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Trends and projections in the EU ETS in 2020

The EU Emissions Trading System in numbers

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** 2 May 2021: this is an updated version of the report. Table 1.2 has been replaced. **

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About this report

This report provides an analysis of past, present and future emission trends under the European Union (EU) Emissions Trading System (ETS). It also analyses the balance between supply and demand of allowances in the market.

The report is based on the data and information available from the European Commission and Member States as of June 2020. Data on verified emissions and compliance by operators under the EU ETS for the years up until 2019 are based on an extract of the EU Transaction Log from 1st July 2020.

As in previous years, this report is structured in three parts: Recent Trends, Long-term Trends and Projected Trends. In the former two sections on historical developments the scope of analysis remains at EU27+UK. In the latter section on projected trends, however, analysis for the EU27 only is provided.

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 surplus of emissions allowances that accumulated in the EU ETS between 2009 and 2013 has been reduced over the course of the third trading period by the backloading measure and the introduction of the Market Stability Reserve (MSR).

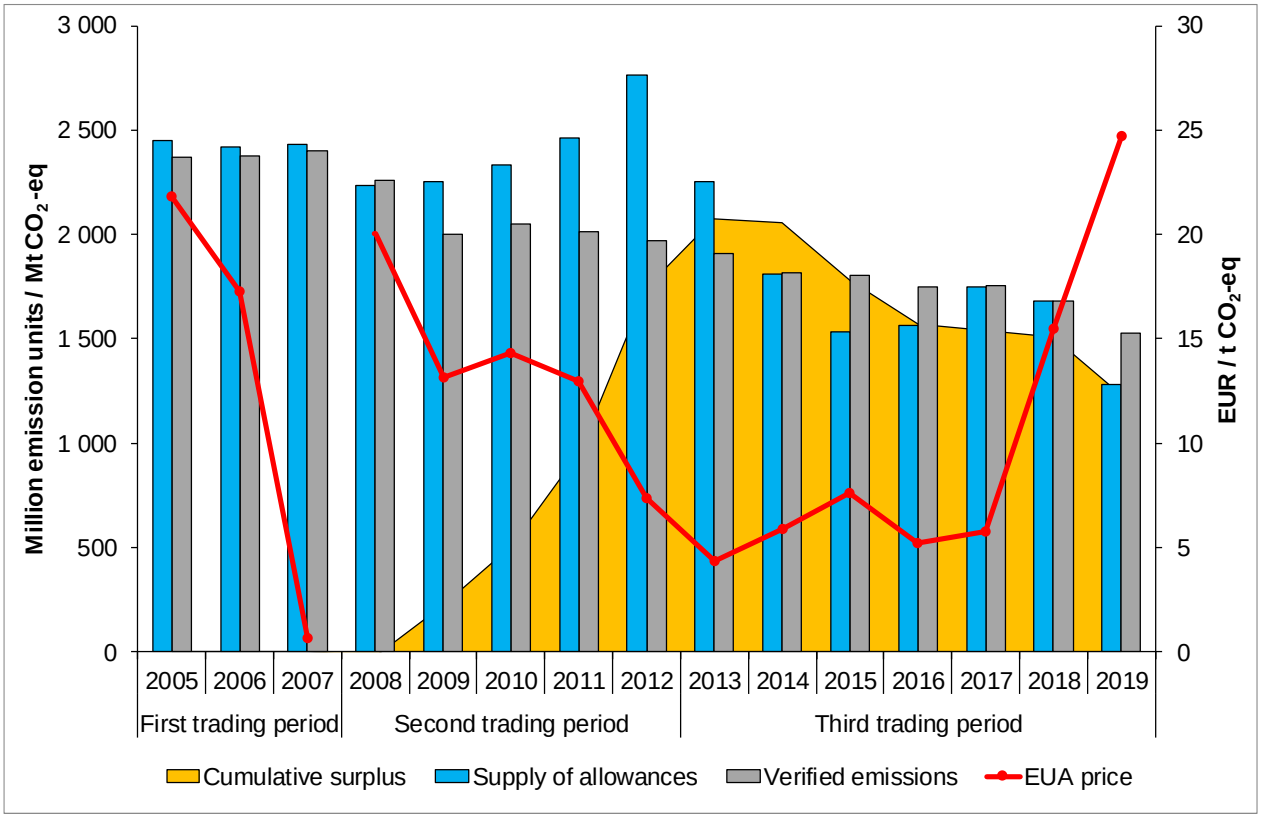
Between 2009 and 2013, the number of allowances available exceeded the demand for allowances (related to total emissions in the EU ETS). A surplus of allowances accumulated during this period, which resulted in lower prices for emission allowances and limited the incentive to invest in clean, low-carbon 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 2019, the supply of allowances decreased significantly compared to the previous year. This decrease of 20.7% is mainly due to the suspension of British auctions in 2019 and the fact that the Market Stability Reserve (MSR) started to withdraw allowances in 2019.

([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, 2005-2019



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 (2020b), EEX (2020), ICE (2020)

Between 2018 and 2019 stationary EU ETS emissions decreased by 9%, bringing the overall reduction achieved since the start of the scheme to 35%. 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.

Between 2018 and 2019 overall EU ETS emissions decreased by 9%. Emissions from combustion plants (mainly power plants) were down 13%, while emissions from industrial installations decreased by 2% between the two years.

Since the start of the EU ETS in 2005, emission from stationary installations have decreased by about 35%([2]). 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 CO_2 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.

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

([2]) The emission reduction between 2005 and 2019 is estimated based on the scope of the EU ETS in the third trading period (incl. UK).

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. 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.

Member States project that, with the current measures in place, their EU ETS emissions will continue to decrease, albeit at a slower rate than historically. On the one hand, the overall projected reduction is not yet in line with EU objectives for emission reductions by 2030. On the other hand, projections do not yet reflect the recent downward trends observed for ETS emissions or the impact of the Covid-19 pandemic.

The Covid-19 pandemic has considerable impacts on ETS emissions in the short-and possibly the medium-term. Greenhouse gas (GHG) emission projections submitted in 2019 and 2020 do not consider these effects, nor do they reflect the considerable reduction in ETS emissions between 2018 and 2019. Therefore, GHG projections need to be considered with special care in this year's report.

Twelve countries submitted updated GHG projections in 2020 under EU legislation. In these projections total stationary ETS emissions of EU27 Member States, Iceland, Liechtenstein and Norway the rate of reduction is projected to slow, according to scenarios submitted by countries in 2019 and 2020. Stationary EU ETS emissions (excluding UK emissions) are projected to continue decreasing with existing measures (WEM) in place, resulting in a reduction of 32.8% 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 40.3 % compared to 2005, falling short of the 43 % reduction target set for the same year.

With the strong decrease of ETS emissions between 2018 and 2019, historic emissions stand at 35% below 2005 levels at the end of 2019 and are therefore already below the level projected for 2030 under the WEM scenario. The Covid-19 pandemic is expected to further reduce emissions at least in 2020 and possibly following years. These latest effects need to be considered in next year's projections report.

1 Recent trends

- Between 2018 and 2019, total emissions from the European Union (EU) Emissions Trading Scheme (ETS) for stationary installations decreased by 9.1%.
- This decrease in verified emissions is attributable to combustion plants (mainly power plants; down 12.9% compared to 2018) and mirrors the increased CO_2 price and the resulting fuel switch from coal to gas power plants and renewables. Emissions from industrial plants decreased by 2.0% on average ([3]). These trends are also observed for the top 30 emitting power plants and industrial installations, which are responsible for roughly a quarter of their respective sector's emissions.
- In 2019, the supply of EU allowances (EUAs) declined by 20.7% compared to the previous year. This decline is primarily due to the suspension of British auctions in 2019, the start of the Market Stability Reserve (MSR) and the ongoing reduction in free allocation. In most industrial sectors, verified emissions were higher than the number of free allowances received in 2019.
- Emissions from the aviation sector increased by 1.0 % in 2019 compared with the previous year, as the number of passengers continued to grow for many operators.
- The number of EU Aviation Allowances (EUAAs) allocated in 2019 was lower than emissions from the aviation sector. Aircraft operators therefore had to buy EUAs from the stationary sector to meet the cap on aviation emissions, which is set separately from the cap for stationary installations.
- The combined demand for allowances from stationary installations and airline operators was higher in 2019 than the total supply of allowances. This shortfall was mainly driven by the MSR (in operation since January 2019), which has reduced the surplus of allowances accumulated in previous years.
- Certificate prices continued their rally in 2019, averaging EUR 24.72 per EUA[4].

In this section, developments for stationary installations and aviation are presented separately, focussing first on emission trends over the past year and then on their effects on 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.

([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 2019 are based on an extract of the EU Transaction Log from July 1st 2020.

([4]) The average EUA price for a given year is calculated by taking primary market auctioning EEX prices and supplementing this with ICE prices for days only where the EEX price is not available.

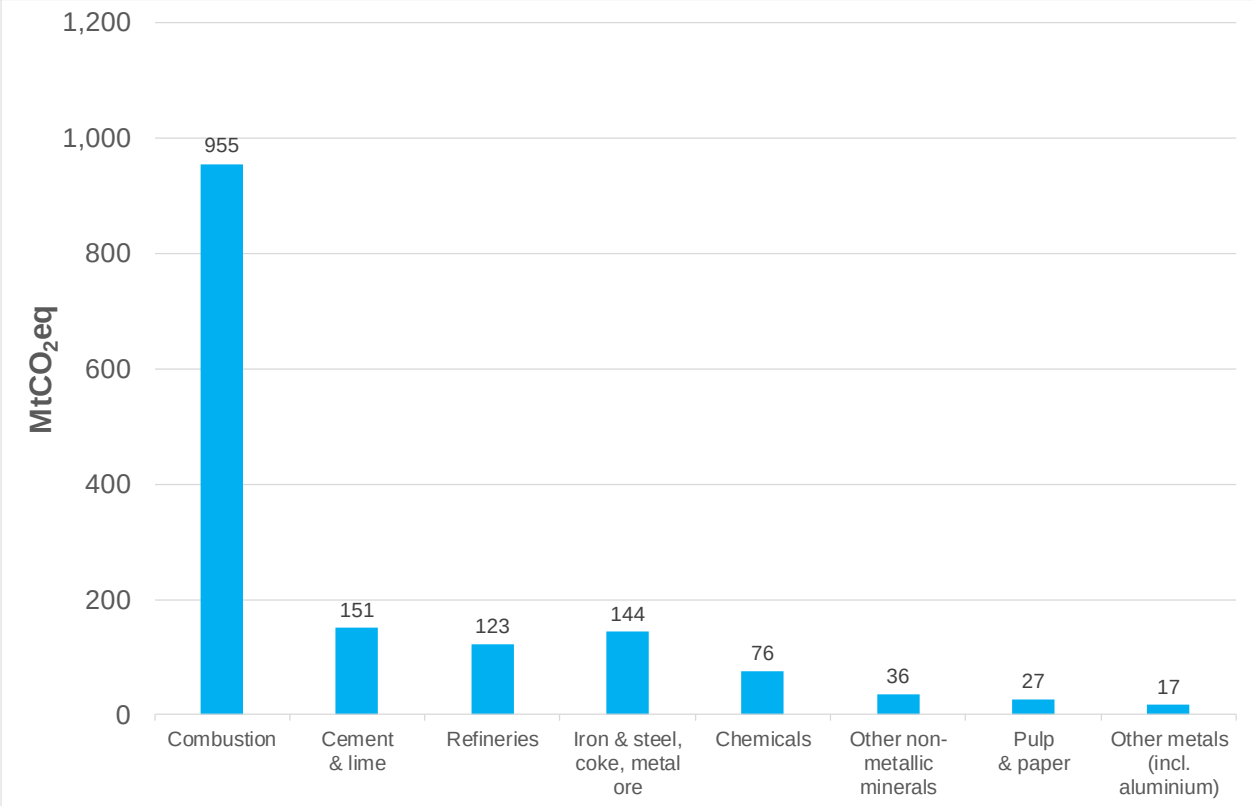
1.1 Stationary installations

1.1.1 Emission trends

Status in 2019

Combustion plants ([5]) are the main source of emissions under the EU ETS. In 2019, these installations accounted for 62% (955 Mt CO_2-eq) ([6]) of total verified emissions in the stationary part of the EU ETS (Figure 1.1). Cement and lime installations accounted for 10% (151 Mt CO_2-eq.), followed by iron and steel ([7]) (9%; 144 Mt CO_2-eq.), refineries (8%; 123 Mt CO_2-eq.) and chemical installations (5%; 76 Mt CO_2-eq.).

Figure 1.1 EU ETS emissions by main activity type in 2019



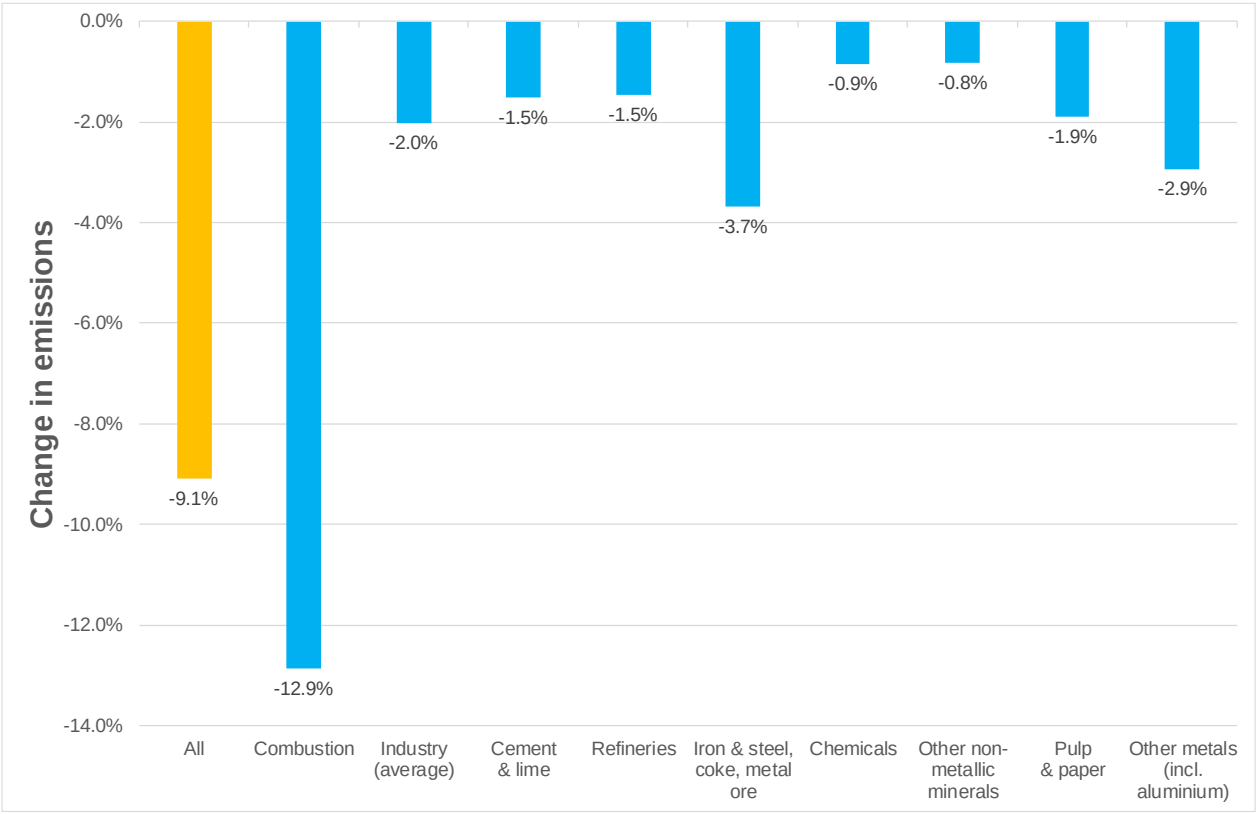
Note: Numbers cover all 31 countries that currently participate in the EU ETS.
EU Transaction Log (EUTL) activity codes have been aggregated for certain sectors throughout the report (refer to Table A1.1).
According to EUTL attribution, emissions originating from the combustion of blast furnace gases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

Source: EEA (2020b)

([5]) 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).
([6]) Mt CO_2e refers to million tonnes of carbon dioxide equivalent.
([7]) 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 2019, all sectors have lower verified emissions than in 2018 (see Figure 1.2). The overall emissions in the EU ETS for stationary installations decreased from 1682 Mt in 2018 to 1530 Mt in 2019, representing a drop of 9.1 %. The strongest decrease in verified emissions took place in combustion installations with 12.9% relative to 2018. On average, verified emissions in the remaining (industrial) sectors declined by 2% relative to 2018. This decrease in emissions is accompanied by a slight decrease in the annual output of EU-28 manufacturers of 0.9 % ([8]) on average compared to the previous year (Eurostat 2020b). This applies to all main activities, except for the cement industry, where a slight increase of 0.1 percent in output contrasts with a decrease of 1.5% in verified emissions (see Figure 2.4 in Section 2.1.1).

Figure 1.2 Change in EU ETS emissions by main activity, 2019 vs. 2018



Source: EEA (2020b)

The strong decline in the combustion sector is mainly caused by the decline in coal-fired power generation in Europe. Table 1.1 shows that there was a switch from coal to natural gas. This was mainly due to the increased price of CO_2 allowances and the higher share of renewable energy.

At -77% and -47%, the largest relative reductions in emissions were observed in the combustion sector in Iceland and Estonia. The Estonian decrease is mainly due to the decline in shale oil electricity generation. This was offset mainly by Russian electricity imports which are not covered by the European emissions trading scheme (ERR 2020). The largest decline in coal-based electricity production in terms of volume took place in Germany. Here, coal-fired power generation was replaced by natural gas, wind power and electricity imports from neighbouring countries. To a lesser extent this also applies to Poland. In Spain, on the other hand, coal has been replaced mainly by natural gas and some additional nuclear power.

([8]) 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 2018 and 2019.

Additional emissions in the combustion sector compared to 2018 to 2019 were reported in Austria, Belgium, Malta, Luxembourg and Croatia. For the first two, this is accompanied by additional electricity production, which was then exported. Most likely mainly to Germany.

