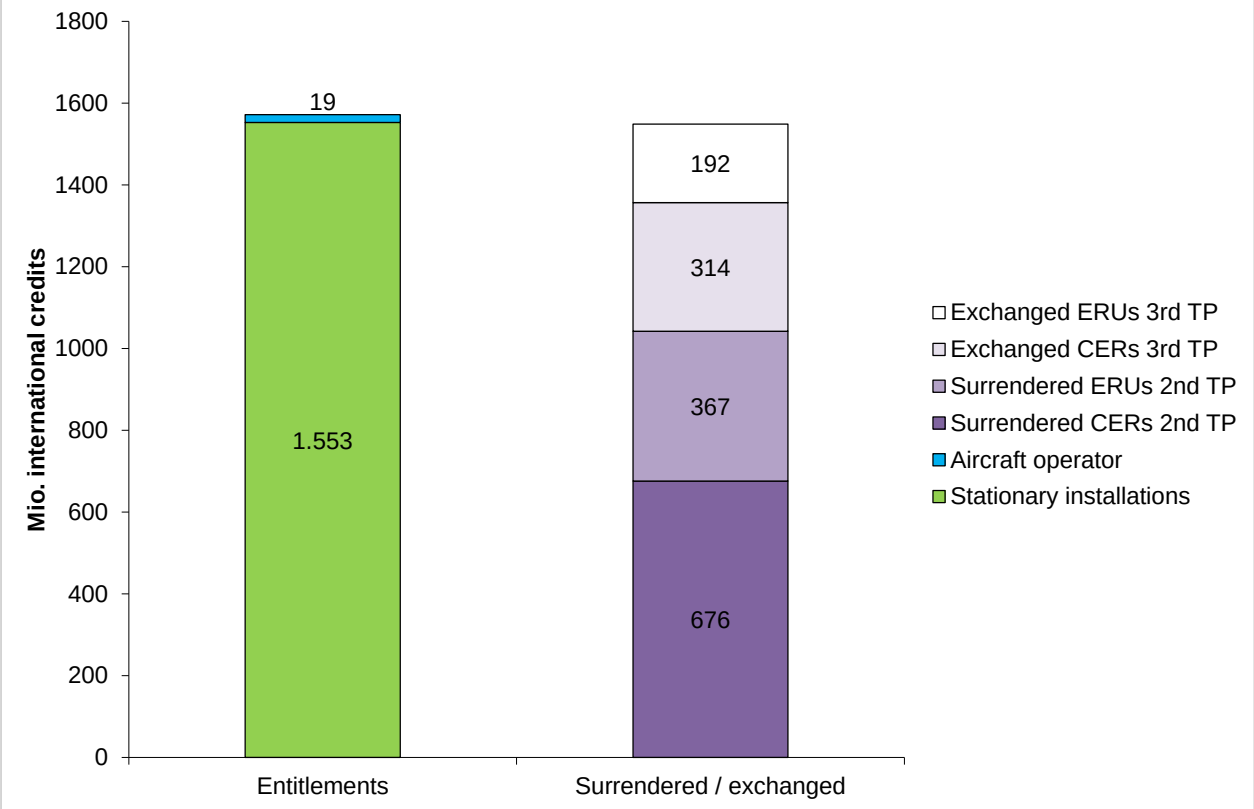
Entitlements of aviation operators are shown in Figure 2.10 since the data on international credits exchanged is only available at an aggregate level and not installation or operator specific. Therefore, the amounts used are total for the whole EU ETS.

([25]) These credits stem from flexible mechanisms under the Kyoto Protocol: the Clean Development Mechanism (CDM) and Joint Implementation (JI). The international credits corresponding to these flexible mechanisms are CERs in the CDM and ERUs in JI. Overall use of credits is limited to 50 % of the community-wide reductions below 2005 levels of the existing sectors over the period 2008-2020. Additional limits are also set for new sectors and aviation.

([26]) Nuclear energy projects and afforestation and reforestation projects were never accepted for compliance under the EU ETS; large hydroelectric projects (above 20 MW of installed capacity) are accepted only under certain restrictions. Projects involving the destruction of industrial gases (HFC-23 and N_2O) in advanced developing countries (especially China) were the main project type surrendered by operators in the second trading period; since April 2013 they have been barred from being used for compliance because of environmental concerns (EU (2011).

([27]) While for most installations international credits entitlements are based on 2008-2012 data, in two cases 2013-2020 verified emissions data is used: (i) for stationary installations without free allocation between 2008 and 2012, which received their first emissions permit after 30 June 2011 and (ii) for installations with 'significant' capacity extensions. The overall number of entitlements is therefore subject to small updates each year until 2020. Aviation operators are also eligible to use CERs and ERUs for up to 1.5 % of their verified emissions between 2013 and 2020 (plus any remainder from the claims in 2012).

Figure 2.10 International credit entitlements and use (2008-2020)



Notes: International credit entitlements from EUTL. TP refers to trading period.
Sources: EC (2020b), EEA (2021b).

2.2 Aviation

2.2.1 Emission trends

During the third trading period, total verified emissions for airline operators have increased by 25 % from 53.5 Mt CO_2-eq in 2013 to 68.2 Mt CO_2-eq in 2019 (Table 2.2). In 2020 emissions decreased sharply to 24.9 Mt CO_2-eq. due to the impact of the Covid-19 pandemic on air traffic. Ryanair has consistently been responsible for the largest amount of verified emissions of any single aircraft operator covered by the EU ETS. Considering this decline in 2020 as exception Wizz Air experienced the fastest growth in emissions during the third trading period, more than doubling emissions covered by the EU ETS between 2013 and 2019. Some flag carriers such as Lufthansa or British Airways, have experienced much slower growth in ETS emissions over the same period or have even managed to reduce their emissions. However, this only concerns flights within the scope of the EU ETS and gives no indication of the overall emissions of the airline, as these airlines traditionally cover many long-haul flights outside the EU.

Table 2.2 Total aviation emissions and the top 10 emitters in aviation between 2012 and 2020

	Verified emissions (Mt CO_2-eq)								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Aviation	**84,0**	**53,5**	**54,8**	**57,1**	**61,5**	**64,4**	**67,5**	**68,2**	**24,9**
Ryanair	7,5	6,6	6,6	7,4	8,4	9,2	9,9	10,5	4,2
Easyjet	4,6	4,3	4,4	4,7	5,1	5,5	6,1	6,3	1,9
Deutsche Lufthansa	4,9	4,4	4,0	3,8	3,8	4,0	4,4	4,4	1,4
British Airways	2,5	2,5	2,5	2,6	2,7	2,7	2,7	2,6	0,9
Air France	3,8	2,6	2,4	2,4	2,3	2,4	2,4	2,5	1,2
Scandinavian Airlines System	3,6	2,3	2,4	2,4	2,4	2,5	2,5	2,4	0,9
Vueling Airlines, S.A.	1,3	1,3	1,6	1,8	2,0	2,0	2,2	2,2	0,6
Wizz Air	1,1	1,1	1,3	1,5	1,8	2,1	2,3	2,4	1,2
Koninklijke Luchtvaart Maatschappij (KLM)	1,9	1,5	1,6	1,6	1,6	1,8	1,8	1,9	0,8
Norwegian Air	1,7	1,8	2,1	2,0	1,4	1,2	1,3	1,3	0,4

Note: For the period 2013-20120, only flights within the European Economic Area are covered under the EU ETS. Flights between the continental European Economic Area and its outermost regions are also exempt, for example flights between mainland Europe and the Canary Islands.

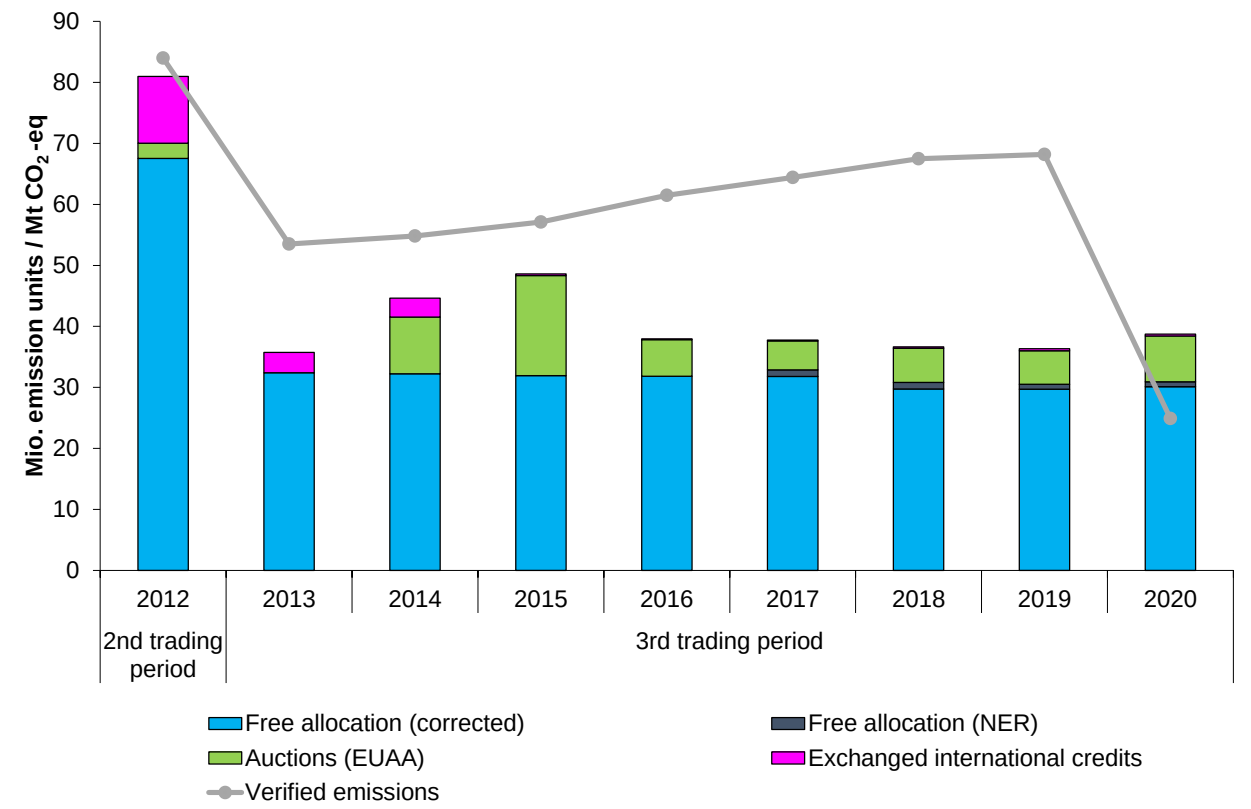
Source: EEA (2021b), EU (2021).

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

Figure 2.11 illustrates the development in the supply of and demand for aviation allowances (EUAAs) between 2012 and 2020. The difference in emissions between 2012 and 2013 is due to a reduction in scope regarding aviation activities covered by the EU ETS ([28]). In the third trading period, verified emissions have surpassed the supply of allowances reserved for the aviation sector every year with an exception for the year 2020. The aviation sector was usually a net buyer of allowances from the stationary sector. If there is a net demand from the aviation sector, the sector has to cover its liability with allowances from the stationary sector. EU aviation allowances (EUAA), however, could until 2020 not be used by stationary operators. This changes from 2021 onwards, when allowances become fully fungible.

([28]) In 2012, aircraft operators had the choice of fulfilling their EU ETS obligations for intra-European Economic Area flights only, or for the full scope (all flights on routes to, from or between European Economic Area airports). Some opted for full scope, which resulted in higher emissions and a large amount of allowances issued. Switzerland was included in the scope for the aviation under the EU ETS in 2012 and was then excluded in 2013. The exemption threshold and the treatment of the outermost regions were also introduced in 2013.

Figure 2.11 Demand and supply balance for aviation allowances (2012-2020)



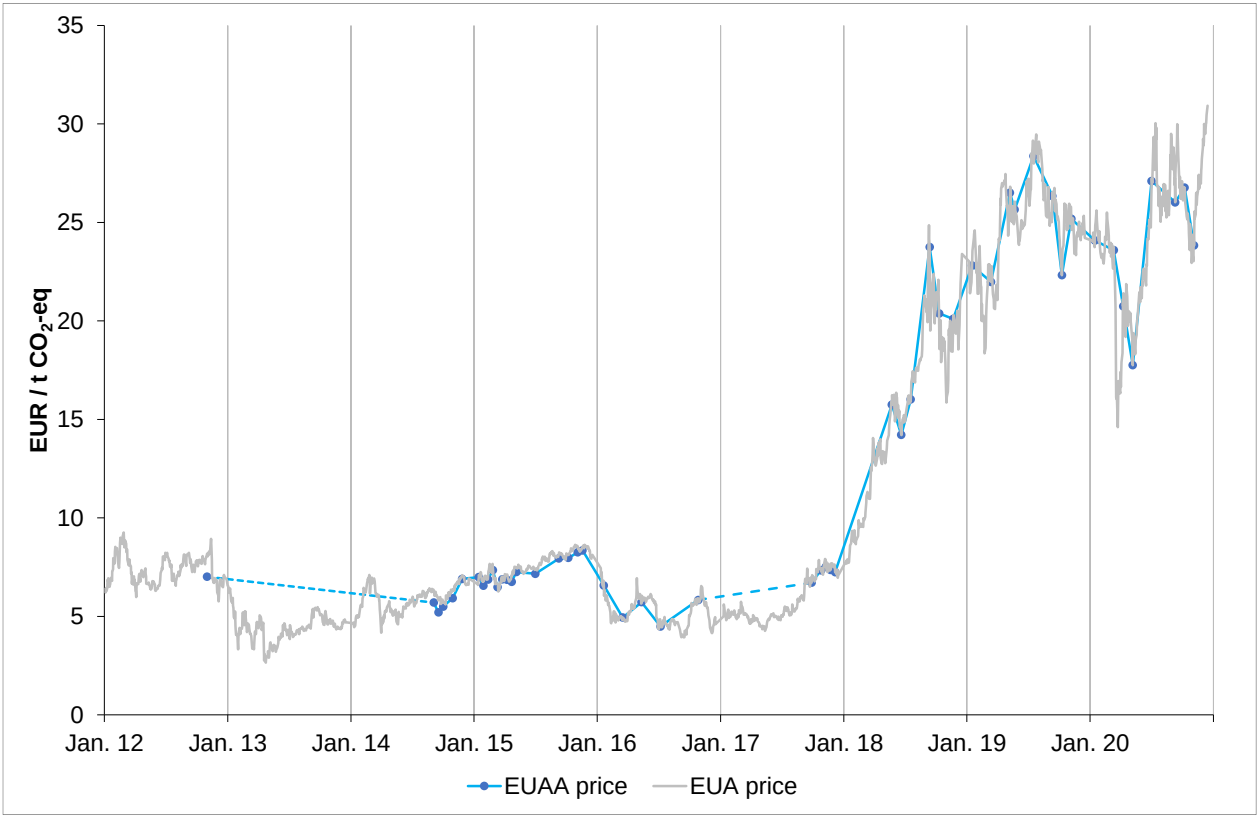
Notes: Auctions of aviation allowances were suspended after the 'stop the clock' decision taken in 2012. The allowances attributable to 2013, 2014 and 2015 were all auctioned in 2015. The volume of aviation allowances effectively released to the market in 2015 was equal to 16.4 million EUAAs.
International credit use by aircraft operators in the third trading period is not reported separately (cf. Section 2.1.6). 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 (cf. Figure 2.10). 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 (2021d), EEA (2021b)