Table 1.1 Change in electricity generation between 2019 and 2018

	Change in emissions 2018 vs. 2019*	Net electricity generation [TWh]								
		Total	of which							Net Import
			Thermal	of which**		Nuclear	Hydro	Wind	Solar	
				Coal	Gas					
IS***	-77%	-	-	-	-	-	-	-	-	-
EE	-47%	-4.4	-4.4	-	-	-	0.0	0.0	-	4.1
LI***	-42%	-	-	-	-	-	-	-	-	-
PT	-28%	-6.2	-4.2	-6.0	1.7	-	-3.4	1.1	0.3	6.1
DK	-26%	-0.5	-2.8	-3.1	-0.1	-	0.0	2.3	0.0	0.6
LT	-23%	0.5	0.2	-	0.2	-	0.0	0.3	0.0	-0.3
ES	-22%	-0.1	-0.2	-24.8	25.6	2.6	-9.7	5.1	2.2	-4.2
DE	-18%	-31.6	-45.3	-53.6	9.2	-1.3	2.7	13.6	-1.3	15.8
GR	-18%	-2.9	-2.3	-5.0	2.6	-	-1.8	1.0	0.2	3.4
FI	-16%	-1.4	-1.7	-1.2	-0.1	1.0	-0.9	0.1	0.1	0.1
SE	-15%	5.9	0.5	-0.2	-0.1	-1.5	3.6	3.3	-	-8.9
RO	-14%	-4.8	-3.0	-1.8	-1.1	-0.1	-2.2	0.4	0.0	4.1
BG	-13%	-1.4	-0.9	-1.9	0.1	0.4	-1.3	0.0	0.4	2.0
GB	-11%	-8.2	-6.9	-9.4	0.9	-8.1	-0.3	7.2	-0.2	2.1
IE	-10%	-0.4	-1.6	-1.5	-0.1	-	0.2	1.0	-	0.6
SK	-10%	2.3	1.1	-0.1	1.5	0.6	0.6	0.0	0.0	-2.0
PL	-10%	-5.4	-8.3	-11.5	2.4	-	0.3	2.2	0.4	4.9
CZ	-7%	-0.8	-1.7	-3.9	2.0	0.3	0.5	0.1	-0.1	0.8
NL	-7%	4.6	1.9	-12.4	12.8	0.4	0.0	-0.8	2.6	-5.0
IT	-6%	3.6	1.8	-	-	-	-2.3	2.7	1.4	-5.7
HU	-5%	2.2	0.7	-0.6	1.3	0.6	0.0	0.1	0.8	-1.8
LV	-5%	-0.3	0.0	0.0	-0.1	-	-0.3	0.0	-	0.2
SI	-5%	-0.3	-0.1	-0.1	0.0	0.0	-0.3	0.0	0.0	0.1
FR	-4%	-8.7	3.2	-7.1	10.6	-13.7	-7.7	8.0	1.4	5.2
CY	-2%	0.1	0.0	-	-	-	-	0.0	0.0	-
NO	-1%	-12.2	-0.2	-	0.2	-	-13.7	1.7	-	10.2
AT	3%	5.4	1.1	-0.2	1.3	-	3.1	1.4	-	-5.8
BE	5%	17.6	1.5	0.2	1.6	14.3	-0.1	2.0	0.0	-19.2
MT	6%	0.1	0.1	-	1.8	-	-	-	-	0.0
LU	8%	-0.3	0.0	-	0.0	-	-0.4	0.0	0.0	-0.3
HR	11%	-1.0	0.7	0.2	0.4	-	-1.8	0.1	0.0	0.7

Note: * Combustion installations (Activity Code 20)

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

***No data for Iceland and Liechtenstein available

Source: EEA (2020b); Eurostat (2020a)

Top 30 emitters (power)

The 30 power plants with the highest emissions emitted about 13% less in 2019 compared to 2018. With annual emissions of 259 Mt CO_2 these power plants are responsible for 27% 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 32.7 Mt CO_2 in 2019 ([9]). This

([9]) Following the construction of a new block in 2011, it has an installed capacity of 5 GW, and is thus the second largest power plant in the world.

represents a 15 % decline in emissions compared to 2018 and is due to a decrease in electricity production of the same percentage amount. On the list of top emitters, Bełchatów is followed by six German lignite-fired power plants: Neurath, Niederaußem, Jänschwalde, Weisweiler, Boxberg and Schwarze Pumpe. Together, these plants emitted 93.5 Mt CO_2 in 2019. In total, nine German power plants were included in the top 30 emitters in 2019 and accounted for 46 % 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 28 % of the emissions from the top 30.

Nine out of the ten highest emitting power plants in 2019 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 2019 averaged 1 200 g CO_2/kWh. The emission intensity of hard coal-fired power plants ranges between 800 and 1 500 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 and had a higher emission intensity of 1 600 g CO_2/kWh.

Table 1.2 Top 30 emitters in 2019 (power plants)

Company					Installed capacity 2019	Verified emissions 2019		Electricity generation 2019		Emission intensity 2019	
EUTL ID	Company		Power plant	Fuel	MW	$MtCO_2$	vs. 2018	TWh	vs. 2018	t CO_2/ MWh	vs. 2018
PL 1	PGE	PL	Bełchatów	Lignite	5,472	32.7	-15%	28.1	-15%	1.2	1%
DE 1606	RWE	DE	Neurath	Lignite	4,210	22.6	-30%	21.1	-28%	1.1	-2%
DE 1649	RWE	DE	Niederaußem	Lignite	2,795	18.4	-29%	16.2	-31%	1.1	3%
DE 1456	LEAG	DE	Jänschwalde	Lignite	2,500	17.6	-23%	15.9	-20%	1.1	-4%
DE 1607	RWE	DE	Weisweiler	Lignite	2,362	13.3	-21%	10.7	-19%	1.2	-2%
DE 1454	LEAG	DE	Boxberg Werk IV	Lignite	1,470	11.0	8%	10.5	7%	1.0	1%
DE 1459	LEAG	DE	Schwarze Pumpe	Lignite	1,510	10.5	-15%	9.3	-15%	1.1	0%
PL 4	ENEA	PL	Kozienice	Hard Coal	2,941	10.46	8%	11.4	8%	0.9	0%
DE 1460	LEAG	DE	Lippendorf	Lignite	1,782	8.9	-24%	9.3	-23%	1.0	-1%
BG 50	TPP	BG	Maritsa East 2	Lignite	1,604	7.9	-18%	6.7	-21%	1.2	5%
DE 1453	LEAG	DE	Boxberg Werk III	Lignite	1,000	7.6	-13%	6.4	-13%	1.2	0%
PL 2	PGE	PL	Opole	Hard Coal	3,339	7.0	-6%	10.0	25%	0.7	-25%
GR 15	ΔΕΗ AE	GR	Dimitrios	Lignite	1,456	6.8	-26%	4.4	-28%	1.6	3%
PL 5	Enea Elektrownia Połaniec	PL	Połaniec	Hard Coal	1,882	6.8	-18%	8.7	-15%	0.8	-4%
BG 9	Contour Global Maritsa East	BG	TEC ContourGlobal Mar	Lignite	908	5.7	17%	5.5	28%	1.0	-9%
PL 3	PGE	PL	Turów	Lignite	1,488	5.5	-20%	5.1	-22%	1.1	3%
NL 205957	RWE	NL	Eemshaven Centrale	Hard Coal	1,580	5.4	-32%	7.2	-33%	0.8	1%
BE 750	Electrabel	BE	Electrabel - Knippegroe	Blast Furnace Gas	315	5.1	10%	2.3	10%	2.2	0%
DE 1380	Großkraftwerk Mannheim	DE	Mannheim	Hard Coal	1,983	4.9	-27%	5.0	-30%	1.0	5%
ES 201	EDP	ES	Aboño 1	Hard Coal, Blast Furnace Gas	904	4.9	-31%	3.1	-39%	1.6	12%
DE 206180	Vattenfall	DE	Moorburg	Hard Coal	1,600	4.7	-24%	5.8	-25%	0.8	1%
CZ 124	Elektrarna Pocerady, a.s.	CZ	CEZ, a. s. - Elektrarna Pc	Lignite	930	4.7	-14%	4.7	-13%	1.0	-2%
RO 87	CE Oltenia	RO	Rovinari	Lignite	1,189	4.6	-11%	5.2	-7%	0.9	-4%
FR 988	ENGIE THERMIQUE FRANCE	FR	ETF - CENTRALE DK6	Natural Gas	796	4.6	2%	4.3	6%	1.1	-3%
IT 521	ENEL	IT	Brindisi Sud	Hard Coal	2,420	4.6	-17%	4.3	-22%	1.1	7%
IT 439	ENEL	IT	Torrevaldaliga Nord	Hard Coal	1,845	4.5	-44%	4.6	-48%	1.0	8%
HU 142	RWE	HU	Mátrai Eromu ZRt.	Lignite, Natural Gas	950	4.5	-14%	4.0	-14%	1.1	0%
PL 209933	ENEA	PL	Kozienice Block 11	Hard Coal	1,075	4.4	2%	5.4	2%	0.8	0%
PL 6	EDF	PL	Oddział w Rybniku	Hard Coal	1,797	4.4	-17%	4.6	-16%	1.0	-1%
IT 511	Taranto Energia	IT	Taranto	Blast Furnace Gas	n.A.	4.4	-7%	n.A.			
CZ 129	CEZ, a. s.	CZ	CEZ, a. s. - Elektrarna Tu	Lignite	728	4.3	-3%	4.7	1%	0.9	-4%

Note: 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.

Sources: EEA (2020b), ENTSO-E (2020), Platts (2014),

Five plants are no longer among the top 30. The hard coal-fired power plant Endesa As Pontes should be highlighted here. With an installed capacity of 1.4 GW, As Pontes is the largest power plant in Spain. Compared to 2018, electricity generation from this plant fell by 60% in 2019, and emissions decreased from 7.9 to 2.3 Mt. Since many coal-fired power plants in Spain can no longer be operated economically, half of them are to be closed in 2020 ([10]). Reasons are the increased CO_2 price and the lower gas price in 2019. The relatively low gas price probably also led to the fact that, with installation FR 988, a natural gas power plant can now be found in the top 30. New on the list is also the blast furnace plant IT 511 Taranto, for which no information on the installed capacity or the amount of electricity generation is publicly available. This power plant is part of the Taranto steelworks (IT 515), which is also one of the top 30 industrial emitters in the EU ETS (see Table 1.2).

Top 30 emitters (industry)

The 30 industrial installations with the highest emissions in 2019 that are not power plants ([11]) emitted 24 % of total industrial emissions (about 136 Mt CO_2-eq.) (see Table 1.3). These industrial installations are spread across Europe, with no single country dominating the list. The six largest industrial emitters all belong to the iron and steel sector. Overall, this sector accounted for 70.6% of the total emissions of the 30 largest industrial installations ([12]), followed by refineries (25.6%), cement clinker (2.0%) and chemicals (1.8%).

A total of three new industrial installations are in the top 30: the PL 362 and GB 86 refineries and the LT 18 chemical plant; the CZ 73 steelworks, FR 253 refinery and the BE203830 chemical plant are not in the top 30 anymore. However, these are only minor shifts in the lower positions of the list.

([10]) https://english.elpais.com/economy_and_business/2020-06-29/spain-to-close-half-its-coal-fired-power-stations.html

([11]) 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.

([12]) 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).

Table 1.3 Top 30 emitters in 2019 (industrial plants, excluding combustion)

EUTL ID	Company	Installation	Activity code	Verified Emissions 2019	
				$MtCO_2$	vs. 2018
AT 16	Voestalpine Stahl Gmbh	Voestalpine Stahl Linz	24	8.8	13%
DE 69	Thyssenkrupp Steel Europe Ag	Integriertes Hüttenwerk Duisburg	24	7.8	-6%
FR 628	Arcelormittal Mediterranee	Arcelormittal Mediterranee	24	7.7	3%
FR 956	Arcelormittal Atlantique Et Lorraine	Arcelormittal Atlantique Et Lorraine - Dunkerque	24	7.5	-7%
GB 325	Tata Steel Uk Limited	Port Talbot Steelworks	24	6.4	11%
NL 144	Tata Steel Ijmuiden B.V.	Tata Steel Ijmuiden Bv Bkg 1	24	6.3	-4%
IT 575	Sarlux Srl	Impianti Di Raffinazione	21	6.1	-3%
IT 515	Arcelormittal Italia S.P.A.	Arcelormittal Italia Spa - Stabilimento Di Taranto	24	5.9	-3%
DE 53	Hüttenwerke Krupp Mannesmann Gmbh	Glocke Duisburg	24	5.1	4%
ES 212	Arcelormittal España, S.A.	Arcelormittal España, S.A.	24	5.1	-10%
SK 150	U. S. Steel Košice, S.R.O.	U. S. Steel Košice, S.R.O.	24	5.0	-16%
GB 321	Slb 2020 Limited	Scunthorpe Integrated Iron & Steel Works	22	4.5	-11%
NL 99	Shell Nederland Raffinaderij B.V.	Shell Nederland Raffinaderij B.V.	21	4.4	3%
BE 203912	Arcelormittal Belgium	Arcelormittal Gent 1	24	4.3	-3%
DE 52	Rogesa Roheisengesellschaft Saar Mbh	Roheisenerzeugung Dillingen	24	4.2	-10%
RO 44	Sc Liberty Galati Sa	Liberty Galati Sa	24	4.2	2%
DE 43	Salzgitter Flachstahl Gmbh	Glocke Salzgitter	24	4.1	-6%
BE 127	Total Raffinaderij Antwerpen	Total Raffinaderij Antwerpen	21	4.0	10%
DE 19	Pck Raffinerie Gmbh	Pck Raffinerie Glocke Schwedt	21	3.4	-10%
FI 445	Ssab Europe Oy	Raahen Terästehdas	24	3.3	-18%
DE 4	Ruhr Oel Gmbh	Ruhr Oel Gmbh - Werk Scholven - Co2-Glocke	21	3.0	5%
FI 533	Neste Oyj	Porvoon Jalostamo	21	3.0	9%
AT 13	Voestalpine Stahl Donawitz Gmbh	Sinteranl., Hochöfen, Stahlwerk Donawitz	24	2.8	-3%
PL 362	Polski Koncern Naftowy Orlen S.A.	Rafineria	21	2.8	5%
AT 26	Omv Refining & Marketing Gmbh	Raffinerie Schwechat	21	2.8	-1%
PL 490	Górażdże Cement Spółka Akcyjna	Górażdże Cement Spółka Akcyjna	29	2.7	-2%
DE 11	Mineralölraffinerie Oberrhein Gmbh & C	Werk 1 Und Werk 2	21	2.7	-1%
CZ 114	Třinecké Železárny, A. S.	Třinecké Železárny	24	2.7	-2%
GB 86	Esso Petroleum Company Limited	Esso Petroleum Company Ltd	21	2.6	4%
LT 18	Ab Achema	Katilinė,Amoniako Paleidimo Katilinės Nr.1 Ir Nr.2	41	2.5	3%

Note: A list of activity codes can be found in Annex 1 Table A1.1
Sources: EEA (2020b), EU 2020

1.1.2 Balance of allowances

Supply and demand

The total supply of allowances in 2019 declined by 21 % compared with the year 2018, amounting to 1334.6 million allowances. This 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 2.7 % lower than in 2018. 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 ([13]). 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 ([14]). Under Article 10(c) of the ETS Directive allowances are allocated for free to electricity generators in eligible Member States in order to enable them to modernise their energy sector. This amount decreased by 29.7 % in 2019 compared to the previous year.

([13]) 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.

([14]) 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).

The number of allowances auctioned in 2019 was 36 % lower than during the previous year. Two different effects account for the bulk of this large decline. Firstly, the auctioning of emission allowances for the UK was suspended in 2019 due to the Brexit (EC 2018a). As a result, approximately 11% of the total auction volume were withheld. Furthermore, in 2019 the Market Stability Reserve (MSR) started to take effect. The goal of the MSR is to make the EU ETS more resilient to demand shocks, avoiding gross imbalances by adjusting the supply based on a set of rules. Tackling the large surplus of allowances built up during the second and beginning of the third trading period, 397 million EUAs were placed into the reserve instead of being auctioned in 2019 (EC 2020c).

The use of international credits increased by 51 % in 2019 compared to 2018, but at 27 million allowances remains at a low level overall. This is due to the fact that the overall limit for the use of international credits has almost been reached (cf. Figure 2.12).

While demand and supply of allowances for stationary installations were balanced in 2017 and 2018, the effects described above imply that in 2019 demand exceeds supply by 245.7 million allowances (277.8 million allowances if net demand from aviation is taken into account.

Certificate prices continued their rally in 2019. While the price of EUAs tripled in 2018 compared to 2017, it has risen by a further 60% in 2019 reflecting the expected shortage in future years due to the introduction of the MSR and the political agreement on reforms to the EU ETS for the fourth trading period.

Table 1.4 EUA demand, supply and price (stationary installations), 2018-2019

	2018	2019	Change
Verified emissions (Mt CO_2-eq.)	1682.4	1529.6	**-9%**
Combustion emissions	1095.9	954.9	**-13%**
Industrial emissions	586.5	574.7	**-2%**
Total supply of allowances (millions of EUAs)	1682.4	1334.6	**-21%**
Free allocation (incumbents, new entrants)	714.5	694.9	**-3%**
To existing installations	688.4	668.3	**-3%**
To new entrants and capacity extensions	26.0	26.5	**2%**
Transitional free allocation to electricity generation	34.3	24.1	**-30%**
Auctioned amounts/primary market sales	915.8	588.5	**-36%**
International credits exchanged	17.9	27.0	**51%**
Supply/demand balance (millions of EUA)			
Balance stationary installations only	0.0	-245.7	-
Net demand in EUAs from aviation	-31.1	-32.1	**3%**
Annual balance all ETS	-31.0	-277.8	**795%**
EUA price (EUR)	15.50	24.72	**60%**

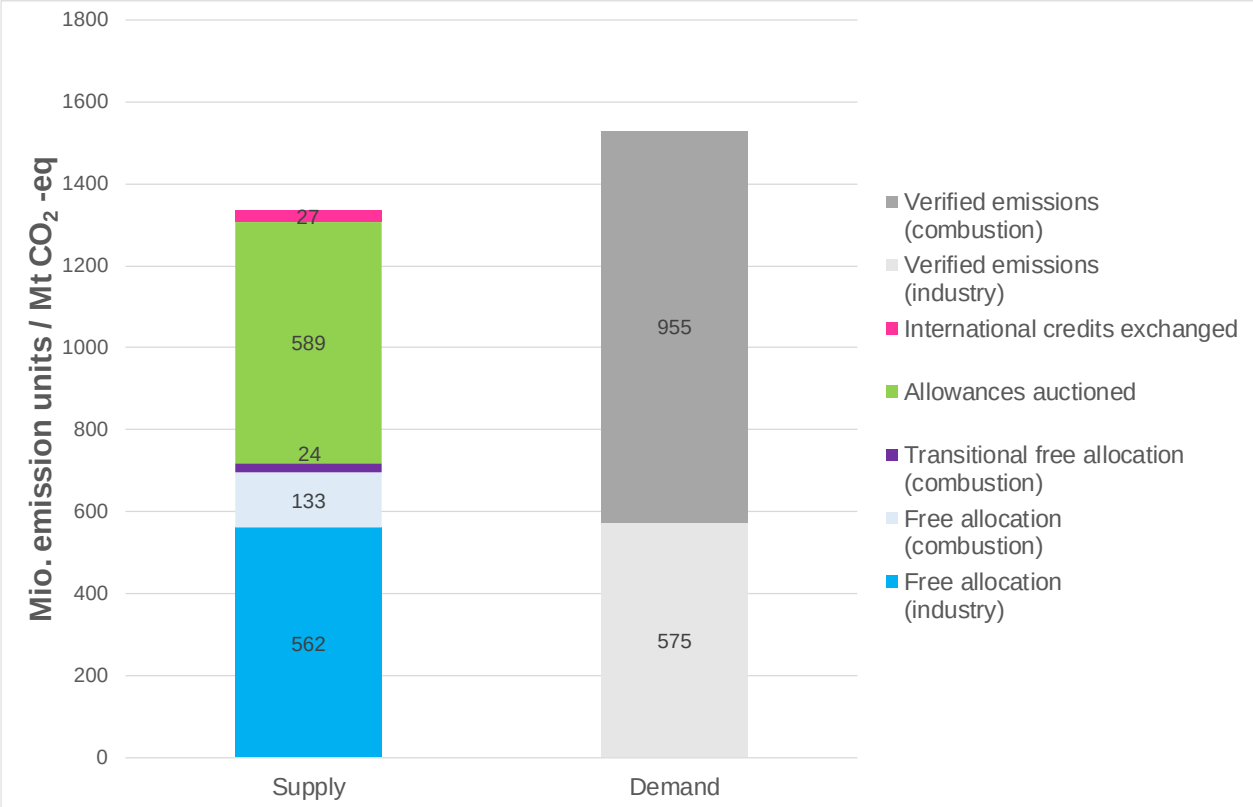
Notes: Based on data from July 1st 2020
The distinction between combustion (activity code 20) and industrial emissions (activity code 21 and above) is based on the EUTL classification of activities and does not take into account waste gas transfers from the production of iron and steel or cross-boundary heat flows.

Sources: EEA (2020b), EEX (2020), ICE (2020)

Supply and demand by main activity type

In 2019, 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) ([15]). Industrial installations received a larger number of free allowances, but these were not enough to fully cover their verified emissions ([16]). 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 2019



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 (2020b)

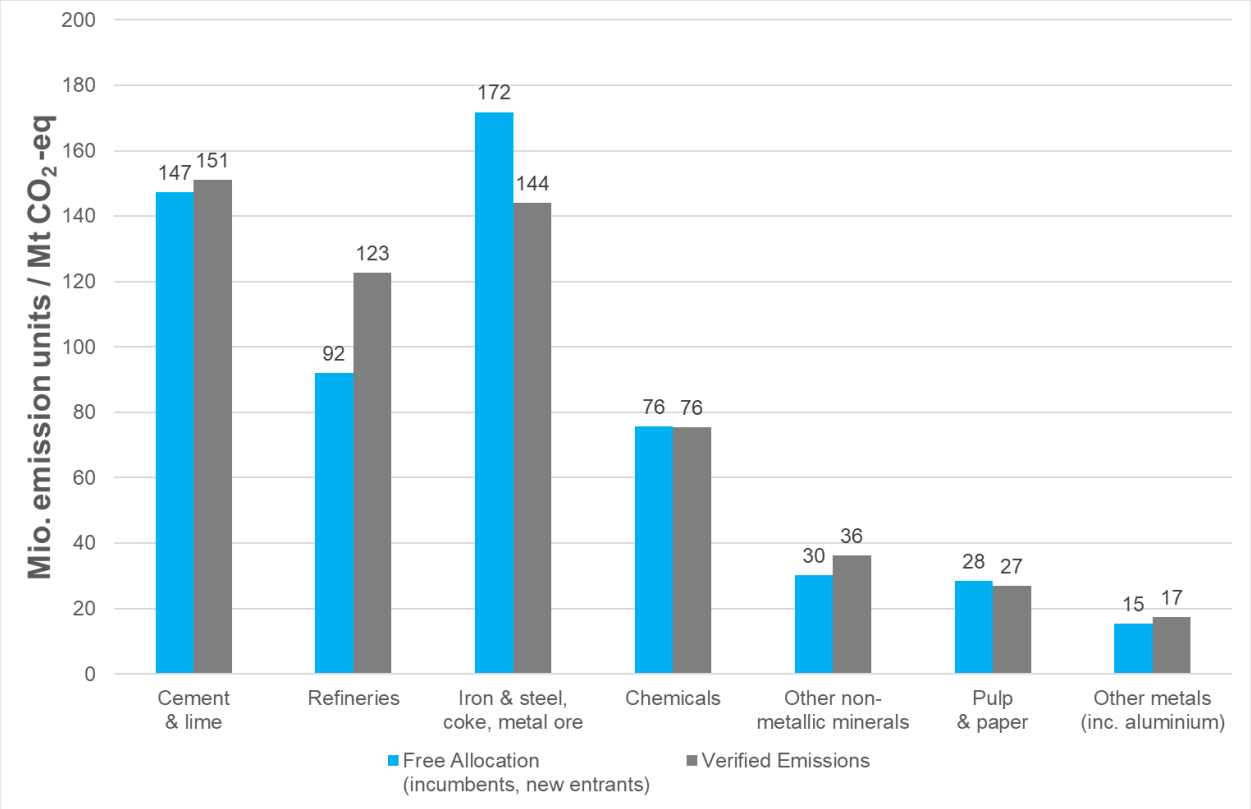
([15]) While free allocation was still made to electricity generation during the first and second trading periods, it ceased with the beginning of the third trading period, because a general consensus emerged that this sector can pass on costs to consumers (and made windfall profits while receiving free 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.

([16]) 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.

Based on EUTL activity classifications, Figure 1.4 shows that in 2019 free allocation to the iron and steel sector exceeded its verified emissions by around 28 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 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. For refineries, verified emissions exceeded free allocation by around 31 Mt. Emissions also exceeded freely allocated allowances (albeit to a lesser extent) in all other industry sectors, except chemicals, where free allocation and verified emissions were of equal amount.

The fact that the majority of industry sectors did not receive freely allocated allowances sufficient to cover verified emissions in 2019 reflects 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 ([17]). 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 (cf. Figure 2.5).

Figure 1.4 Balance of free allocations and emissions, industrial sectors, 2019



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 (2020b)

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

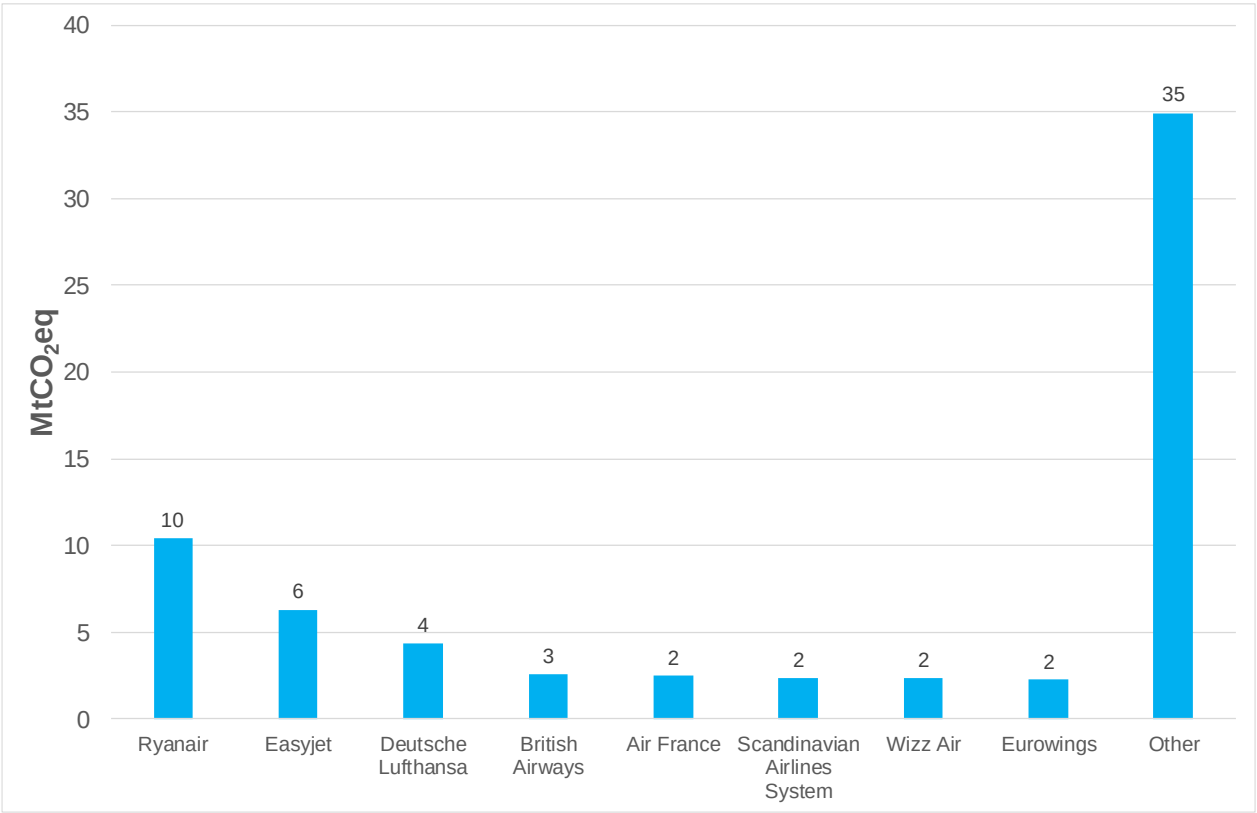
1.2 Aviation

1.2.1 Emission trends

Status in 2019

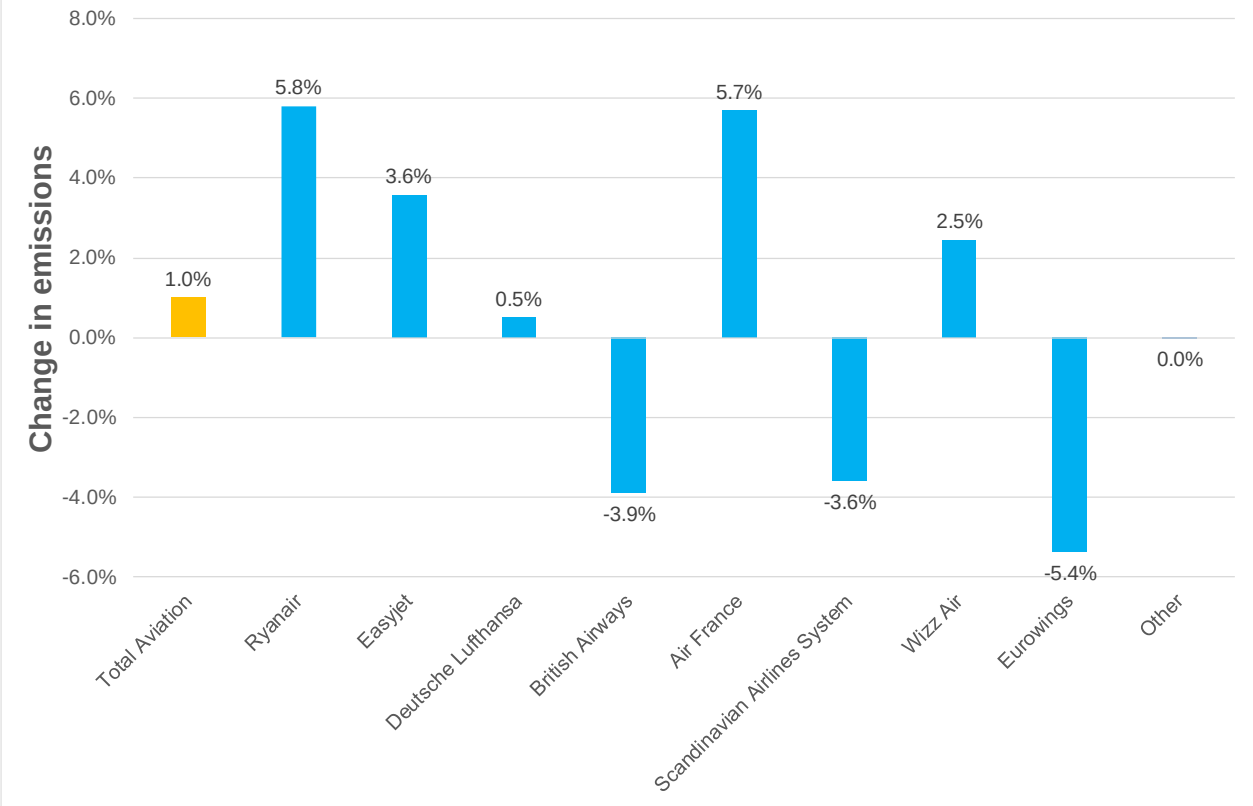
In 2019, aviation emissions covered by the EU ETS amounted to 68.2 Mt CO_2–eq., which represents an increase of 1.0 % compared to the previous year. The eight largest aircraft operators were responsible for 49 % of total emissions. Ryanair and Easyjet were responsible for the largest share of EU ETS-covered emissions in 2019, accounting for around 10 Mt CO_2-eq. and 6 Mt CO_2-eq. respectively (Figure 1.5) and making Ryanair one of the top ten emitters in the EU ETS overall. It also has the highest emissions growth rate among the top 8 aviation emitters, with an increase of 5.8% compared to 2018 (Figure 1.6). This growth coincides with an increase in passenger numbers of approximately 9% in 2019 compared to 2018 (Ryanair 2020). The highest decline (-5.4%) was observed for Eurowings. The number of flights offered in 2019 was 2% lower than in the previous year (Lufthansa Group 2020).

Figure 1.5 Aviation emissions by carrier, 2019



Source: EEA (2020b)

Figure 1.6 Relative change in ETS aviation emissions, 2019 vs. 2018



Source: EEA (2020b)

1.2.2 Balance of allowances

Supply and demand

In 2019, aviation emissions covered by the EU ETS increased by 1.0 % compared to the previous year. On the contrary, the supply of EU aviation allowances (EUAA) decreased by 1.1%. 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 2018b).

Table 1.5 shows that 5.5 million allowances were auctioned in 2019, 1.8 % less than in the previous year. Similar to EUA prices, EUAA prices showed a large uptick from an average of EUR 18 per unit in 2018 to EUR 25 per unit in 2019. Overall, the aviation sector had to purchase more EUAs in order to comply with its emissions cap. In 2019, this net demand for EUAs has rose to 32.1 million.

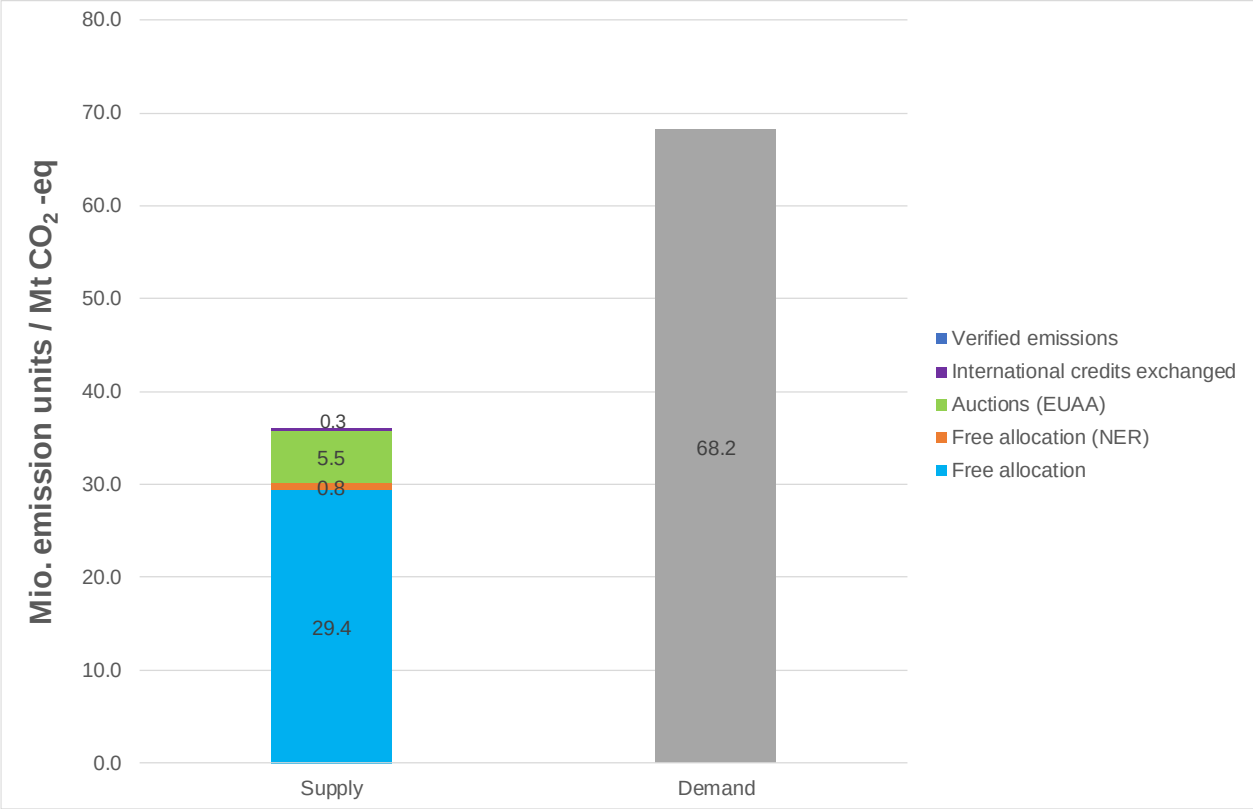
In 2019, aircraft operators were allocated 30.2 million free allowances (including free allowances from the New Entrants Reserve). An additional 5.5 million EUAAs were auctioned and a further 0.3 million of international credits are estimated to have been exchanged for EUAAs (Figure 1.7). In total, these allowances covered 53 % of the total aviation emissions (68.2 Mt CO2-eq.). The shortfall in allowances necessary for compliance had to be purchased on the market. Aircraft operators can use allowances from the stationary sector (EUAs) to comply with their legal obligation (but, conversely, stationary installations cannot use EUAAs for compliance).