Auctions of EUAAs occur less frequently than those of EUAs. Following the reduction of scope 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. When the auctioning of EUAAs resumed in 2014, their price closely followed the EUA price, reaching a peak value of around EUR 8 per unit towards the end of 2015. However, the EUAA price then reversed in 2016, with lows of only EUR 4 per unit early in 2016, before recovering slightly to around EUR 5 per unit towards the end of the year. With the agreement on reforms to the EU ETS for the fourth trading period, the EUAA price followed the rising value of the EUA price to over 7 EUR per unit in 2017 (Figure 2.12). A further delay in auctioning in 2017, due to prolongation of the 'stop-the clock' decision ([29]), led to another gap in EUAA price data in the same year. Similar to the EUA price, the EUAA price has entered a steep upward curve since the beginning of 2018. In 2020, the average EUAA price stood at EUR 23.74 and thus slightly lower than EUR 24.89 in 2019, mainly due to a temporary drop due to the Covid-19 pandemic.

([29]) 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 2.12 Price trends for EUAAs compared with EUAs (2012-2020)



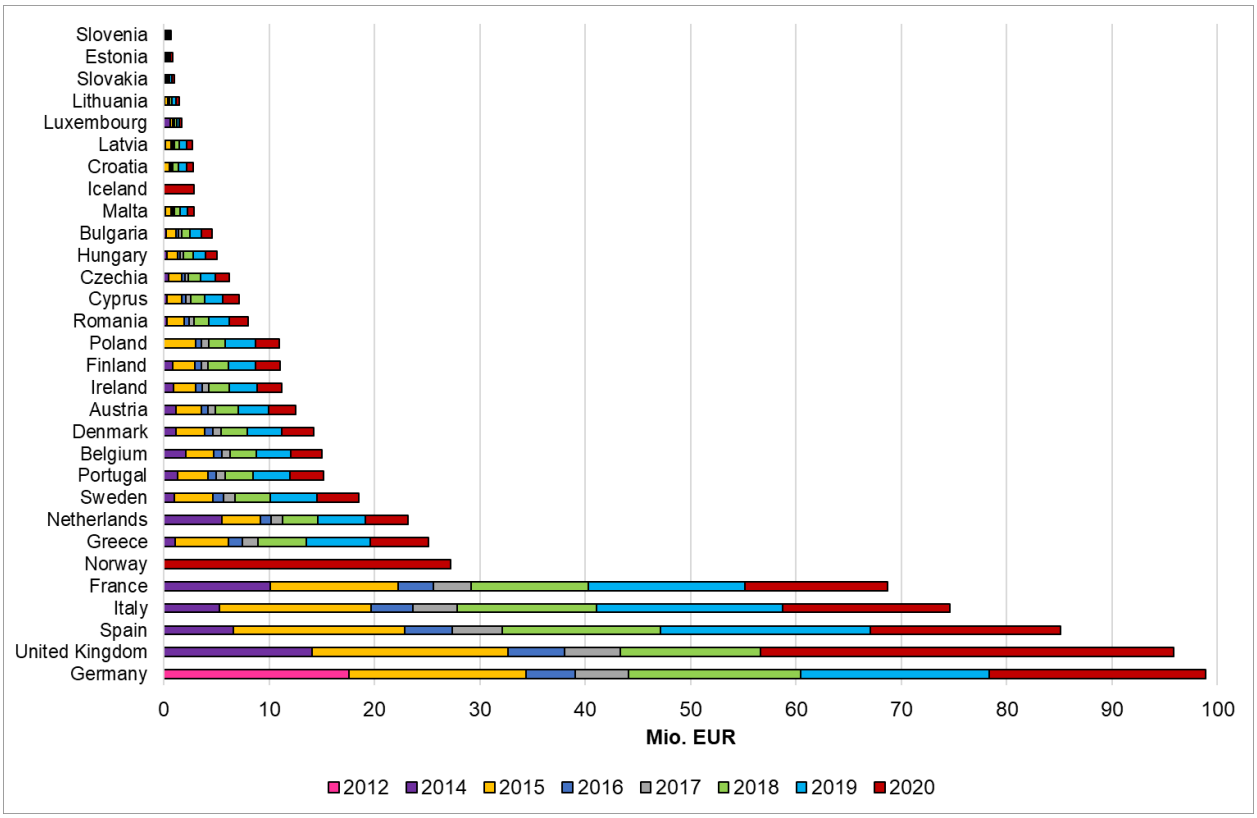
Note: The EUA price represents historical spot price data from the secondary market in 2012. In the third trading period, the EUA price refers to primary market auctioning data from the EEX and ICE trading platforms. This trend is compared with the shorter time series of EUAA prices from primary market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

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

2.2.3 Auctioned allowances and auctioning revenues

Similar to the auction of EUAs (Section 2.1.3), Member States auction EUAAs according to their share in historical aviation emissions. To date, Germany has received the largest revenue from the auctioning of EUAAs (EUR 99 million), followed by the UK (EUR 96 million) and Spain (EUR 85 million) (Figure 2.13). As the price of allowances has risen greatly over the last three years, revenues have also risen significantly, reaching a peak of annual revenue of EUR 149 million in 2020. Even though the average EUAA price was lower in 2020 than 2019 (see chapter 2.2.2) the total revenue was higher. This is due to the after-effects of the suspended auctions for the United Kingdom in 2019 that were then carried out in 2020. Norway and Iceland started auctioning in 2020.

Figure 2.13 Aviation allowances auction revenues by Member State, 2012-2020



Sources: EEX (2021), ICE (2021).

3 Projected trends

- The EU Commission presented a proposal for the implementation of the Green Deal in July 2021. As the actual implementation has not yet been decided and the impact of the Covid19 pandemic leads to further uncertainties, the projected trends section in this report focuses on projected emissions and does not include a projection of the expected supply and resulting balance of allowances.
- All EU ETS countries apart Liechtenstein have submitted current GHG emission projections under Article 18 of the Governance Regulation.
- The Covid19 pandemic had a strong impact on emissions in the EU ETS in 2020, which are not yet fully reflected in the projections.
- EU ETS stationary emissions are projected to decrease from a higher level with existing measures (WEM) in place, leading to a reduction of 41.1 % by 2030 compared to 2005. If reported additional measures are also taken into account, emissions in stationary EU ETS sectors are projected to decrease by 48.2 % compared to 2005, about the current level of ETS emissions.
- Projections show that the current ETS target of a reduction of 43 % can be achieved reduction if additional policies and measures are implemented. To achieve the proposed target of more than 61 % GHG reduction in the stationary EU-ETS in 2030 (compared to 2005) as proposed by the European Commission, additional emission reductions need to take place.
- The scope for aviation in the EU ETS is currently limited to intra-EEA flights. The derogation for extra-EEA flights is prolonged until 31 December 2023.

3.1 Stationary installations

This chapter deals with the future developments of emissions covered by the EU ETS. For this purpose, the current projections of the ETS countries submitted under Article 18 of the Governance Regulation are taken into account. Except for Liechtenstein, all countries have submitted up-to-date projections. As no projections from previous years exist for Liechtenstein, no gap filling is carried out.