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

	2018	2019	Change
Total demand (Mt CO_2-eq.)	67.5	68.2	**1.0%**
Aviation emissions	67.5	68.2	**1.0%**
Total supply (millions of EUAAs)	36.4	36.0	**-1.1%**
Aviation free allocation	29.5	29.4	**-0.5%**
Aviation free allocation (NER)	1.1	0.8	**-24.4%**
Average auctioned amounts	5.6	5.5	**-1.8%**
Estimated international credits exchanged	0.2	0.3	**51.4%**
Annual supply-demand balance (millions of EUAAs)	-31.1	-32.1	**3.4%**
EUAA price (EUR)	18.37	24.89	**35.5%**

Notes: NER, New Entrants Reserve.
Sources: EEA (2020b), EEX (2020), ICE (2020)

Figure 1.7 Supply and demand balance for aviation in 2019



Note: International credits exchanged (aviation) estimated based on total CER/ERUs exchanged (cf. Figure 2.13).
Sources: EC (2020f); EEA (2020b)

2 Long-term trends

- Between the start of the EU ETS in 2005 and 2019, emissions from stationary installations decreased by 35 %. 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.
- 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.
- 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.
- The New Entrants Reserve (NER) provides allowances for new installations or a significant increase in capacity for existing installations. After seven years of the current eight-year trading period, 35 % of the allowances in the NER have either been used up or reserved for future use. The majority of NER certificates used were allocated to support capacity expansions.
- 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 in 2018, which continued in 2019. Price drivers likely are the start of 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 2019, then deriving implications for the balance of supply and demand of allowances. 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.

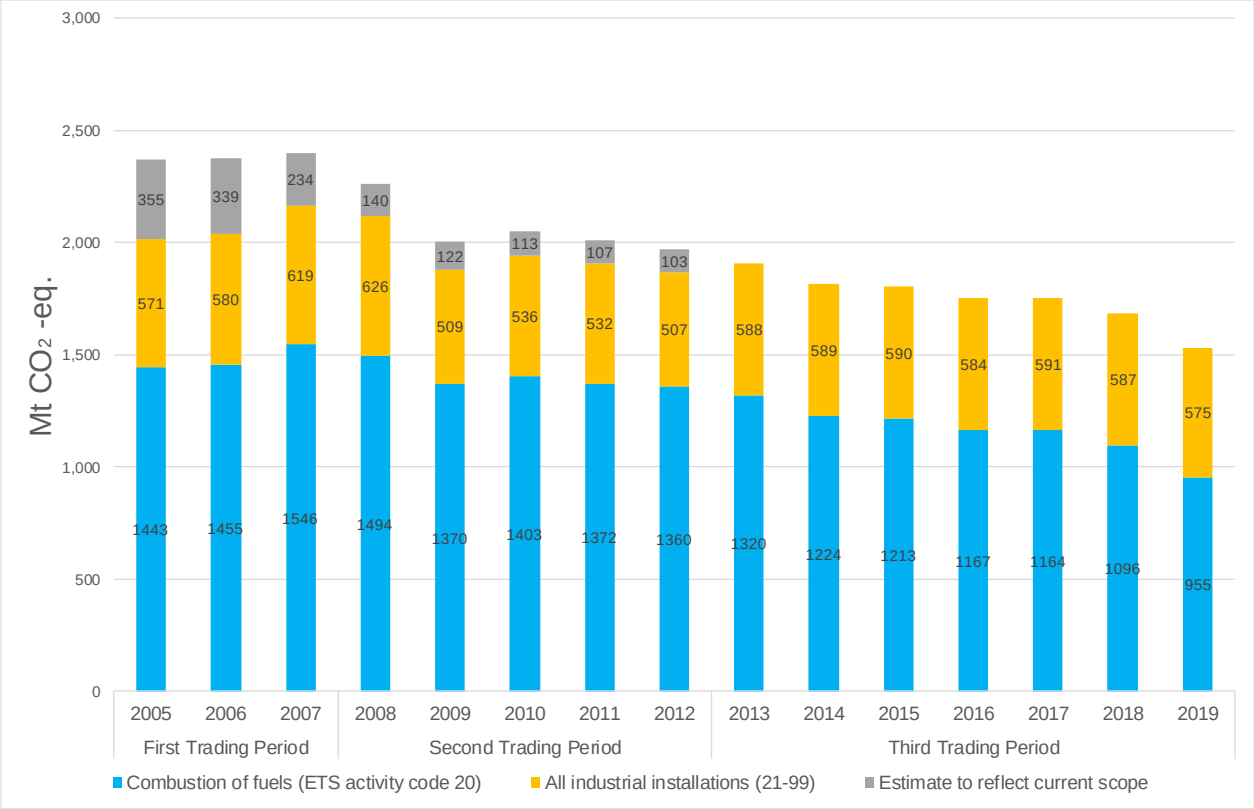
2.1 Stationary installations

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). After seven years of the third trading period, emissions are now 35 % 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 from EU ETS sectors foreseen in the 2030 Climate and Energy Framework. The EU is, however, in the process of revising the 2030 emission reduction target upwards substantially, which would also entail a tighter cap for the EU ETS.

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 (2020a), EEA (2020b)

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 62 % of total EU ETS emissions in 2019, 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.

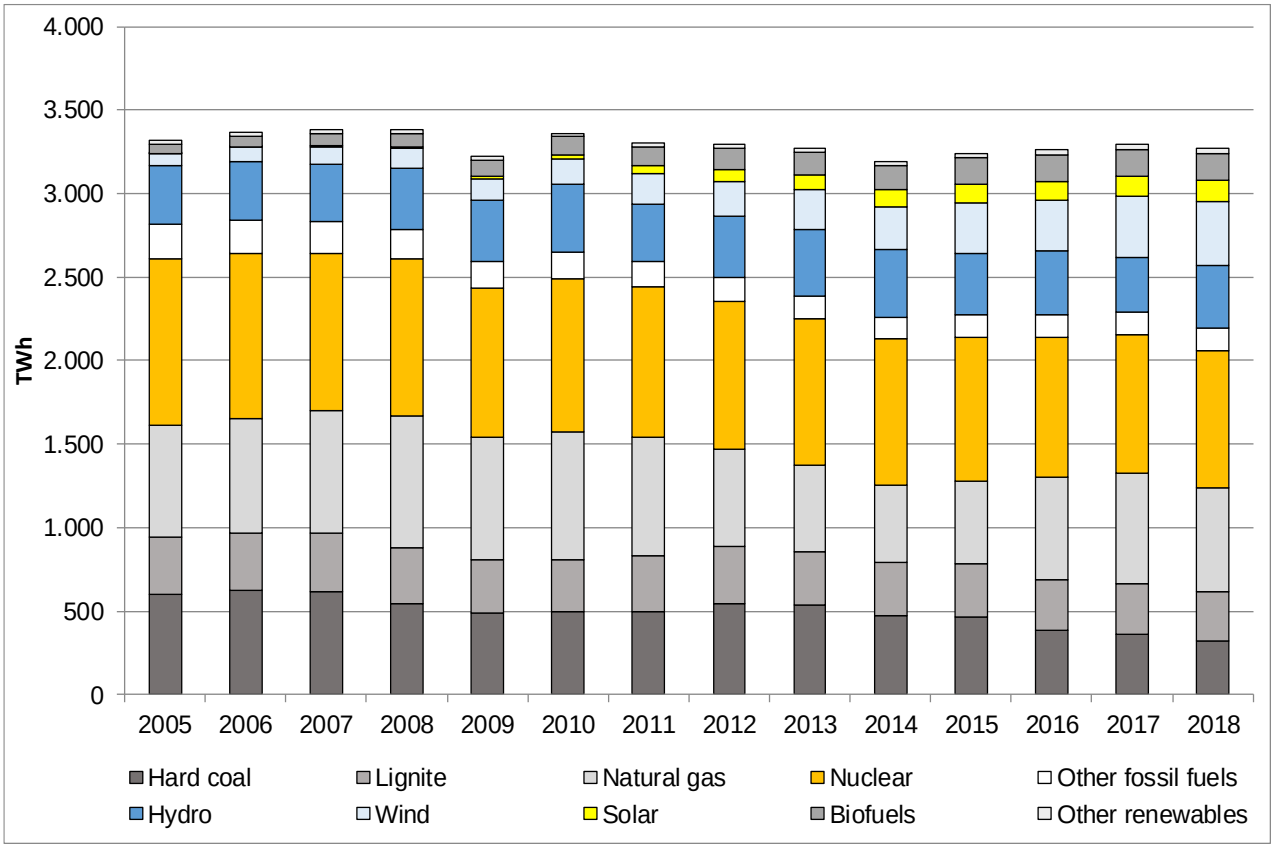
Emissions from activities other than combustion are generally more strongly linked to economic activity/production levels than are combustion-related emissions (EEA 2015). However, improvements in efficiency levels also play an important role, and the EU ETS encourages this through the free allocation of allowances using benchmarks. A product benchmark is set on the basis of the average GHG emissions of the top 10% most efficient 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 2018([18]), electricity generation for the EU-28 from hard coal, lignite and nuclear power declined by 47 %, 15 % and 17 %, respectively (Figure 2.2). These reductions in electricity generation 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.

([18]) 2018 are the most recent data available at Eurostat for the production of electricity as of July 2020

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



Source: Eurostat (2020c)

Industry sector

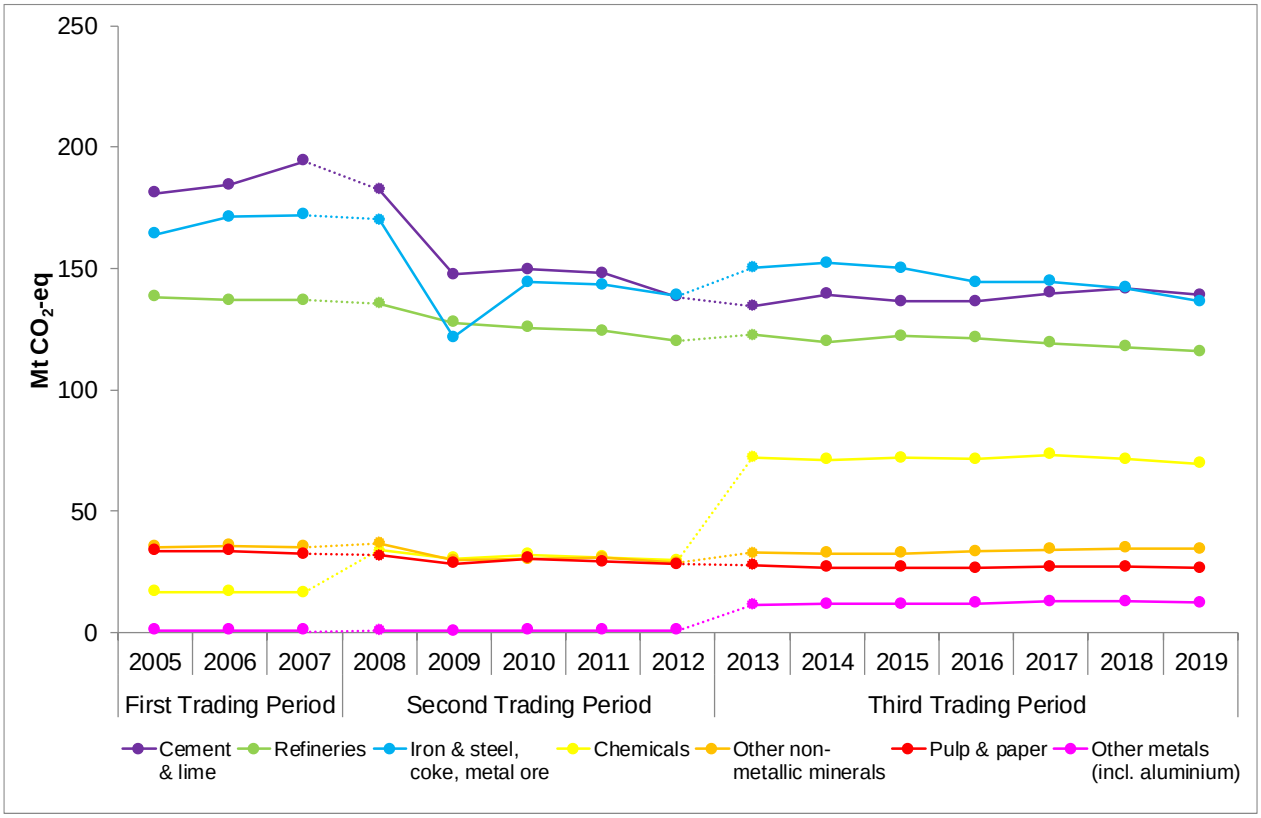
Three sectors dominate industrial emissions in the EU ETS: iron and steel, cement and lime and refineries (Figure 2.3). While ETS emissions from refineries have exhibited a slow and steady decline since the beginning of the EU ETS, the trend of emissions is more variable for steel and cement. During 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 ([19]) 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 increased by 3 %, while they declined by 9 % in the steel sector. 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" ([20]).

Overall, emissions from the three largest industry sectors (i.e. cement and lime, iron and steel and refineries) have been reduced by 19 % since 2005 when looking at the EU-25. 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.

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

([20]) 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.

Figure 2.3 EU ETS emissions by main industrial activity in the EU-25 (2005-2019)

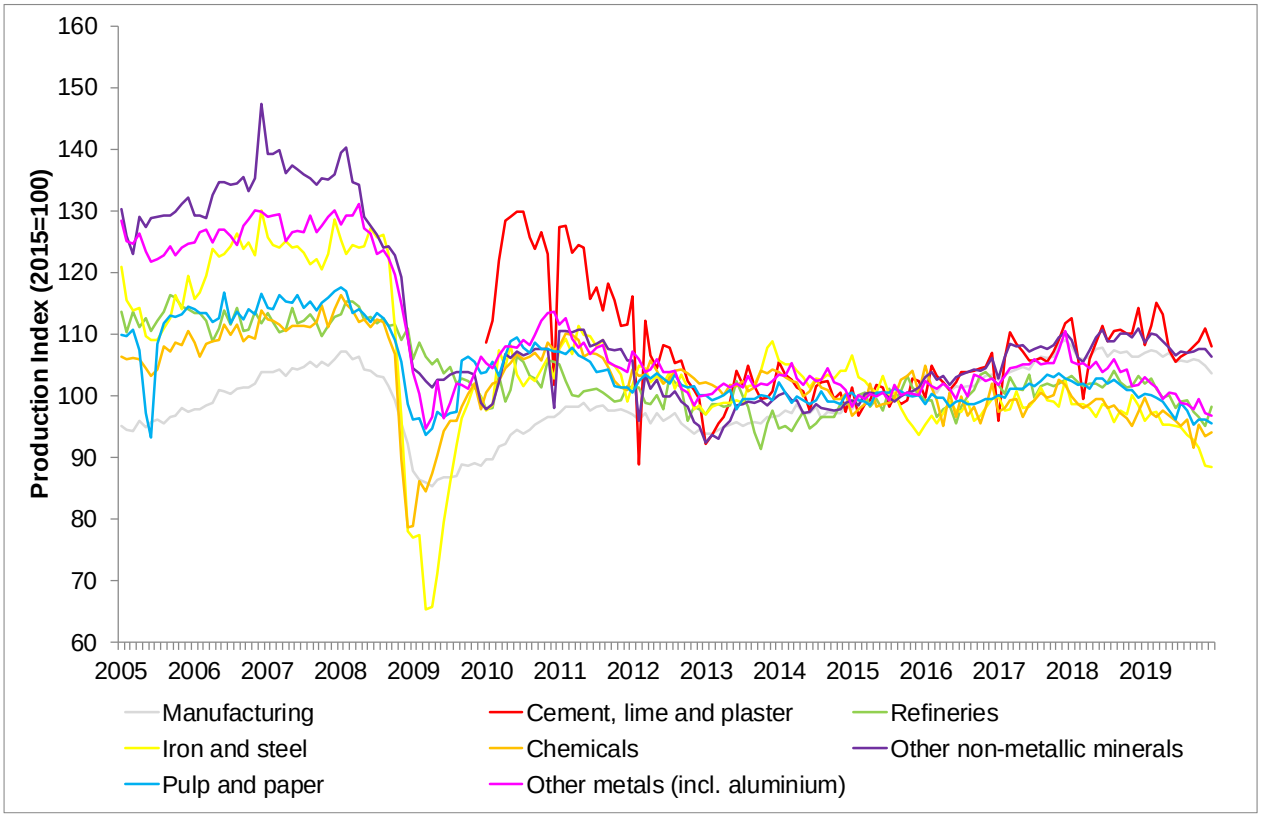


Note: ETS activity codes have been aggregated for certain sectors (refer to Table A1.1).
Source: EEA (2020a), EEA (2020b)

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 ([21]). The development in emissions observed during the third trading period (Figure 2.3) follows trends in production volumes. 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.

([21]) 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-28 (2005-2019)

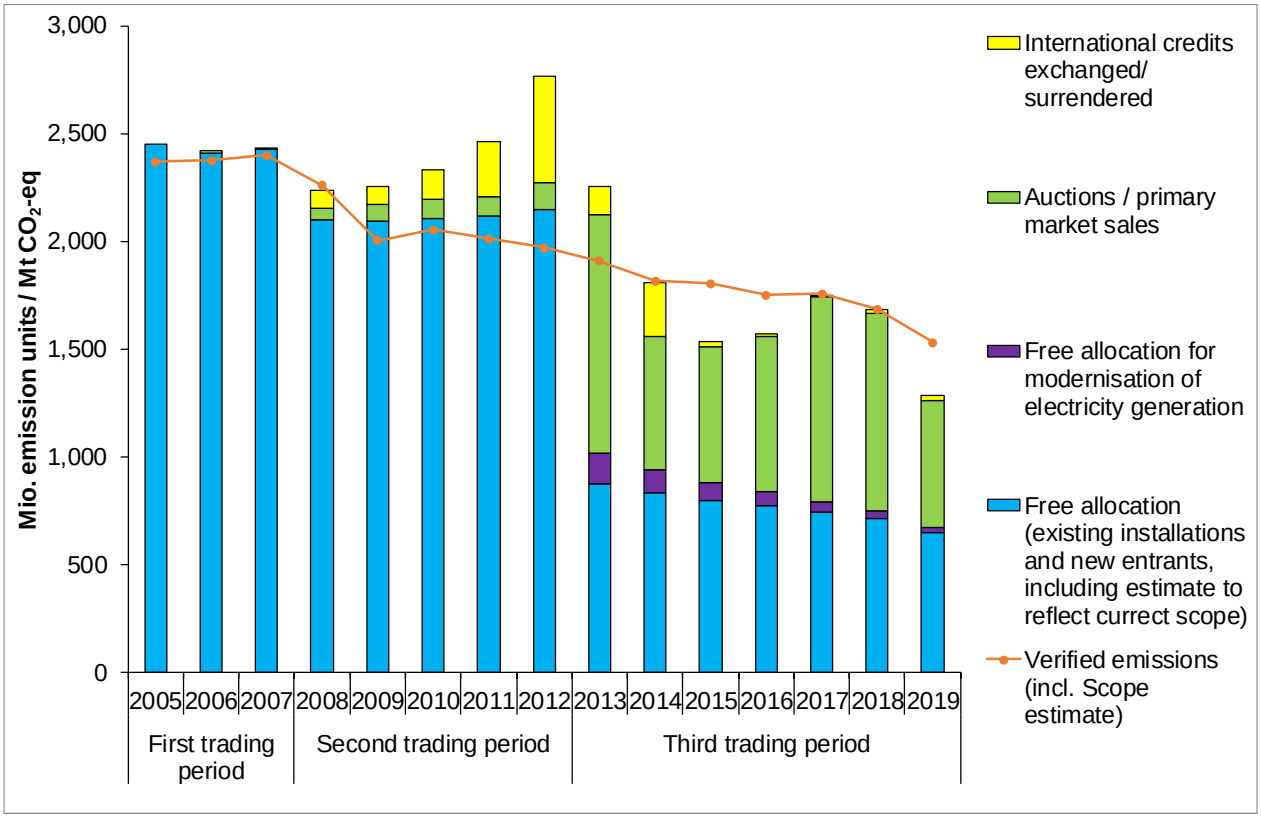


Note: Volume index of production (seasonally and calendar adjusted data for the EU-28).
Source: Eurostat (2020b)

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 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 (2005-2019)



Source: EEA (2020a), EEA (2020b)

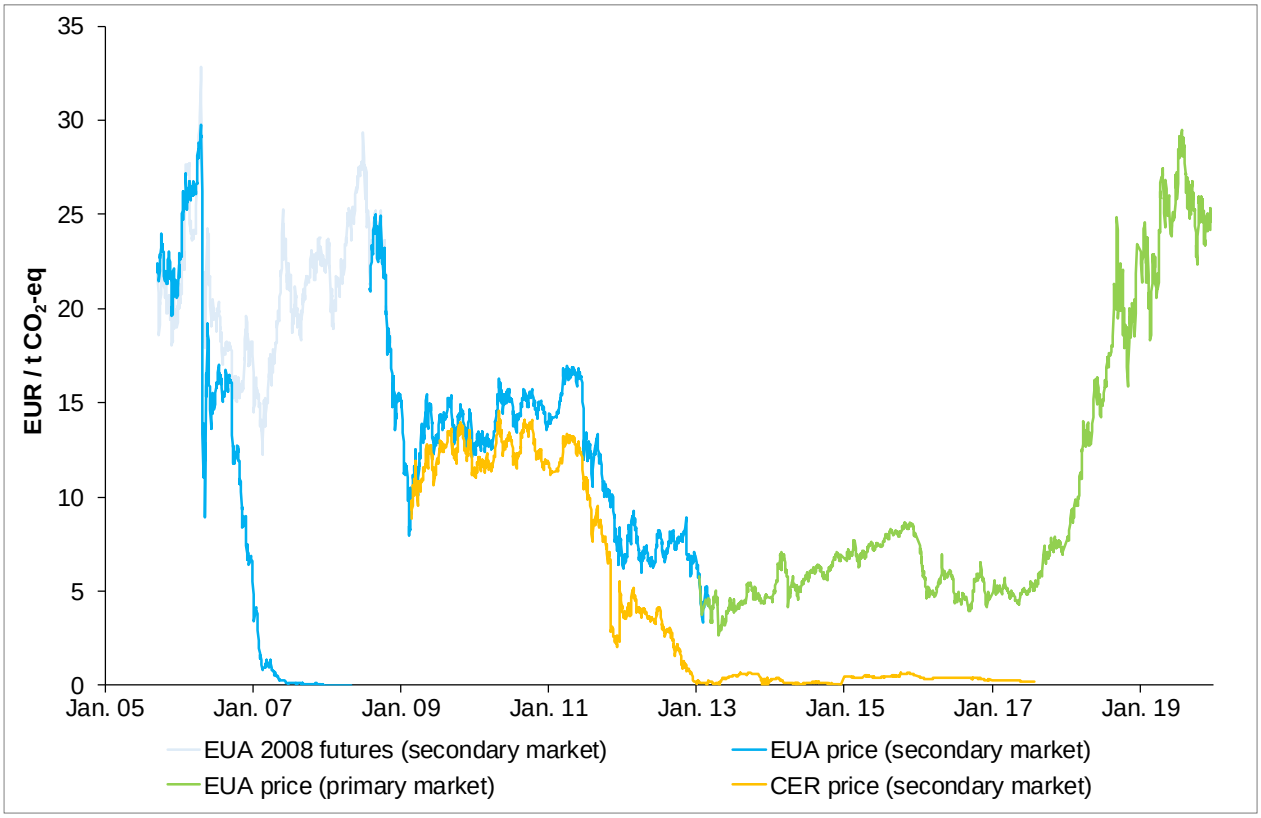
After a more stringent cap was set for the second trading period, verified emissions exceeded the supply of allowances in 2008, pushing allowance prices to around EUR 20 per EUA. Allowance prices climbed to EUR 29.38 per EUA before starting a renewed decline after it became apparent that the financial 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.

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. In 2019, the EUA price rose to an interim high of EUR 29.15. The average EUA price in 2019 was equal to 24.72 EUR, 60% higher than in 2018 (see table Table 1.4 in chapter

Balance of allowances0). The price increase, in part, reflects the expectation that the supply of allowances will be reduced through (1) an increase in the linear reduction factor (LRF) from 1.74 % to 2.2 % from 2021 onwards, (2) the Market Stability Reserve (MSR) removing surplus allowances in circulation from 2019 onwards and (3) the fact that from 2023 onwards holdings in the reserve above the auction volume of the previous year will lose their validity (EC 2018c). Additionally, individual Member States may cancel allowances unilaterally in step with coal phase-out programmes. What is more, the EU is currently in process of revising its 2030 reduction target upwards, which would entail a tightening of the ETS cap. In fact, after supply and demand of allowances were balanced in 2017 and 2018, 2019 saw a large demand overhang (mainly driven by the start of the MSR and the suspension of UK auctions, cf. 0).

Figure 2.6 Price trends for allowances and certified emission reductions (2005-2019)



Sources: Point Carbon (2012); EEX (2020), ICE (2020)

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.([22]) 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).

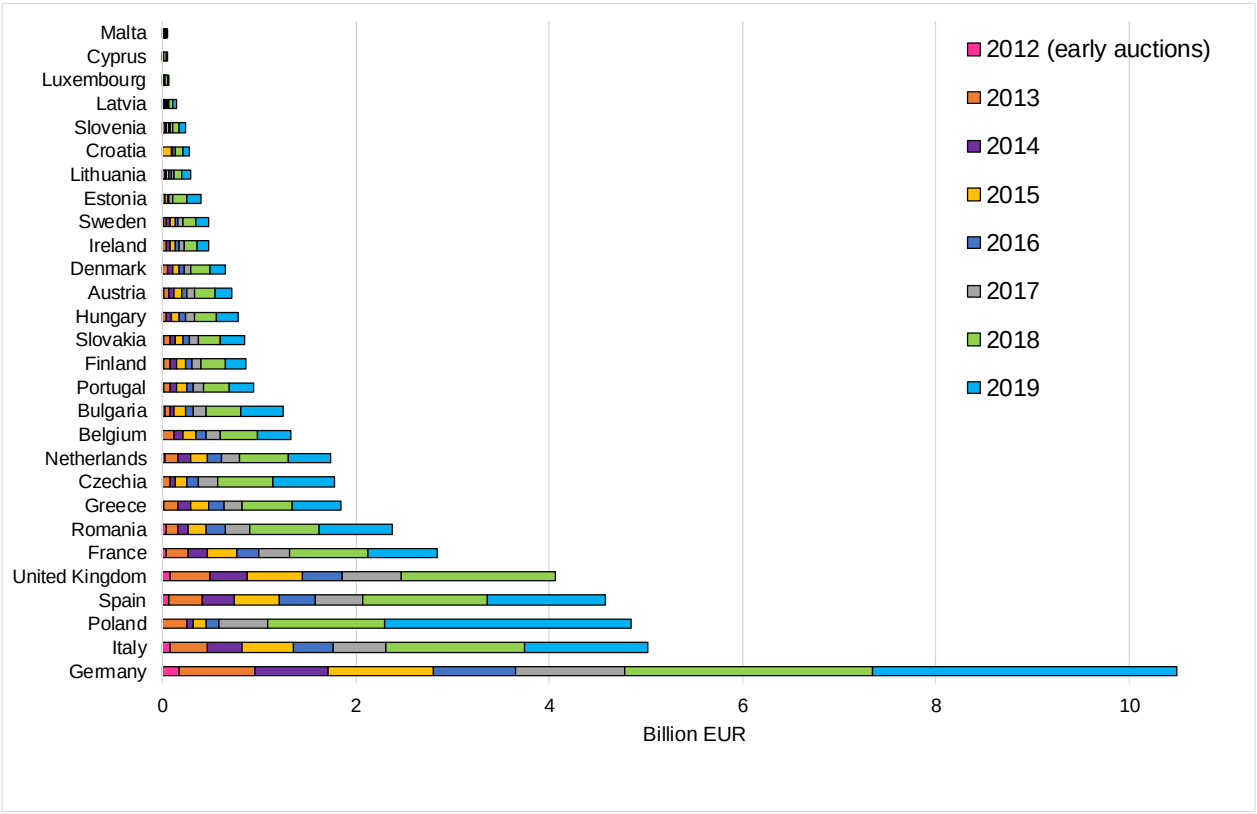
([22]) Eligible for the Kyoto bonus are Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia

In 2019, two singular effects have to be considered when analysing auctioned amounts and auctioning revenues. First, auctioning of UK allowances was temporarily suspended in 2019 due the unclear impact Brexit would have on the role of the UK within the EU ETS (EC 2018a). Second, Iceland, Liechtenstein and Norway had so far not auctioned any allowances during the third trading period but started to do so in June 2019. The designated amounts for 2013-2018 of these three countries are to be spread evenly between 2019 and 2020 (EC 2020d)

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 2013-2018 about 80 % of auctioning revenue has been spent on climate and energy related purposes by Member States (EC 2020d).

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 10.5 billion during the third trading period, followed by Italy with EUR 5.0 billion and Poland with EUR 4.9 billion. These three Member States collectively account for around 41 % 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 two years, mainly due to the rally in allowance prices observed in 2018 and 2019 (Figure 2.7).

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 (2020), ICE (2020)

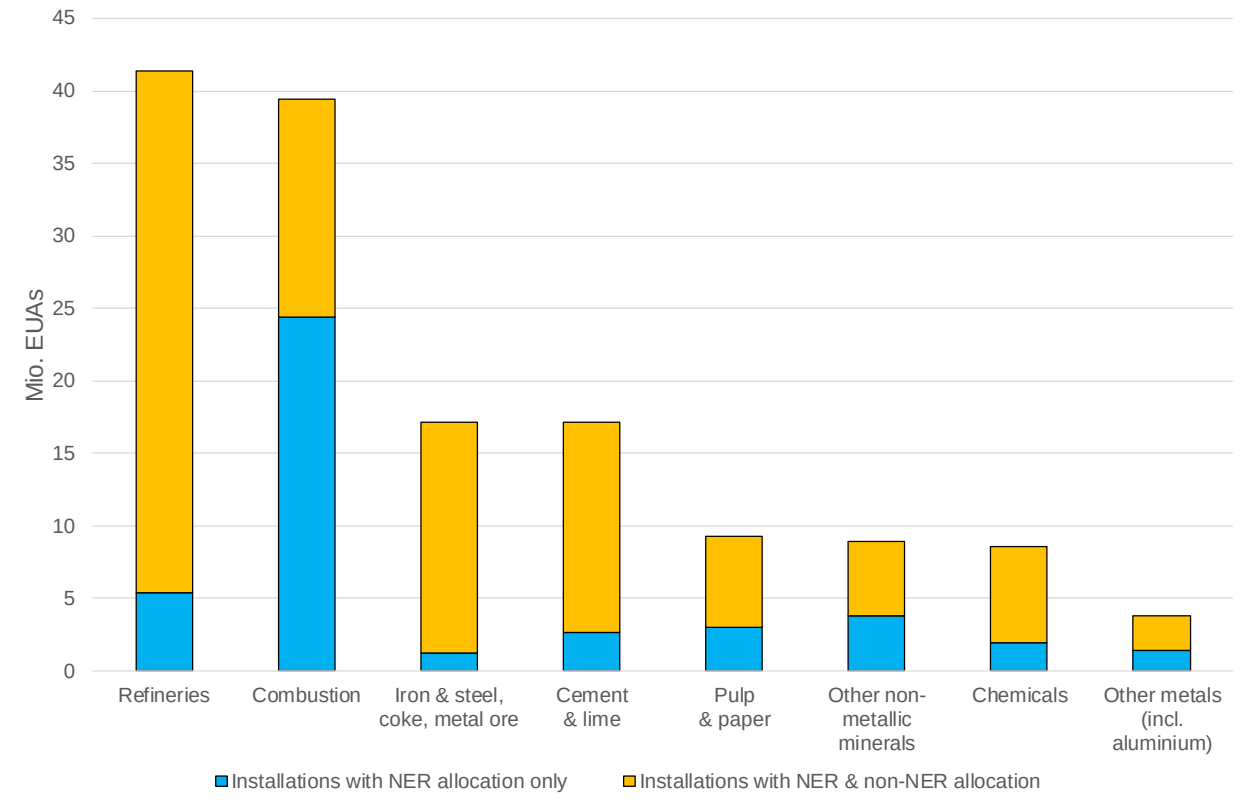
2.1.4 *Free allocation to new entrants and for capacity extensions*

To ensure a level playing field between new entrants and incumbents, a New Entrants Reserve (NER) of 480 million ([23]) allowances was set aside at the start of the third trading period for new installations ([24]) and existing installations with a 'significant' increase in capacity ([25]).

In the combustion sector, 62 % of allocation from the NER during the third trading period (i.e. 24.4 out of 39.5 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. 35.9 out of 41.4 million). The majority of these allowances were allocated to refineries in Spain, Greece and Estonia (Figure 2.9). Similarly, the majority of the 17.1 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 17.2 million in 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 (2013-2019) by sector and by eligibility type



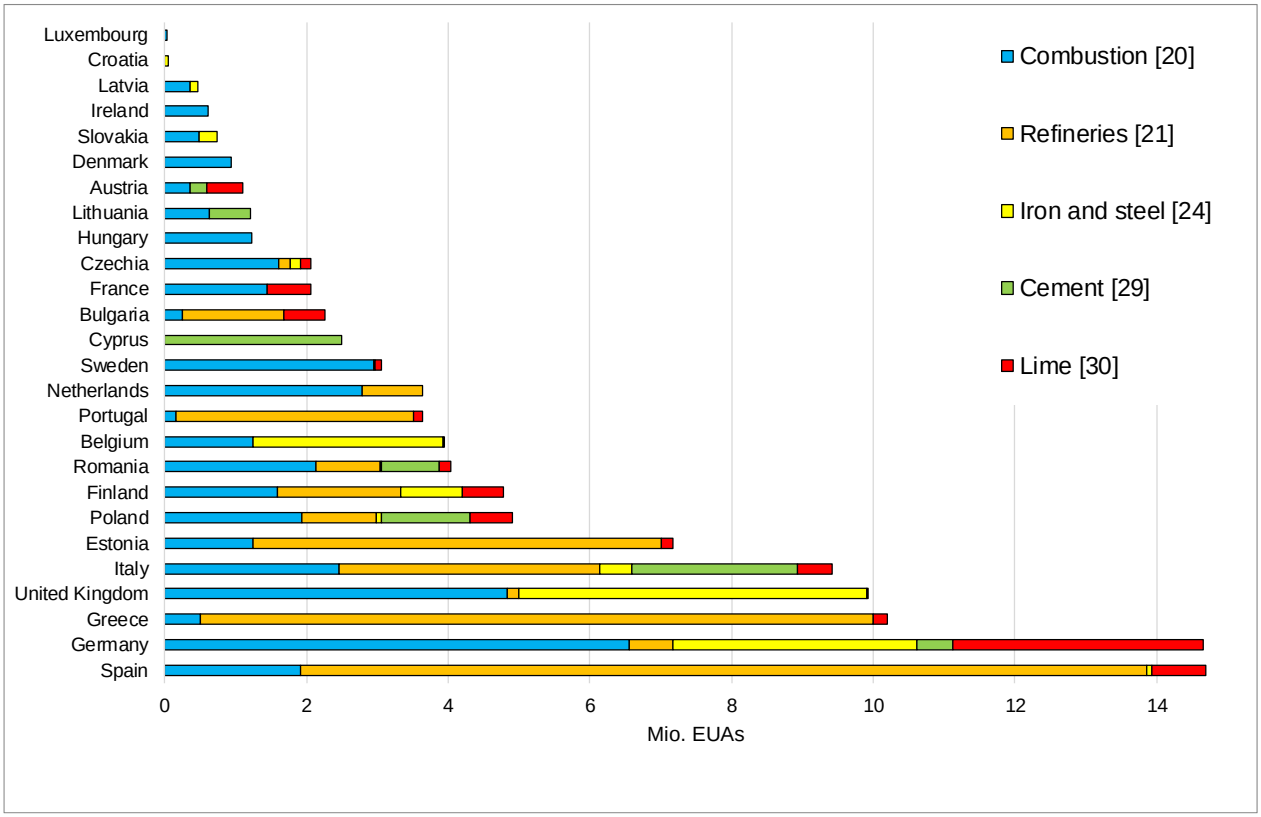
Source: EU (2020); own calculations.