In addition to the submitted projections, the possible effects of the EU Commission's proposals for revision of the ETS directive under" Delivering the European Green Deal" are also discussed. As this was only published in July 2021 and has therefore not yet been implemented in legislation, the proposed measures are not yet part of the submitted projections.

3.1.1 Emission trends by sector

The projections submitted by the EU-Member States and as aggregated by the ETC/CME start from the level of 2019. They show a decline in the EU ETS emissions ([30]) which will mostly take place in the energy sector ([31]). As can be seen in Figure 3.1 the emissions from manufacturing and construction installations, shown as 'other sectors' are projected to reduce at a slower pace until 2030. As in previous years, these projected trends contrast with historical trends, which showed emissions decrease below those

([30]) The analysis is based on projections of EU ETS emissions under the WEM and WAM scenario, reported by 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 and Energy (ETC/CME).. Liechtenstein did not submit a GHG projection.

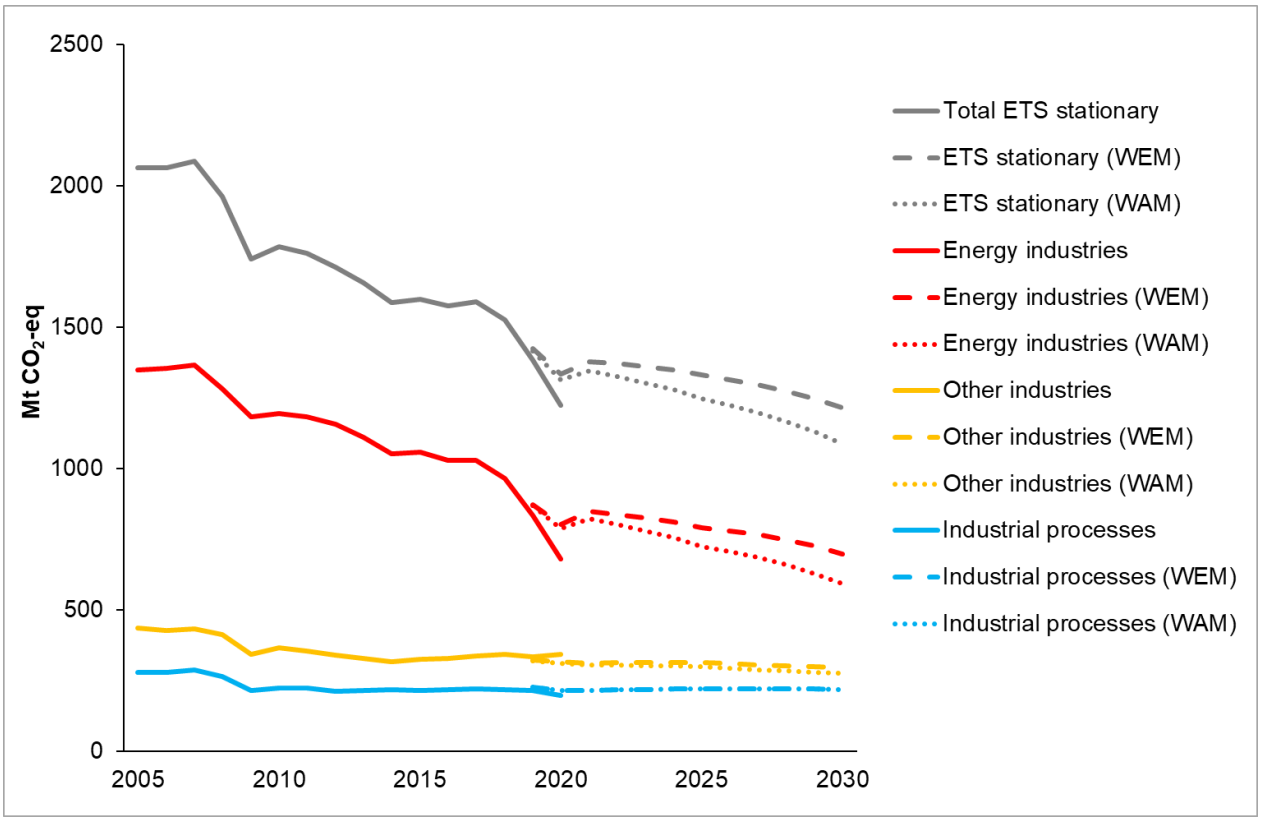
([31]) Corresponding to greenhouse gas inventory source categories 1.A.1, 1.B and 1.C (Intergovernmental Panel on Climate Change (IPCC) nomenclature).

projected in a number of industrial sectors, such as manufacturing, construction and industrial processes. EU ETS emissions from industrial processes are projected to slightly increase although they have shown a decrease since 2005.

If only the existing policies and measures are considered, a reduction of 41.1 % compared with 2005 is estimated for EU ETS emissions in projections submitted by EU27 Member States, Norway and Iceland. This would not be sufficient to reach the EU target of a reduction of EU ETS emissions by 43% until 2030. With the additional policies and measures reported by some Member States, emissions are projected to decrease by 48.2 % compared with 2005, sufficient for the current 2030 target. Again, the main effects of additional policies and measures are projected to take place in the sector of energy industries. To achieve the proposed reduction of 55 % compared to 1990, the EU Commission submitted a proposal in July 2021 to increase the ETS target to more than 61 % for stationary installations and a bundle of revisions in European legislation to support the achievement of the targets (see chapter 3.2.3)

Figure 3.1 shows that real emissions in 2020 are significantly lower than the staring level of projections. This is primarily linked to the decrease in emissions in the energy sector, partly due to the Covid19 pandemic. However, these effects of the Covid 19 pandemic are largely not due to structural changes in the energy system. The reduction in ETS emissions to this extent are probably only temporary and could increase again in the next few years.

Figure 3.1 **EU ETS historic and projected emissions between 2005 and 2030 for EU-27, by inventory category**



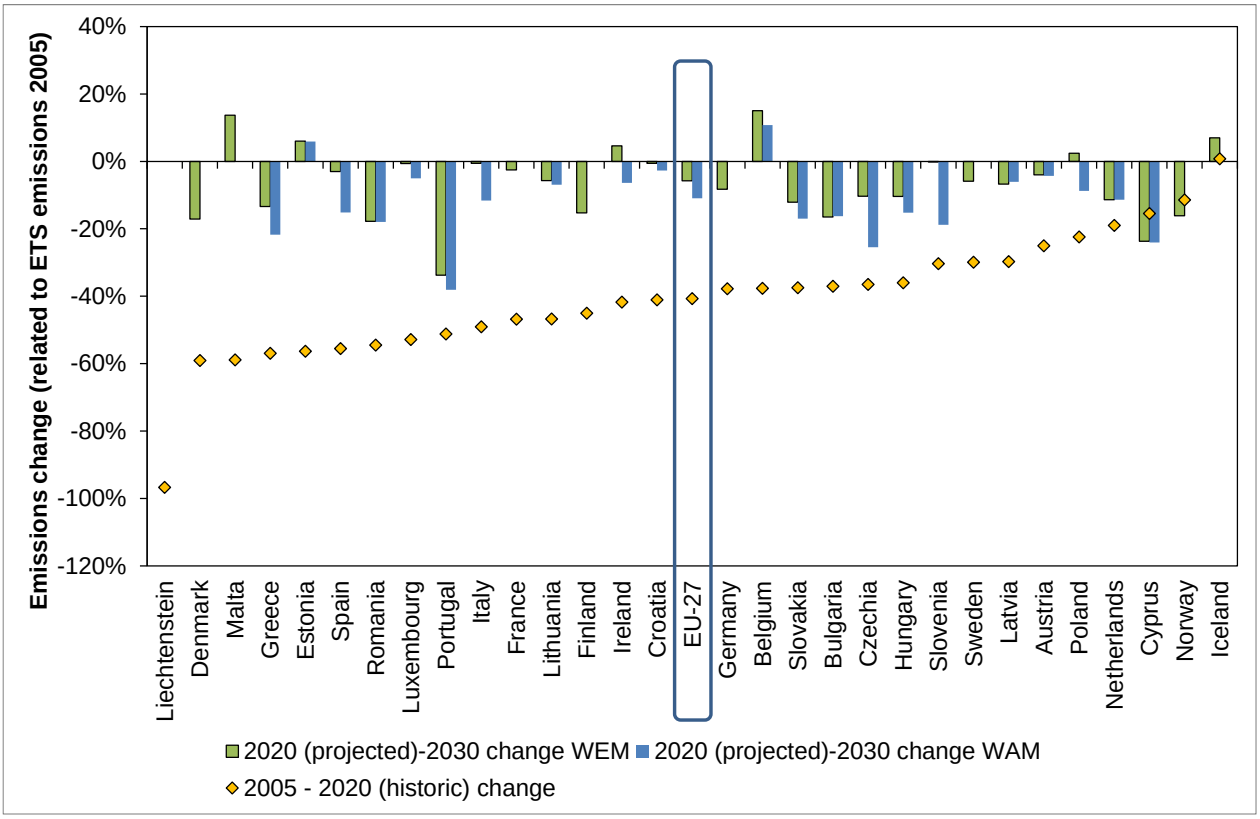
Notes: Solid lines represent historical greenhouse gas emissions up to 2019, taking into account proxy inventory numbers. Dashed lines represent projections under the 'with existing measures' WEM scenario. Dotted lines represent projections under the 'with additional measures' (WAM) scenario. This figure 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 (2021a), projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of August 2021.

3.1.2 Emission trends by country

Figure 3.2 shows that EU ETS emissions are expected to decline in 24 countries between 2020 and 2030 under the WEM scenario, with reductions ranging from 0.2 % for Slovenia to 33.8 % for Portugal. There are six countries who anticipate increases in their EU ETS emissions between 2020 and 2030 based upon their WEM projections. Among those countries with increasing ETS emissions under the WEM scenario, Ireland and Poland are expecting to reduce their EU ETS emissions with additional policies and measures (WAM). Belgium and Estonia project an increase of its EU ETS emissions under both the WEM and WAM scenarios.

Figure 3.2 Historic and projected changes in EU ETS emissions relative to 2005 emission levels



Notes: Projections from German still from 2019.
Sources: EEA (2021a), projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of August 2021.

In several countries, projections indicate rising emissions in the ETS sectors until 2030 with existing measures. This is often related to developments in the energy sector.

Estonia and Belgium each project increasing emissions between 2005 and 2030 in both the WEM and WAM scenarios. The increasing emissions in Belgium are related to the phase-out of nuclear power by 2025 and the accompanying increase in emissions from fossil energy supply. Estonia's rising emissions are likely to be related to the decision to build a new shale oil plant.

3.1.3 Balance of allowances

This year's report does not calculate the expected balance of allowances and the contribution of the Market Stability Reserve (MSR) until 2030. With the ”Delivering the European Green Deal” package, the Commission has made various proposals to change the EU ETS (see chapter3.2.3). These have an impact on the Market Stability Reserve. As these proposals still have to go through the EU legislative process, a projection of the MSR is not yet possible.

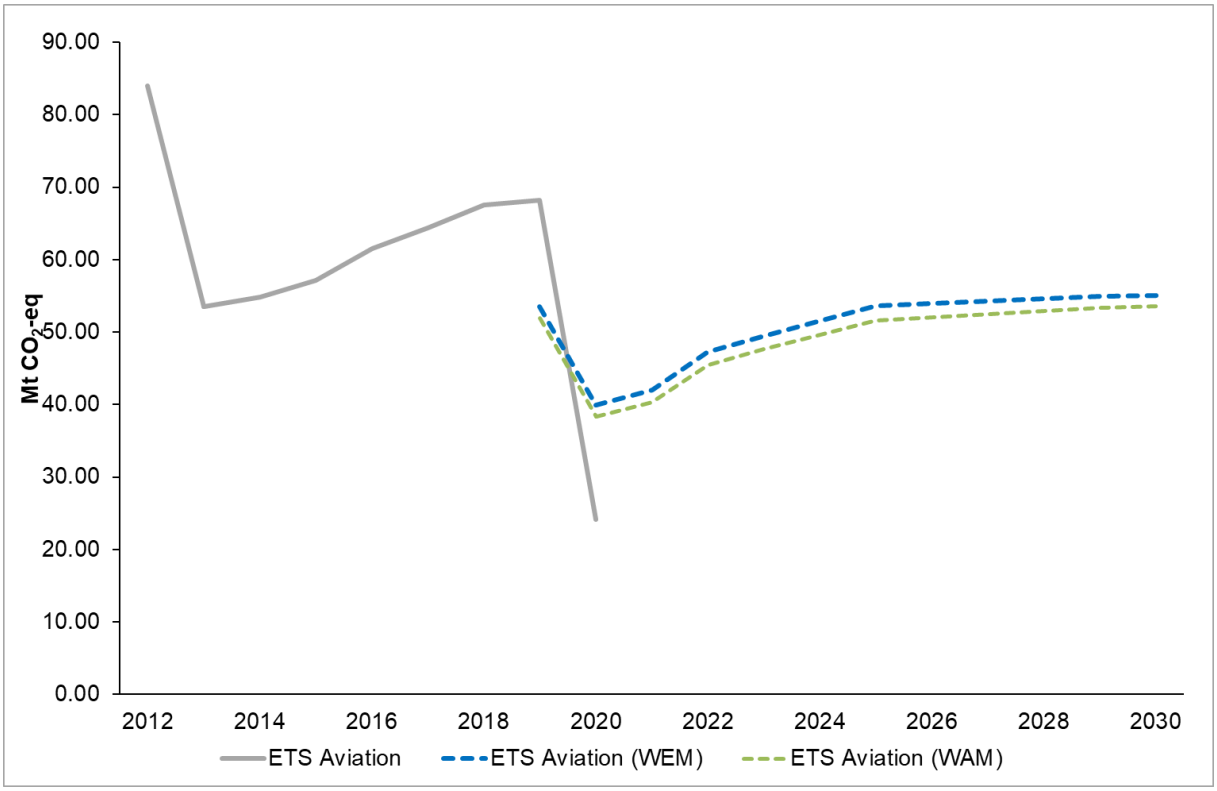
3.2 Aviation

3.2.1 Emission trends

Emissions from aviation activities covered by the EU ETS, as projected by Member States under the WEM and WAM scenario, are expected to rise continuously until 2030 (Figure 3.4). 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 Covid19 pandemic and the resulting decrease in aviation. As in the stationary sector, the projections do not yet fully reflect this decline. The EU Commission made a proposal to change the allocation mechanism in such a way that there will no longer be any free allocations in air traffic (see chapter 3.2.5). These and other measures are likely to change the current emissions pathway.

Figure 3.3 EU ETS emissions for aviation between 2012 and 2030



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.
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 (2021a), projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of August 2021.

3.2.2 Balance of allowances

Aviation emissions are projected to increase continuously until 2030 in GHG projections. If aviation emissions increase as projected, net demand of this sector needs to be accounted for in the estimation of the future supply of and demand for allowances.