([23]) 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.

([24]) 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.

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

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 (2020); own calculations.

The annual status update for the New Entrants Reserve of the European Commission 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 remain available in 2020. The allowances that remain unallocated until the end of 2020 are to be put into the MSR.

2.1.5 Transitional free allocation to modernise electricity generation

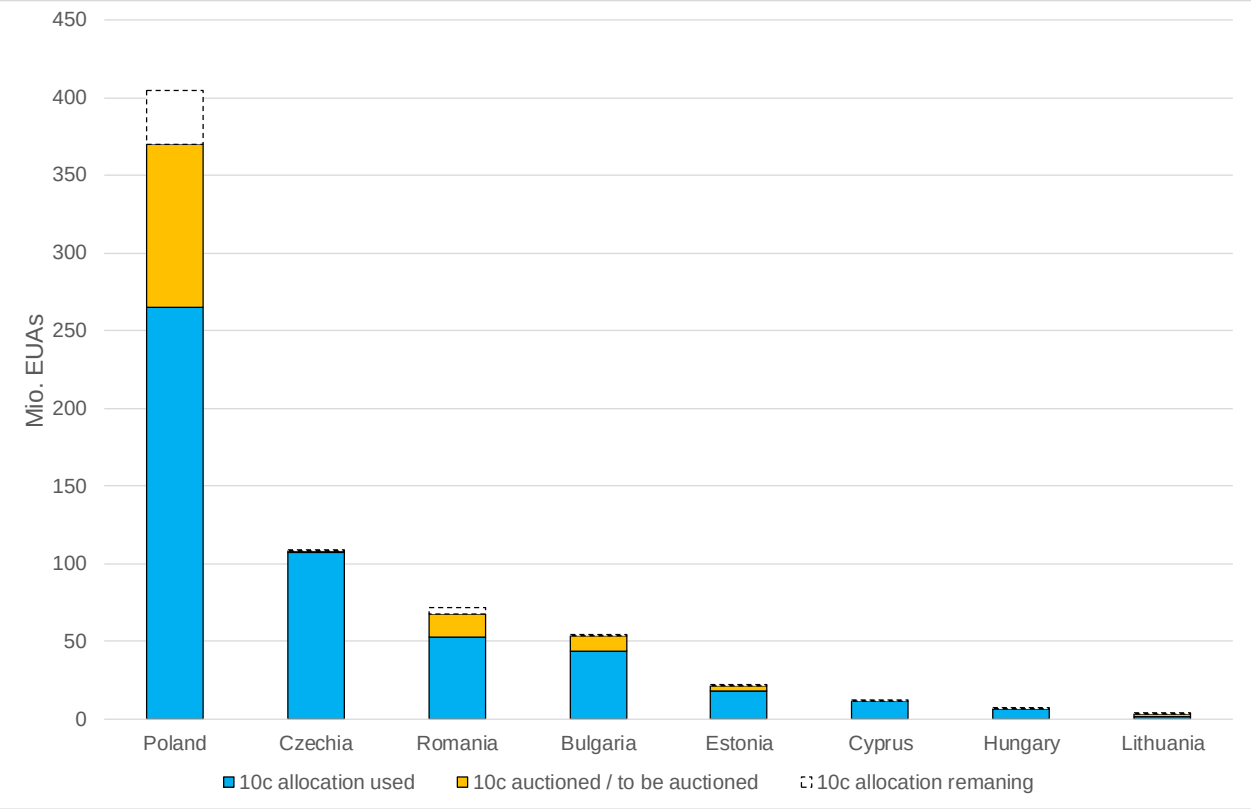
Article 10(c) of the ETS Directive provides a derogation from the general rule that allowances should no longer be allocated for free to electricity generation during the third trading period. This derogation applies to ten eligible Member States, out of which eight chose to make use of this rule.([26]) 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.

Between 2013 and 2019, 74 % of the overall available budget had been allocated for free (Figure 2.10), while 20 % had been auctioned or earmarked for auctioning (EC 2020d). The remaining 6 % (mostly from Poland) will either be auctioned or can be allocated to relevant projects during the fourth trading period (EC 2020d) .

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

Transitional free allocation under Article 10(c) will continue to be available to eligible Member States during the fourth trading period. Rules on the transparency of national plans and the way in which individual projects are selected (i.e. though competitive bidding) have been updated (EU 2018a). Out of the ten Member States eligible only Bulgaria, Hungary and Romania have declared that they will make use of the derogation during the fourth trading period (EC 2020e).

Figure 2.10 Use of Article 10(c) allowances between 2013 and 2019 by Member State



Note: Includes Article 10(c) amounts to be auctioned up until 2019.

Sources: EC, (2012a); (2012b); (2012c); (2012d); (2012e); (2012f); (2012g); (2012h); (2018e); (2019); (2020b) EU (2020)

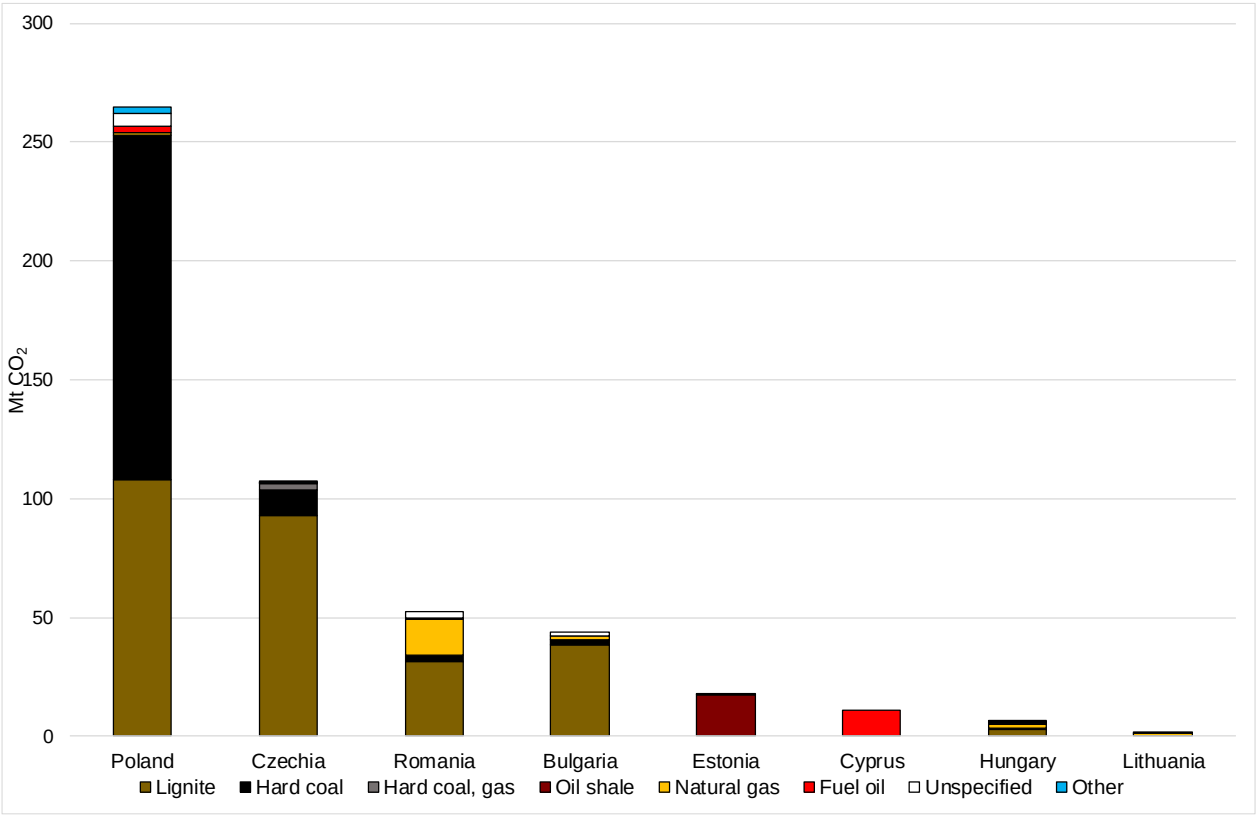
The extent of the environmental benefits of the Article 10(c) allocation depends on the nature of the investments each Member State makes to modernise its electricity generation. Investments undertaken from June 2009 onwards in the national plans of the eight eligible Member States were reported as counting towards their Article 10(c) allocation. The total value of reported investment between 2009 and 2018 was around EUR 12.4 billion, with approximately 82 % of the investments dedicated to upgrading and retrofitting infrastructure (EC 2020d). The remaining investments supported clean technologies or supply diversification. Investments cited by the European Commission (EC 2017b) include:

- creating a new cogeneration-condensing steam turbine in Estonia (upgrade of infrastructure);
- rehabilitating district heating networks in Bulgaria (retrofitting of infrastructure);
- replacing coal with renewable energy sources through waste utilisation in Czech Republic (clean technologies); and
- constructing an interconnector pipeline for natural gas in Hungary (diversification of supply).

Despite these examples of low-carbon investments, the majority of investments completed so far under Article 10(c) are not expected to have contributed to diversifying the energy mix. To date, most Article

10(c) allowances have been spent on modernising existing fossil fuel capacity. In fact, between 2013 and 2019, 54 % of the Article 10(c) allowances were allocated to lignite plants while 32 % were allocated to hard coal plants (Figure 2.11). Modernising the existing fossil fuel capacity accounted for 82 % of the total investments outlined in the Polish national plans under Article 10(c), with allowances used to extend the lifetime of two of the oldest units (i.e. units 1 and 2) at the Bełchatów lignite plant (Carbon Market Watch 2016).

Figure 2.11 **Free allocation for the modernisation of electricity generation, by fuel type of the receiving power plant and Member State, 2013-2019**



Notes: Allowances issued only to eligible EU ETS installations, i.e. existing ETS installations operational before a specified date. Thus, they are by definition existing electricity generators with a capacity of more than 20 MW thermal. Attribution of free allowances to fuel type based on own calculations.

Sources: EC, (2012d); (2012e); (2012f); (2012g); (2012h); (2012a); (2012b); (2012c); (EC 2019) (EC 2018e); EC (2020b) Platts, (2014); EU (2020)

In the revised ETS Directive 2018/310, Article 10(c) now requires that "where an investment leads to additional electricity generation capacity, the operator concerned shall also demonstrate that a corresponding amount of electricity-generation capacity with higher emission intensity has been decommissioned by it or another associated operator by the start of operation of the additional capacity". This clause aims at ensuring that overall electricity generation capacity becomes less carbon intensive over time.

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 ([27]). International credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) projects can be used with certain qualitative restrictions ([28]). Since April 2015, emission reductions that occurred in the first commitment period of the Kyoto Protocol (2008-2012) can no longer be exchanged (EC 2018d). 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 2.12). 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 ([29]).

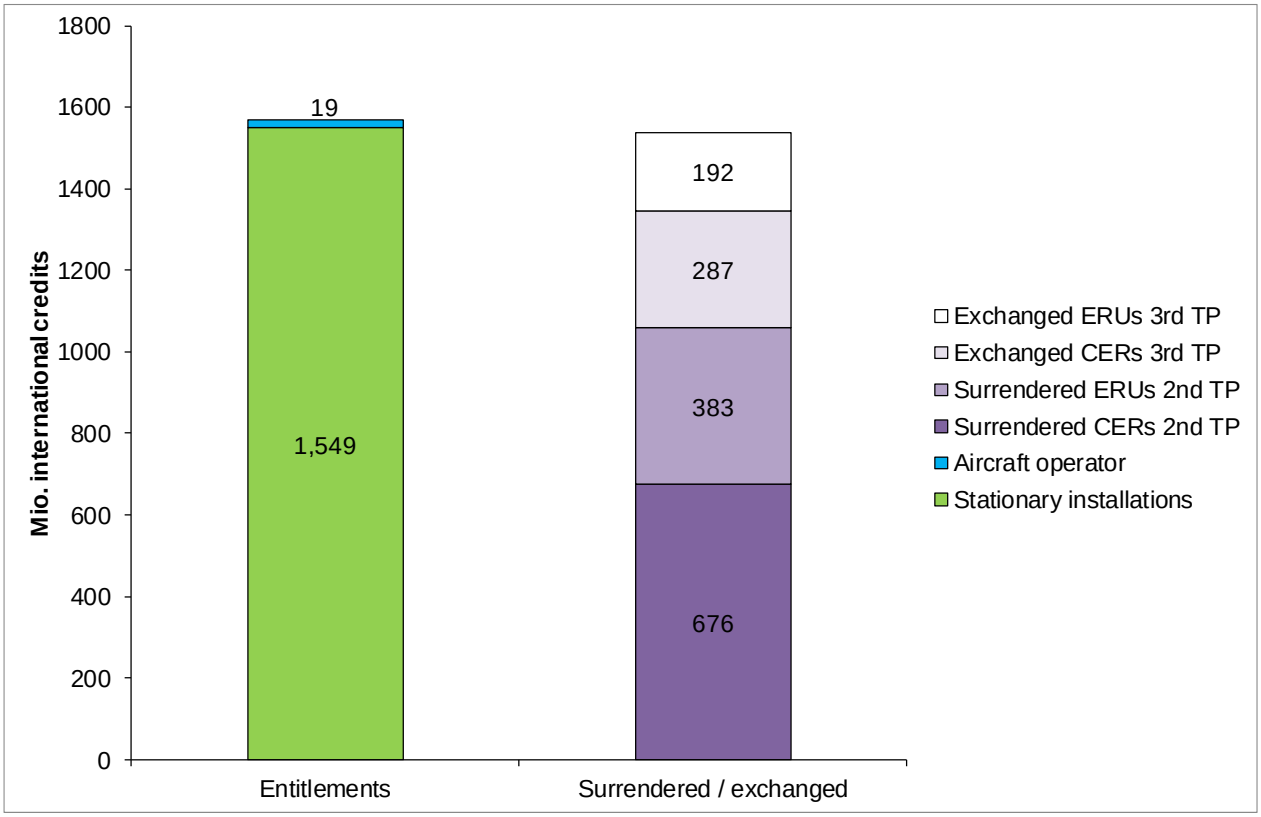
Entitlements of aviation operators are shown in Figure 2.12 since the data on international credits exchanged is only available at an aggregate level and not installation or operator specific. Therefore, the amounts used are total for the whole EU ETS.

([27]) 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.

([28]) 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).

([29]) 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 2.12 International credit entitlements and use (2008-2020)



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

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 2.1). Ryanair has consistently been responsible for the largest amount of verified emissions of any single aircraft operator and is the ninth largest emitter overall under the EU ETS since 2018. Wizz Air experienced the fastest growth in emissions during the third trading period, more than doubling emissions between 2013 and 2019. Some flag carriers such as Lufthansa or British Airways, have experienced much slower growth in 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 2.1 Total aviation emissions and the top 10 emitters in aviation between 2012 and 2019

	Verified emissions (Mt CO_2-eq)							
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Total Aviation	**84.0**	**53.5**	**54.8**	**57.1**	**61.5**	**64.4**	**67.5**	**68.2**
Ryanair	7.5	6.6	6.6	7.4	8.4	9.2	9.9	10.5
Easyjet	4.6	4.3	4.4	4.7	5.1	5.5	6.1	6.3
Deutsche Lufthansa AG	4.9	4.4	4.0	3.8	3.8	4.0	4.4	4.4
British Airways	2.5	2.5	2.5	2.6	2.7	2.7	2.7	2.6
Air France	3.8	2.6	2.4	2.4	2.3	2.4	2.4	2.5
Scandinavian Airlines System SAS	3.6	2.3	2.4	2.4	2.4	2.5	2.5	2.4
Wizz Air Hungary Ltd.	1.1	1.1	1.3	1.5	1.8	2.1	2.3	2.4
Eurowings GmbH	0.0	0.0	0.0	0.1	0.5	1.3	2.4	2.3
Vueling Airlines, S.A.	1.3	1.3	1.6	1.8	2.0	2.0	2.2	2.2
Koninklijke Luchtvaart Maatschappij (KLM)	1.9	1.5	1.6	1.6	1.6	1.8	1.8	1.9

Note: For the period 2013-2019, 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.

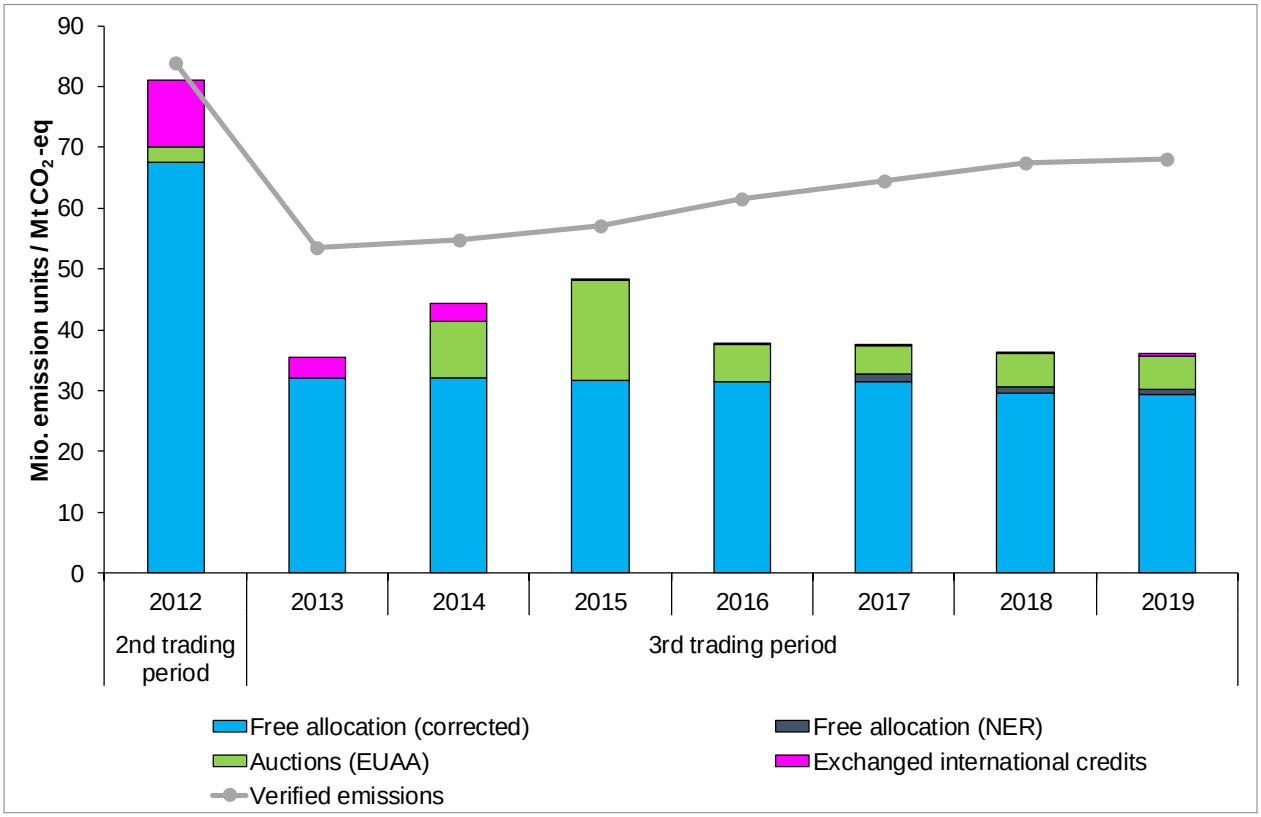
Source: EEA (2020b), EU (2020)

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

Figure 2.13 illustrates the development in the supply of and demand for aviation allowances (EUAAs) between 2012 and 2019. The difference in emissions between 2012 and 2013 is due to a reduction in scope regarding aviation activities covered by the EU ETS ([30]). In the third trading period, verified emissions have surpassed the supply of allowances reserved for the aviation sector every year. The aviation sector is thus a net buyer of allowances from the stationary sector. The net demand of the aviation sector in 2019 was 32,1 Mt. This means that the sector had to cover 47% of its liability with allowances from the stationary sector

([30]) 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 2.13 Demand and supply balance for aviation allowances (2012-2019)



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.