3.2.3 Further future developments

In June 2021 the EU Commission presented its proposal for "Delivering the European Green Deal". The package covers all sectors of the economy and aims to achieve the enhanced 2030 target of a 55 % greenhouse gas emission reduction compared to 1990 (EC, 2021a). In the following, the main aspects of the Commission's proposal concerning the EU ETS are presented. The proposal assumes that the reform could be implemented by 2024.

3.2.4 Stationary installation

The scope of the stationary ETS remains largely unchanged. The proposal only includes small adjustments to ensure that installations that fall below minimum thresholds for the inclusion of the ETS still remain in the trading system.

The cap for stationary ETS is supposed to increase from currently 43 % below 2005 to approx. 62 %. To achieve this, the linear reduction factor (LRF) is increased from 2.2 % per year to 4.2 % per year from 2024 onwards. In addition, the cap is reduced by 117 million allowances once; this adjustment brings the cap down to the level that would be achieved if the LRF could be adjusted from 2021 onwards already.

As in the past the primary allocation process is based on auctioning. Free allocation only remains for sectors which are at risk of carbon leakage, i.e. of a relocation of installations, investments and emissions to third countries due to the carbon price. Free allocation will remain based on benchmarks which will be updated to reflect the increased ambition level. During the period 2021 to 2030 54-57 % of all allowances should be auctioned. A buffer of three percent of all allowances can be used for free allocation to avoid the application of the cross-sectoral correction factor (CSCF). The CSCF is applied if the sum of the product-specific benchmarks exceeds the quantity of allowances available for free allocation.

As a major new element to the stationary ETS the Commission proposes the introduction of a Carbon Border Adjustment Mechanism (CBAM) for some products in the electricity, cement, iron and steel, fertilizers and aluminium sectors. The CBAM is supposed to gradually replace free allocation for industry until the year 2035. Under the CBAM, importers need to surrender CBAM certificates in relation to the embedded direct emissions of the imported goods. Embedded emissions can be calculated either through the application of default values or verified country-specific emission intensities. The price of these CBAM certificates is based on the price of ETS allowances and set weekly by the Commission. In the year 2026, importers will need to buy CBAM certificates for 10 % of the embedded emissions; each year this share increases by 10 percentage points until it reaches 100 % in 2035. In parallel, free allocation to industry for the products covered by the CBAM is reduced by 10 percentage points each year; in 2035 there will be no more free allocation under the proposal. If a carbon pricing scheme exists in the exporting country this can reduce the number of CBAM certificates which need to be surrendered.

For the MSR the Commission proposes to extend the increased intake rate of 24 % until 2030. Together with the total number of allowances in circulation (TNAC) the intake rate determines the quantity of allowances which will be transferred into the MSR if the TNAC is above the upper threshold. While the thresholds are supposed to remain constant the proposal includes a mechanism to avoid threshold effects when the TNAC is just above the upper threshold. Under the proposal, aviation will be included in the TNAC calculation from 2024 onwards; the shipping sector will be included directly from its start. Lastly, the maximum number of allowances in the MSR is supposed to be fixed at 400 million instead of the auction volume in the previous year.

3.2.5 Aviation

For the aviation sector, the reduced scope of intra-EEA flights will continue to be applied; in addition, flights to the UK and Switzerland will be included in the EU ETS whereas the returning flights will be covered in the respective ETS of those two countries. From 2024 onwards the enhanced LRF will be applied but without a one-off reduction like in the stationary sector. Instead, the cap will be adjusted in 2024 to reflect the changes due to new entrants and closures in the aviation sector.

A major change is proposed for the allocation mechanism: the share of free allocation is supposed to decrease from 85 % in 2023 to zero by 2027. The aviation ETS remains in a separate cap with separate

aviation allowances. These allowances are fully fungible and can be used in the stationary sector, in practical purposes both types of allowances are equivalent.

For flights leaving and entering the EU to/from third countries the Carbon Offsetting and Reduction Scheme for international Aviation (CORSIA) developed under ICAO will be applied.

3.2.6 Shipping

The Commission proposes to extend the ETS to seaborne shipping from 2024 onwards covering emission at berth, on intra-EEA voyages and 50 % of emissions to and from third countries. The ETS cap will be increased by 79 million allowances in 2024; this value is based on the average emissions in the years 2018-2019 and the application of the LRF of 4.2 % from 2021 onwards.
The proposal foresees no free allocation for the shipping sector. In 2023, the first year when shipping is expected to participate in the ETS, operators will only need to surrender allowances in respect to 20% of the verified emissions. This share will increase to 45 % in 2024, 70 % in 2025 and 100 % from 2026 onwards.

3.2.7 ETS 2 for building and road transport

The Commission also proposes a separate emission trading system (ETS 2) for energy related emissions in road transport and the buildings sector. It would cover approx. 55 % of the emissions included under the Effort Sharing Regulation. Emissions from the combustion of fossil fuel in non-road transport (inland shipping, trains, off-road machinery), in small energy and industrial facilities and in agriculture are not included in the ETS 2; in total the proposed scope would cover approx. 85 % of the energy-related emissions outside of the current ETS (ETS 1). The ETS 2 emissions would also remain under the ESR, i.e. the ETS 2 is an instrument to achieve the ESR but not a separate element of the 2030 climate target architecture. ETS 2 allowances cannot be used in the ETS 1 and vice versa.

The ETS 2 is supposed to be a mid-stream/up-stream system where the regulated entities are those companies that bring fuels into the market instead of the fuel users like in the ETS 1. The cap will be based on the share of the covered sectors in the ESR target in 2024. Starting at this value an LRF of 5.15 % per year will be applied until 2027. The 2028 cap will be recalculated based on the verified emissions 2024 to 2026 and an LRF of 5.43 % will be applied from then onwards. All allowances will be auctioned. In 2024, 30 % more allowances will be auctioned to ensure liquidity in the market. This quantity will be reduced from the auctioning volumes in the years 2028 to 2030.

A separate MSR (MSR 2) is included in the proposal. The MSR 2 will initially filled with 600 million allowances. Like the current MSR (MSR 1) two thresholds determine whether it will retain or issue allowances. In addition to the quantity-based approach the MSR 2 will also supply additional allowances into the market if the carbon price in the ETS 2 rises steeply within a few months.

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Annex 1

This annex provides additional supporting information for the EU ETS report, focusing on changes that occurred during 2020.

A1.1 Activities covered by the EU ETS

A1.1.1 Stationary installations

In 2020, the EU ETS covered 12 140 stationary installations in most industrial sectors (Table A1.1). The scope of the EU ETS includes all combustion installations exceeding 20 MW and all installations in which the activities listed in Annex I of the ETS Directive are carried out (EU, 2003). The total emissions of all stationary installations covered by the EU ETS in 2020 were 1 355 Mt CO_2-eq (EEA, 2021b).

The stationary installations covered by the EU ETS can be grouped into eight main categories, based on their main activities responsible for greenhouse gas emissions:

1. fuel combustion (mainly electricity and heat generation plus various manufacturing industries);
2. refineries;
3. iron and steel, coke, and metal ore production;
4. cement, clinker and lime production;
5. other non-metallic minerals (glass, ceramics, mineral wool and gypsum);
6. production of pulp and paper;
7. production of chemicals;
8. other (opt-ins and capture and transport of greenhouse gases).