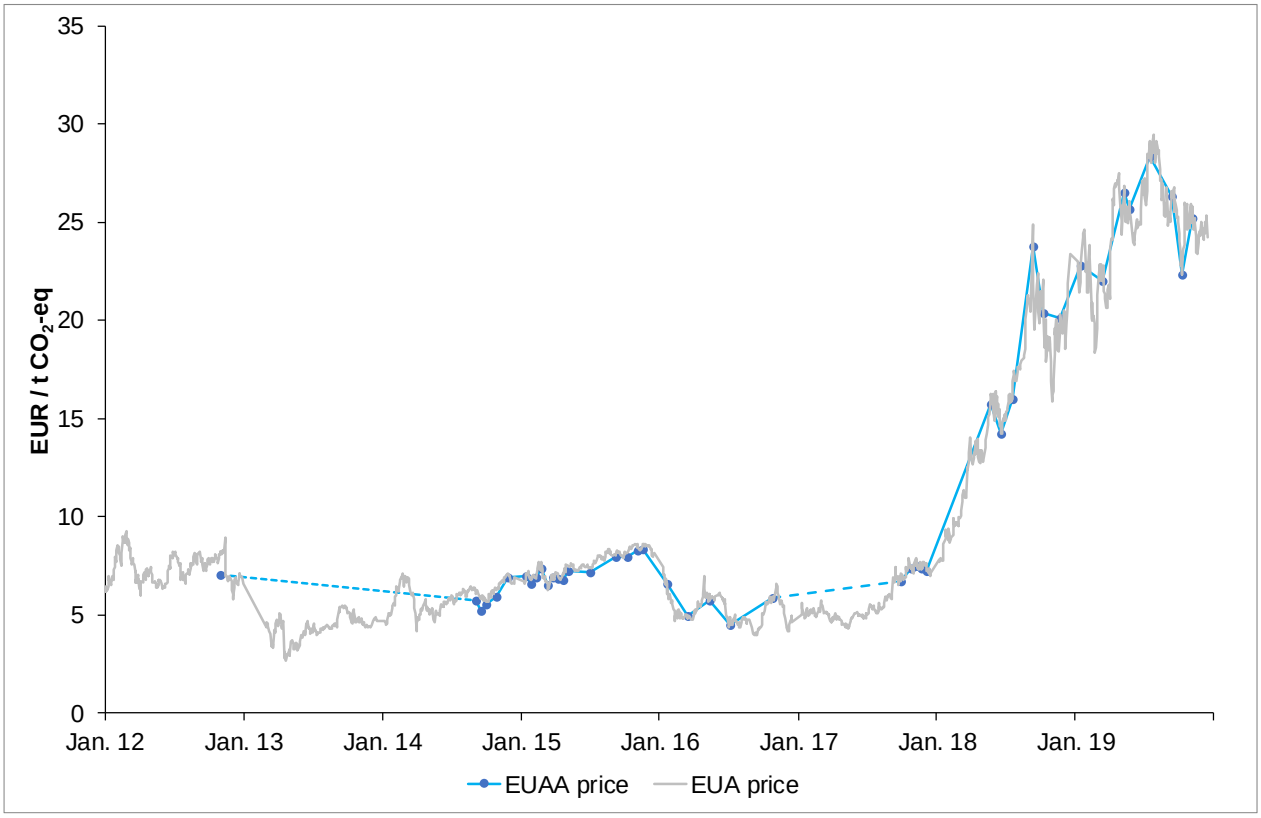
International credit use by aircraft operators in the third trading period is not reported separately (cf. Section 2.1.6). The European Commission reports that operators of stationary installations and aircrafts, together, have exchanged international credits equal to 98% of their total entitlements in 2019 (cf. Figure 2.12). Numbers shown in this figure assume that aircraft operators as a group have also used up 98 % of their entitlements by 2019. Amounts from 2015 onwards are so small that they are hardly visible in the figure (< 0.3 million per annum).

Sources: EC (2020f), EEA (2020b)

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 2.14). A further delay in auctioning in 2017, due to prolongation of the 'stop-the clock' decision ([31]), 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, resulting in average prices of around EUR 25 per unit in 2019.

([31]) 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 2.14 Price trends for EUAAs compared with EUAs (2012-2019)



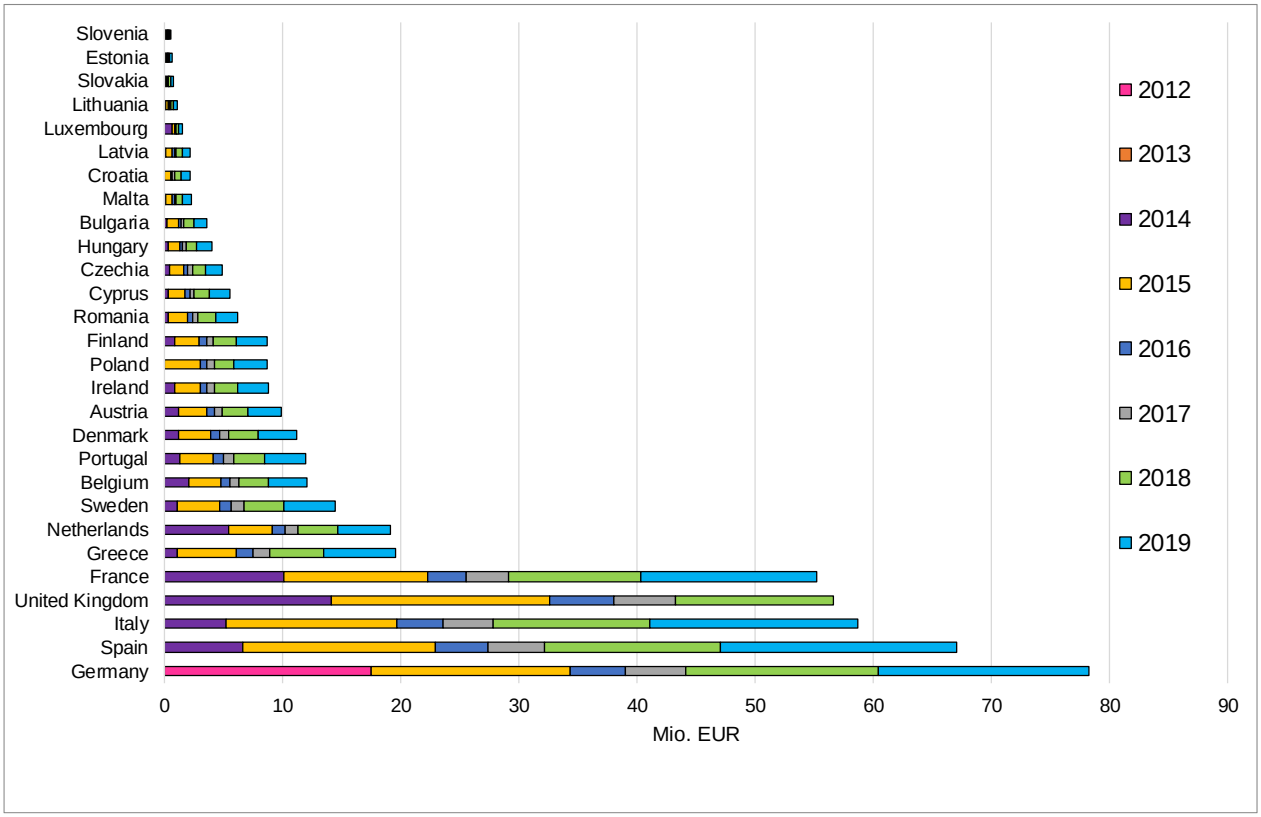
Note: The EUA price represents historical spot price data from the secondary market in 2012. In the third trading period, the EUA price refers to primary market auctioning data from the EEX and ICE trading platforms. This trend is compared with the shorter time series of EUAA prices from primary market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

Sources: Point Carbon (2012); EEX (2020), ICE (2020)

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 78 million), followed by Spain (EUR 67 million) and Italy (EUR 59 million) (Figure 2.15). As already mentioned in Section 2.1.3 no auctioning took place in the UK in 2019. As the price of allowances has risen greatly over the last two years, revenues have also risen significantly, reaching a peak of annual revenue of EUR 117 million in 2019, even with 0 auctioning revenues in the UK.

Figure 2.15 Aviation allowances auction revenues by Member State, 2012-2019



Sources: EEX (2020), ICE (2020)

3 Projected trends

- The Covid-19 pandemic has considerable impacts on ETS emissions in the short- and possibly the medium-term. Emission projections submitted in 2019 and 2020 do not consider these effects, nor do they include the reduction of ETS emissions observed between 2018 and 2019. The lack of information on the UK exit from the EU and the subsequent exit from the EU ETS adds additional uncertainty. That is why, the section on projected trends in this year's report focusses on projected emissions and does not include a projection of the expected supply and resulting balance of allowances.
- Twelve countries submitted updated GHG emission projections in 2020 under EU legislation. According to the latest aggregation of GHG emission projections submitted in 2019 and 2020, EU ETS stationary emissions (without the UK) are projected to continue decreasing with existing measures (WEM) in place, leading to a reduction of 32.8% 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 40.3 % compared to 2005.
- The emissions projected under the WEM scenario are expected to reduce more slowly than historically. Therefore, the overall projected reduction is not yet in line with EU objectives for ETS emission reductions in 2030 (-43% compared to 2005).
- With the strong decrease of ETS emissions between 2018 and 2019, historic emissions already stand at 35% below 2005 levels in 2019 – and are therefore lower than ETS emissions predicted under the WEM scenario for the year 2030. The Covid-19 pandemic is expected to further reduce emissions at least in 2020 and possibly following years. These latest effects need to be considered in next year's projections report.

3.1 Stationary installations

This chapter considers projections as submitted under EU legislation ([32]) by EU27 Member States, Norway and Iceland. Liechtenstein has not provided projections. These projections were updated by twelve Member States in 2020, while for other Member States projections were submitted in 2019 (or 2017 for Romania). Owing to their submission dates, these projections neither consider actual ETS emissions observed in 2019 or the impacts of the Covid-19 pandemic, nor do they show reactions to the possible increase in ambition of the EU target for 2030.

The Covid-19 pandemic is expected to considerably reduce ETS emissions in 2020 and possibly following years. With demand decreases, low gas prices and a large share of power produced by renewable energies in many countries, emissions from coal-fired power plants in particular are expected to drop further in 2020. Additional and more long-term effects of the pandemic on the economy are unknown at the time of writing.

([32]) Article 14(1)(b) of Regulation (EU) No 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC EU (2013).

3.1.1 Emission trends by sector

According to the projections submitted by EU Member States in 2019 and 2020, EU ETS emissions are expected to further decrease with the current policies and measures in place ([33]). The decrease in EU ETS emissions is projected to take place predominantly in the energy sector ([34]), whereas EU ETS emissions from manufacturing and construction installations, shown as 'other sectors' in Figure 3.1 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 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 32.8% 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 40.3% compared with 2005, also falling short of the 2030 target. Again, the main effects of additional policies and measures are projected to take place in the sector of energy industries.

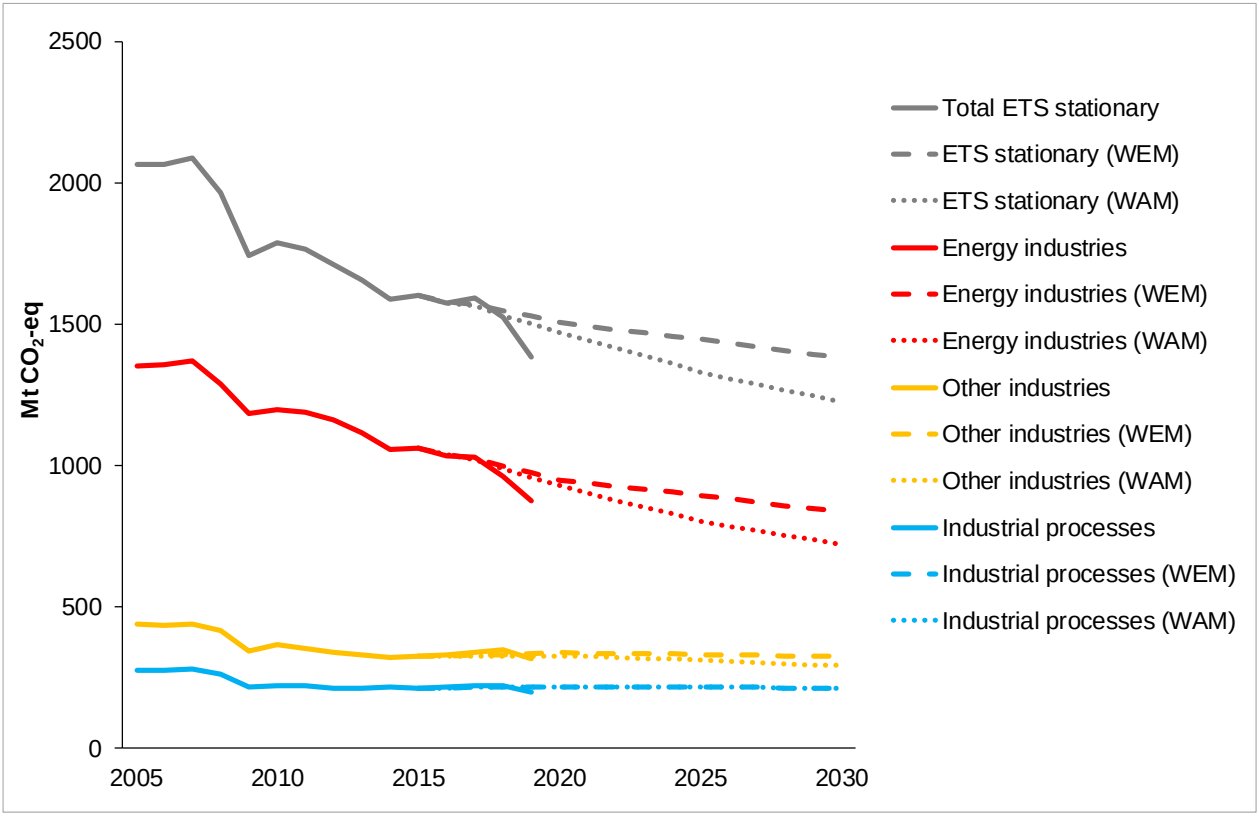
In contrast to recent years, projected ETS emissions for the EU27 poorly reflect the actual development of emissions, especially in 2019. The level of emissions actually observed for 2019 was made public after projections were submitted and could therefore not be taken into account by Member States. In fact, the drop in ETS emissions between 2018 and 2019 implies a reduction of 35% below 2005 levels and is therefore lower than the level of ETS emissions predicted by the scenarios with existing measures (WEM) for 2030 (at a 32.8% reduction from 2005 levels). As noted above, the Covid-19 pandemic is expected to further reduce ETS emissions which may lead to a situation where ETS emissions in 2020 are below those projected for 2030 under the scenario with additional measures (WAM).

It is important to note, however, that the impacts of the Covid-19 pandemic in large part do not amount to structural changes and that, therefore, reductions in ETS emissions related to the pandemic may only be transitory.

([33]) 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) No 749/2014 European Commission (2014). The projections were compiled, assessed and quality checked by the EEA and its European Topic Centre for Climate Change Mitigation and Energy (ETC/CME). In 2020, 12 Member States (Austria, Belgium, Cyprus, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Poland, Slovenia) submitted updated projections under the MMR. Liechtenstein did not submit a GHG projection.