Table A1.1 Activities and sectors covered by the EU ETS in 2020

Activities	Sectors	No. of entities	Verified Emissions
20 Combustion of fuels	Combustion	7662	822
21 Refining of mineral oil	Refineries	140	113
22 Production of coke	Iron and steel, coke, metal ore	20	10
23 Metal ore roasting or sintering		10	2
24 Production of pig iron or steel		244	105
25 Production or processing of ferrous metals		257	11
26 Production of primary aluminum	Other metals (incl. aluminum)	33	8
27 Production of secondary aluminum		36	1
28 Production or processing of non-ferrous metals		86	7
29 Production of cement clinker	Cement and lime	263	114
30 Production of lime, or calcination of dolomite/magnesite		293	27
31 Manufacture of glass	Other non-metallic minerals	371	17
32 Manufacture of ceramics		1093	14
33 Manufacture of mineral wool		54	2
34 Production or processing of gypsum or plasterboard		40	1
35 Production of pulp	Pulp and Paper	181	5
36 Production of paper or cardboard		594	20
37 Production of carbon black	Chemicals	18	1
38 Production of nitric acid		36	4
39 Production of adipic acid		3	0
40 Production of glyoxal and glyoxylic acid		1	0
41 Production of ammonia		29	21
42 Production of bulk chemicals		366	36
43 Production of hydrogen and synthesis gas		43	9
44 Production of soda ash and sodium bicarbonate		15	4
45 Capture of greenhouse gases under Directive 2009/31/EC	Other	3	0
46 Transport of greenhouse gases under Directive 2009/31/EC		0	0
99 Other activity opted-in under Art. 24		249	1
Sum of all stationary installations	**Stationary**	**12.140**	**1.355**
10 Aviation	Aviation	376	25

Source: EEA (2021b).

A1.1.2 Aviation operators

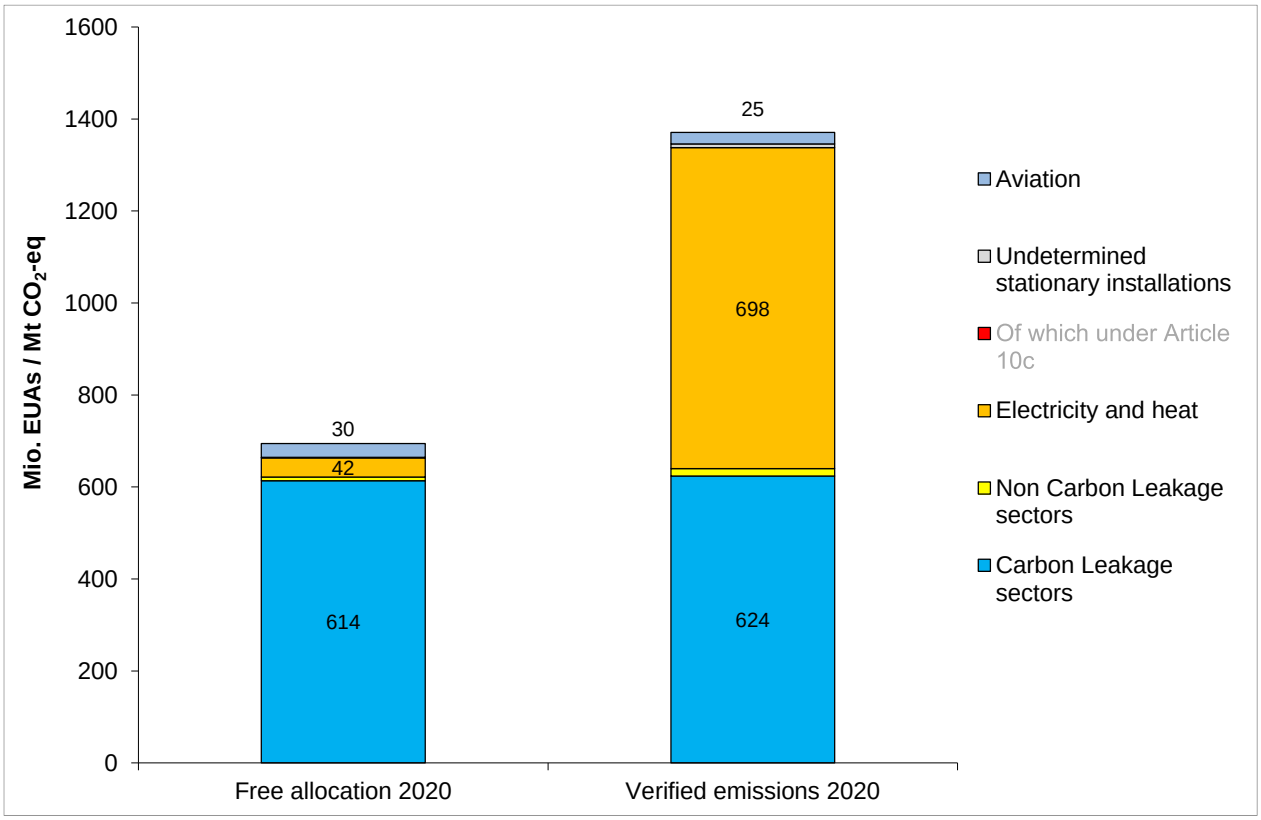
The aviation emissions covered by the EU ETS in 2020 were 25 Mt CO_2-eq (EEA, 2021b). Since its inclusion in the EU ETS in 2012, the aviation sector has had to purchase allowances from the stationary sector to fully cover its emissions, except for 2020 due to the Covid19-pandemic. Initially, aviation covered all flights from, to and within the European Economic Area. However, to allow time for negotiations within the ICAO on a global market-based measure for aviation, the requirements of the EU ETS were suspended for flights to and from non-European countries for the period 2013-2016. The balance between the supply of and demand for EUAAs changed considerably between 2012 and 2013-2016, because in 2012 operators were allowed to choose the applicable scope, whereas since 2013 a uniform scope has been applied. A consensus was reached towards the end of 2017 to maintain the current limitations on the scope of the EU ETS to intra EEA flights and prolong the derogation for extra EEA flights until 31st of December 2023.

A1.2 Allocation of free allowances

A1.2.1 Free allocation based on carbon leakage assessment

Free allocation differs significantly across the various activities. The vast majority of industrial installations host an activity considered to be at risk of carbon leakage. Figure A1.1 shows free allocation and verified emissions based on the sector classification used for the carbon leakage assessment (different from classification according to ETS activities in chapter 1.1.1). The operators of industrial installations as a group receive free allowances that are just under their total verified emissions in 2018. Electricity and heat installations have to purchase the majority of allowances needed to cover their emissions. Aircraft operators also have to purchase additional allowances to cover their verified emissions.

Figure A1.1 Verified emissions and free allocation (2019), according to allocation rules



Notes: Electricity and heat refers to electricity generators as included in the carbon leakage installation list. Both carbon leakage sectors and non-carbon leakage sectors refer to non-electricity generators (industry installations). Verified emissions data for installations producing electricity and heat are available only at an aggregate level. No allocation under Article 10c in 2020.

Sources: Sector classification based on EC, (2014a); EEA (2021b).

A1.2.2 Transitional free allowances

The maximum allocation allowed under Article 10(c) decreases from 152 million allowances in 2013 to 0 EUAs in 2020 (Table A1.2). Notably in Hungary, transitional free allocation was restricted to 2013 only,

while in all other countries the allowed amounts will continue but will reduce steadily until they reach 0 in 2020.

To date, the de facto allocation has always been lower than the allowed amount. In 2013, 139 million allowances were allocated free to installations under Article 10(c), which corresponds to 92 % of the maximum allowed amount (EC, 2014b; 2015; 2016; 2017b; 2018c; 2019; 2020c). In 2014, 109 million allowances were allocated to installations, 84 % of the maximum allowed amount (EC, 2015; EU, 2018). In 2015, 86 million allowances were allocated to installations, 75 % of the maximum allowed amount (EC, 2016; EU, 2018). In 2016, 66 million allowances were allocated to installations, 67 % of the maximum allowed amount (EC, 2017b; EU, 2018). In 2017, 46 million allowances were allocated to installations, 57 % of the maximum allowed amount (EC, 2018c; EU, 2018). In 2018, 34 million allowances were allocated to installations, 55 % of the maximum allowed amount (EC, 2019). In 2019, 24 million allowances were allocated to installations, 57 % of the maximum allowed amount (EC, 2020c).

Table A1.2 Maximum and allocated transitional free allocation for the modernisation of electricity generation under Article 10(c) of the ETS Directive

		2013	2014	2015	2016	2017	2018	2019	2020
Bulgaria	Max	13.5	11.6	9.7	7.7	5.8	3.9	1.9	0.0
	Allocated	11.2	9.8	8.2	6.5	3.8	2.8	1.6	-
Cyprus	Max	2.5	2.2	1.9	1.6	1.3	0.9	0.6	0.0
	Allocated	2.5	2.2	1.9	1.6	1.3	0.9	0.6	-
Czech Republic	Max	26.9	23.1	19.2	15.4	11.5	7.7	3.8	0.0
	Allocated	26.8	23.0	19.2	15.3	11.5	7.7	3.8	-
Estonia	Max	5.3	4.5	3.8	3.0	2.3	1.5	0.8	0.0
	Allocated	5.1	4.4	3.7	2.9	2.1	0.0	0.0	-
Hungary	Max	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Allocated	6.1	0.0	0.0	0.0	0.0	0.0	0.0	-
Lithuania	Max	0.6	0.5	0.5	0.0	0.4	0.3	0.2	0.0
	Allocated	0.3	0.3	0.3	0.2	0.2	0.2	0.1	-
Poland	Max	77.8	72.3	66.7	60.0	52.2	43.4	32.2	0.0
	Allocated	71.6	60.8	43.6	32.2	21.3	19.0	16.3	-
Romania	Max	17.9	15.3	12.8	10.2	7.7	5.1	2.6	0.0
	Allocated	15.7	8.6	9.2	7.2	6.2	3.8	1.7	-
Total	**Max**	**151.5**	**129.5**	**114.6**	**98.0**	**81.1**	**62.7**	**42.1**	**0.0**
	Allocated	**139.4**	**109.0**	**85.9**	**66.0**	**46.3**	**34.3**	**24.1**	**-**

Note: Includes Article 10(c) amounts to be auctioned in 2018.
Sources: EC, (2014b); (2015); (2016); (2017b); (2018c); (2019); (2020c); (EU, 2020).

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A1.3 Auctioned allowances during the third trading period

Table A1.3 and Table A1.4 present the volume of allowances auctioned or sold.

Table A1.3 Allowances auctioned/sold during the third trading period (EUA millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria	1.0	14.3	8.8	10.0	11.2	13.7	13.5	7.4	7.5
Belgium	9.6	26.1	16.1	18.2	20.4	24.9	24.6	14.4	14.5
Bulgaria	0.1	15.3	6.1	15.9	16.2	22.6	23.8	17.8	18.4
Croatia	0.0	0.0	0.0	11.3	3.8	4.7	4.6	2.9	2.9
Cyprus	0.0	0.3	0.1	0.0	0.0	1.1	1.6	1.0	1.6
Czech Republic	2.6	18.6	9.4	14.5	22.4	34.6	37.8	25.6	29.6
Denmark	2.8	12.9	8.0	9.0	10.1	12.3	12.1	6.6	6.7
Estonia	0.0	4.1	1.2	2.8	4.5	6.8	9.1	5.8	5.9
Finland	0.0	17.2	10.6	12.0	13.4	16.4	16.2	8.8	9.0
France	0.0	56.3	34.8	39.3	44.0	53.8	53.1	28.9	29.4
Germany	48.1	206.1	127.1	143.9	160.8	196.8	172.2	127.6	107.4
Greece	8.8	35.8	22.0	24.9	27.9	34.1	33.6	20.5	20.6
Hungary	7.7	8.4	9.5	10.8	12.1	14.8	14.5	9.2	9.3
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.5
Ireland	0.0	9.6	5.9	6.7	7.5	9.2	9.1	4.9	5.0
Italy	0.0	99.2	61.2	69.3	77.4	94.7	93.4	51.7	52.4
Latvia	0.0	2.8	1.7	1.9	2.2	2.6	2.6	1.7	1.7
Liechtenstein	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lithuania	2.5	5.0	2.9	3.7	3.9	5.4	5.2	3.4	3.6
Luxembourg	0.0	1.2	0.8	0.9	1.0	1.2	1.2	0.7	0.7
Malta	0.0	1.1	0.6	0.7	0.8	1.0	1.0	0.6	0.6
Netherlands	4.0	34.5	21.3	24.1	26.9	32.9	32.5	17.7	18.0
Norway	9.8	0.0	0.0	0.0	0.0	0.0	0.0	18.5	29.7
Poland	0.2	51.2	13.3	17.1	25.6	85.9	78.0	103.9	130.1
Portugal	0.0	18.1	11.2	12.6	14.1	17.3	17.0	10.3	10.4
Romania	0.6	33.8	16.5	25.4	36.8	45.2	46.5	30.4	33.0
Slovakia	0.0	15.9	9.7	11.1	12.4	15.1	14.9	9.9	10.0
Slovenia	0.0	4.6	2.8	3.2	3.6	4.4	4.3	2.6	2.7
Spain	0.0	88.9	54.8	62.1	69.3	84.9	83.7	49.8	50.3
Sweden	0.0	9.2	5.6	6.4	7.1	8.8	8.6	5.0	5.1
United Kingdom	27.3	107.4	66.2	75.0	80.3	106.0	101.1	0.0	111.0
NER 300 auctions	0.0	210.6	89.5	0.0	0.0	0.0	0.0	0.0	7.5

Sources: EEX (2021), ICE (2021)

Table A1.4 Allowances auctioned/sold during the third trading period (EUAA millions)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Austria	0.0	0.0	0.2	0.3	0.1	0.1	0.1	0.1	0.1
Belgium	0.0	0.0	0.3	0.4	0.1	0.1	0.1	0.1	0.1
Bulgaria	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Croatia	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Cyprus	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1
Czech Republic	0.0	0.0	0.1	0.2	0.1	0.0	0.1	0.1	0.1
Denmark	0.0	0.0	0.2	0.4	0.1	0.1	0.1	0.1	0.1
Estonia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finland	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.1	0.1
France	0.0	0.0	1.7	1.7	0.6	0.5	0.6	0.6	0.6
Germany	2.5	0.0	0.0	2.2	0.9	0.7	0.8	0.8	0.8
Greece	0.0	0.0	0.2	0.7	0.3	0.2	0.2	0.2	0.2
Hungary	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Ireland	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.1	0.1
Italy	0.0	0.0	0.9	2.0	0.7	0.6	0.7	0.7	0.7
Latvia	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Liechtenstein	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lithuania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Luxembourg	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Malta	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Netherlands	0.0	0.0	0.9	0.5	0.2	0.2	0.2	0.2	0.2
Norway	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.1
Poland	0.0	0.0	0.0	0.4	0.1	0.1	0.1	0.1	0.1
Portugal	0.0	0.0	0.2	0.4	0.2	0.1	0.1	0.1	0.1
Romania	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1
Slovakia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovenia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	0.0	0.0	1.1	2.3	0.8	0.7	0.8	0.8	0.8
Sweden	0.0	0.0	0.2	0.5	0.2	0.1	0.2	0.2	0.2
United Kingdom	0.0	0.0	2.7	2.5	0.9	0.7	0.9	0.0	1.7

Sources: EEX (2021), ICE (2021).

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