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

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



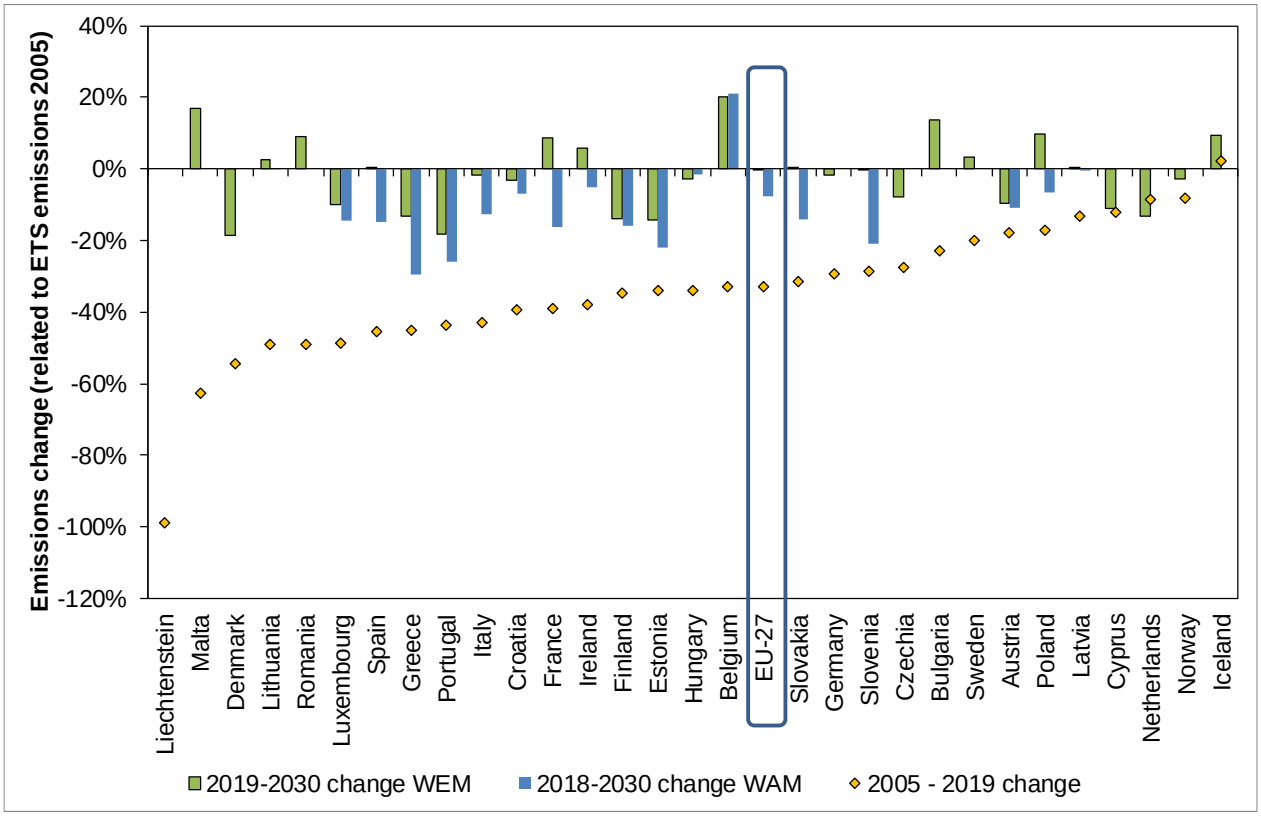
Notes: Solid lines represent historical greenhouse gas emissions up to 2019, taking into account proxy inventory numbers. Dashed lines represent projections under the 'with existing measures' WEM scenario. Dotted lines represent projections under the 'with additional measures' (WAM) scenario. This figure 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 (2020b); projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of June 2020.

3.1.2 Emission trends by country

Figure 3.2 shows that EU ETS emissions are expected to decline in 17 countries between 2019 and 2030 under the WEM scenario, with reductions ranging from 0.01 % for Slovenia to 18.5 % for Denmark. There are 13 countries who anticipate increases in their EU ETS emissions between 2019 and 2030 based upon their WEM projections. This number increased compared to last year's assessment because of lower 2019 ETS emissions than what was anticipated in projections. Among those countries with increasing ETS emissions under the WEM scenario, France, Ireland, Poland, Slovakia and Spain are expecting to reduce their EU ETS emissions considerably with additional policies and measures (WAM). Belgium projects a considerable 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



Sources: EEA (2020b); projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of June 2020.

In several countries, updated projections submitted in 2019 and 2020 indicate rising emissions in the ETS sectors until 2030 with existing measures. This is often related to developments in the energy sector. In Belgium, ETS emissions are projected to rise even more if additional policies and measures are considered. 2030 emissions in the WAM scenarios show a substantial increase compared to last year's projections. This projected increase is largely due to a more electrified society by additional policies and measures, adding to higher emissions because of the partial compensation of phased-out nuclear plants with fossil fuels. Alongside Belgium, WEM projections indicate that emissions are expected to increase by more than 10 % compared to 2019 in Bulgaria and Malta. For both countries, no WAM projection has been submitted.

Denmark, France, Finland, Greece, Hungary, Ireland, Italy, the Netherlands, Portugal, Slovakia and Spain have announced to phase out coal-fired power plants before 2030 (Beyond Coal 2020). Of those Member States that in the past have burned coal, Austria, Belgium and Sweden are now coal-free. Germany has also announced a coal phase-out, which will, however, only be completed well after 2030.

In France, this additional measure has already been taken into account in their WAM scenario where the closure of coal-fired power plants by 2022 will save emissions of 8 $MtCO_2$-eq annually. As a consequence, its WAM scenario projects a decrease in emissions of 16 % by 2030.([35])

([35]) Also contributing to projected emission reductions in France are the continuation of the Energy Savings Certificate scheme promoting energy efficiency and of the Heat Fund providing support to the replacement of fossil fuels by renewable sources in heat production.

3.2 Aviation

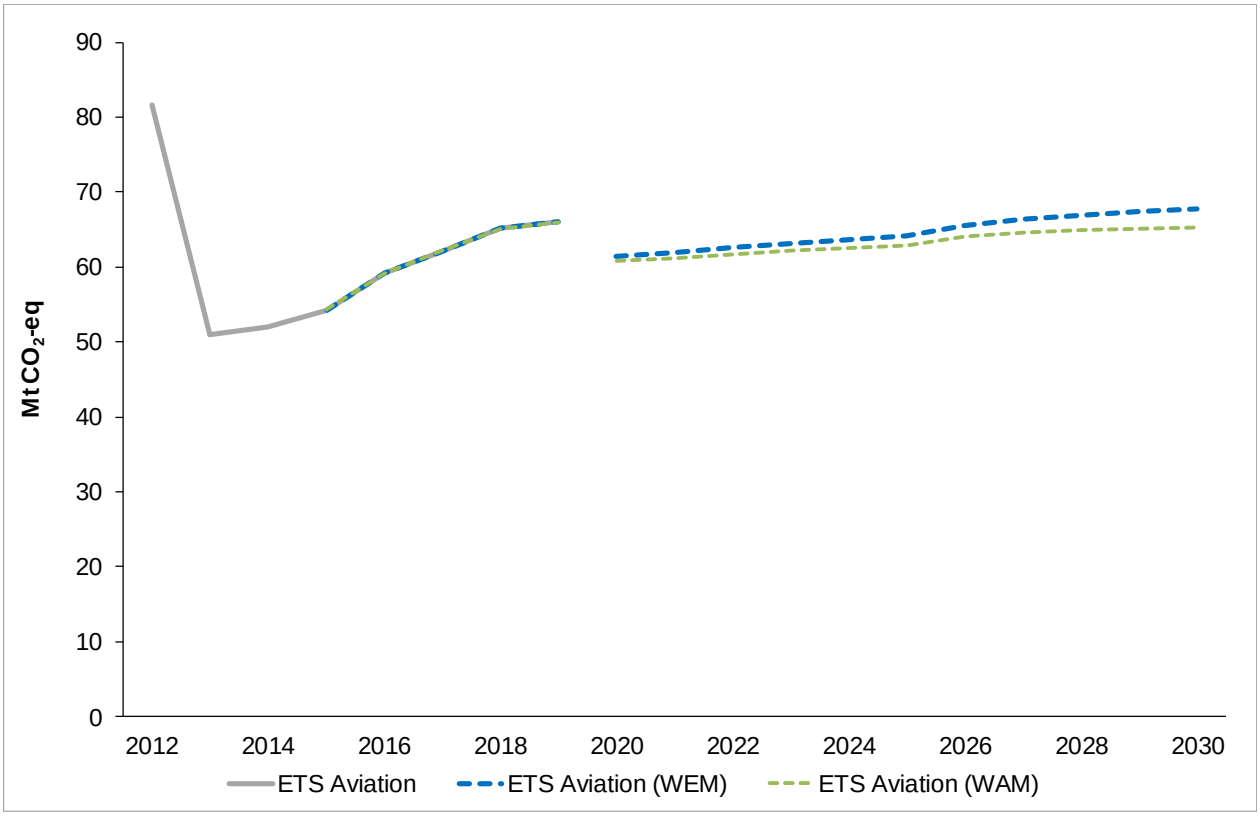
3.2.1 Emission trends

Emissions from aviation activities covered by the EU ETS, as projected by Member States under the WEM scenario, are expected to rise continuously until 2030 (Figure 3.4).([36]) These projections are based upon the continuation of the current reduced scope of aviation activities covered by the EU ETS. The gap between historic and projected ETS aviation emissions results from a considerable underestimation of aviation emissions in GHG projections in historic years. The total difference adds up to 14 Mio. t CO_2-eq in 2018. With about 36% of aviation emissions covered under the EU ETS, the gap of 4 Mio. t CO_2-eq observed for 2019/2020 can be explained.

Additional policies and measures have been reported from several Member States, partly for both national and international aviation. If these were implemented, this would result in a reduction of about 3 Mt CO_2-eq emissions at the EU level. Most countries did not include details of their policies and measures in the aviation sector in their projection reports. France is planning to implement a tax on plane tickets from 2020 onwards for all flights departing from France (except those to Corsica and France's overseas territories as well as transit flights). This tax will add €1.50/€3 to the cost of a plane ticket in economy class within/outside of the EU and €9/€18 for business class. Tax revenues shall be used to fund investments in green transport infrastructure (Climate Home News 2019). Other countries such as Germany and the United Kingdom already have ticket taxes in places.

([36]) In contrast to the approach in the section on stationary installations, this section on ETS aviation emissions does not take into account the exit of the UK from the EU ETS. As ETS aviation data is not directly related to GHG inventory numbers due to the system of the allocation of aircraft operators to single countries, a mere subtraction of UK numbers cannot provide correct numbers in this case.

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. Projections do not include effects of the Covid-19 pandemic.

Sources: EEA (2020b); projections of EU Member States compiled by the European Topic Centre for Climate Change Mitigation and Energy (ETC/CME) as of June 2020.

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Annex 1

This annex provides additional supporting information for the EU ETS report, focusing on changes that occurred during 2019.

A1.1 Activities covered by the EU ETS

A1.1.1 Stationary installations

In 2019, the EU ETS covered 12 074 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 2019 were 1 530 Mt CO_2-eq (EEA 2020b).

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 2019

Activities	Sectors	No. of entities	Verified Emissions
20 Combustion of fuels	Combustion	7605	955
21 Refining of mineral oil	Refineries	140	123
22 Production of coke	Iron and steel, coke, metal ore	20	10
23 Metal ore roasting or sintering		9	3
24 Production of pig iron or steel		245	119
25 Production or processing of ferrous metals		254	13
26 Production of primary aluminum	Other metals (incl. aluminum)	33	9
27 Production of secondary aluminum		34	1
28 Production or processing of non-ferrous metals		90	8
29 Production of cement clinker	Cement and lime	261	121
30 Production of lime, or calcination of dolomite/magnesite		299	30
31 Manufacture of glass	Other non-metallic minerals	372	18
32 Manufacture of ceramics		1092	15
33 Manufacture of mineral wool		53	2
34 Production or processing of gypsum or plasterboard		40	1
35 Production of pulp	Pulp and Paper	180	5
36 Production of paper or cardboard		589	22
37 Production of carbon black	Chemicals	18	2
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	20
42 Production of bulk chemicals		363	36
43 Production of hydrogen and synthesis gas		42	9
44 Production of soda ash and sodium bicarbonate		14	4
45 Capture of greenhouse gases under Directive 2009/31/EC	Other	2	0
46 Transport of greenhouse gases under Directive 2009/31/EC		1	0
99 Other activity opted-in under Art. 24		249	1
Sum of all stationary installations	**Stationary**	**12,074**	**1,530**
10 Aviation	Aviation	524	68

Source: EEA (2020b)

A1.1.2 Aviation operators

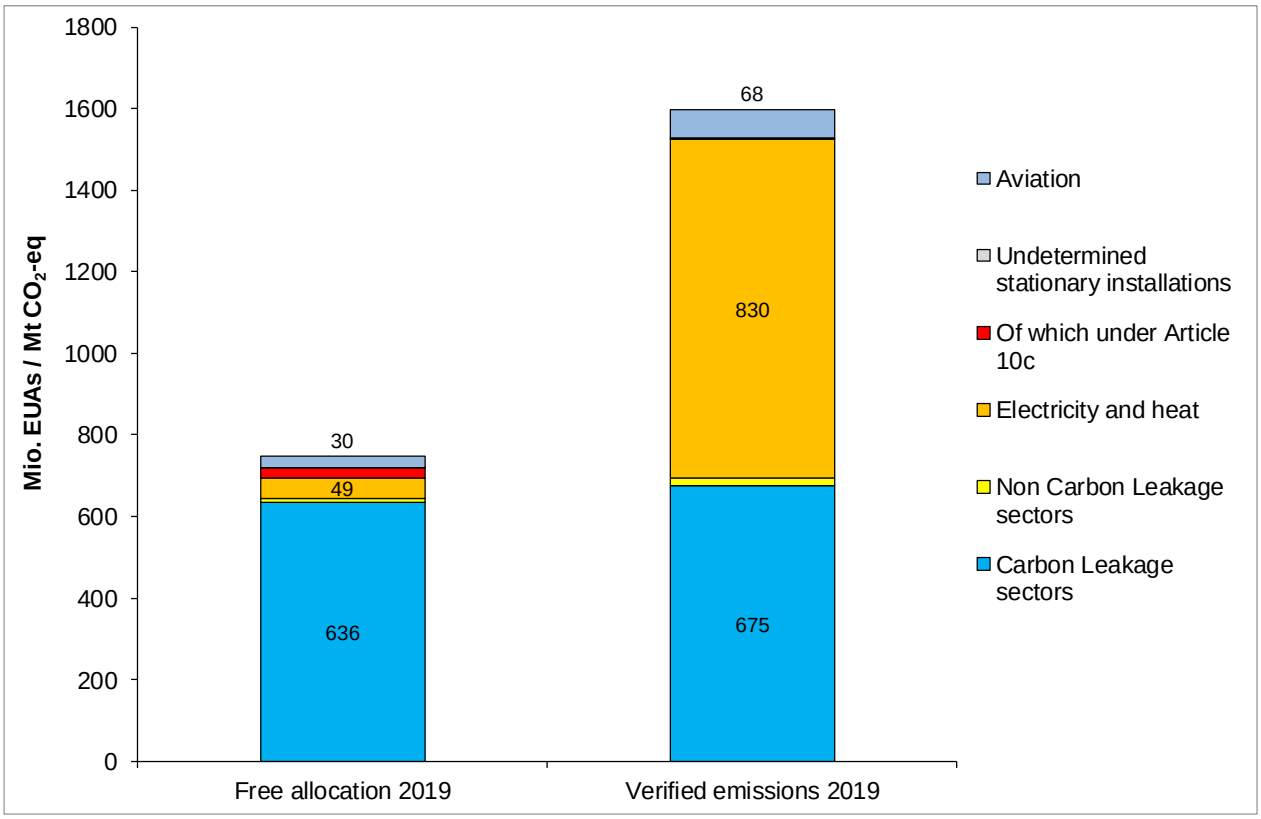
The aviation emissions covered by the EU ETS in 2019 were 68 Mt CO_2-eq (EEA 2020b). Since its inclusion in the EU ETS in 2012, the aviation sector has had to purchase allowances from the stationary sector to fully cover its emissions. Initially, aviation covered all flights from, to and within the European 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.

Sources: Sector classification based on EC, (2014a); EEA (2020b)

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; 2017c; 2018e; 2019; 2020b). In 2014, 109 million allowances were allocated to installations, 84 % of the maximum allowed amount (EC 2015; EU 2018b). In 2015, 86 million allowances were allocated to installations, 75 % of the maximum allowed amount (EC 2016; EU 2018b). In 2016, 66 million allowances were allocated to installations, 67 % of the maximum allowed amount (EC 2017c; EU 2018b). In 2017, 46 million allowances were allocated to installations, 57 % of the maximum allowed amount (EC 2018e; EU 2018b). 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 2020b).

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); (2017c); (2018e); (2019); (2020b); (EU 2020)

A1.3 Auctioned allowances during the third trading period

Table A1.3 and Table A1.4 present the volume of allowances auctioned or sold. Iceland, Liechtenstein and Norway have not auctioned in the years up to 2018 but plan to auction their budget for the third trading period starting in June 2019 and until the end of 2020.

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

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

Sources: EEX (2020), ICE (2020)

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

	2012	2013	2014	2015	2016	2017	2018	2019
Austria	0.00	0.00	0.20	0.34	0.12	0.10	0.11	0.11
Belgium	0.00	0.00	0.34	0.38	0.14	0.11	0.13	0.13
Bulgaria	0.00	0.00	0.04	0.13	0.05	0.04	0.04	0.04
Croatia	0.00	0.00	0.00	0.07	0.03	0.03	0.03	0.03
Cyprus	0.00	0.00	0.05	0.20	0.07	0.06	0.07	0.07
Czech Republic	0.00	0.00	0.08	0.17	0.06	0.05	0.06	0.06
Denmark	0.00	0.00	0.19	0.39	0.14	0.11	0.13	0.13
Estonia	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.01
Finland	0.00	0.00	0.14	0.30	0.11	0.09	0.10	0.10
France	0.00	0.00	1.67	1.73	0.63	0.50	0.59	0.59
Germany	2,50!	0.00	0.00	2.23	0.86	0.68	0.80	0.80
Greece	0.00	0.00	0.18	0.71	0.26	0.20	0.24	0.24
Hungary	0.00	0.00	0.05	0.14	0.05	0.04	0.05	0.05
Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Ireland	0.00	0.00	0.15	0.31	0.11	0.09	0.10	0.10
Italy	0.00	0.00	0.87	2.05	0.75	0.59	0.70	0.70
Latvia	0.00	0.00	0.02	0.08	0.03	0.02	0.03	0.03
Liechtenstein	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	0.00	0.00	0.01	0.04	0.01	0.01	0.01	0.01
Luxembourg	0.00	0.00	0.11	0.03	0.01	0.01	0.01	0.01
Malta	0.00	0.00	0.02	0.08	0.03	0.02	0.03	0.03
Netherlands	0.00	0.00	0.91	0.52	0.19	0.15	0.18	0.18
Norway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
Poland	0.00	0.00	0.00	0.43	0.12	0.10	0.11	0.11
Portugal	0.00	0.00	0.21	0.41	0.15	0.12	0.14	0.14
Romania	0.00	0.00	0.05	0.23	0.08	0.07	0.08	0.08
Slovakia	0.00	0.00	0.01	0.03	0.01	0.01	0.01	0.01
Slovenia	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.01
Spain	0.00	0.00	1.09	2.32	0.85	0.67	0.79	0.79
Sweden	0.00	0.00	0.17	0.52	0.19	0.15	0.18	0.18
United Kingdom	0.00	0.00	2.71	2.52	0.92	0.73	0.86	0.00

Sources: EEX (2020), ICE (2020)

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