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# Trends and projections in the EU ETS in 2018

## The EU Emissions Trading System in numbers

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European Environment Agency

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# Executive summary

## About this report

This 2018 report of the European Environment Agency (EEA) provides an analysis of past, present and future emissions trends under the European Union (EU) Emissions Trading System (ETS), based on the latest data and information available from the European Commission ([1]) and Member States ([2]). The report also analyses the balance between supply and demand of allowances in the market.

## Main findings

***In 2017, the surplus of EU ETS allowances declined for the third consecutive year.***

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 with one another, which ensures that emission reductions take place where it costs least.

Between 2009 and 2012, the number of available allowances 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, in particular, 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.

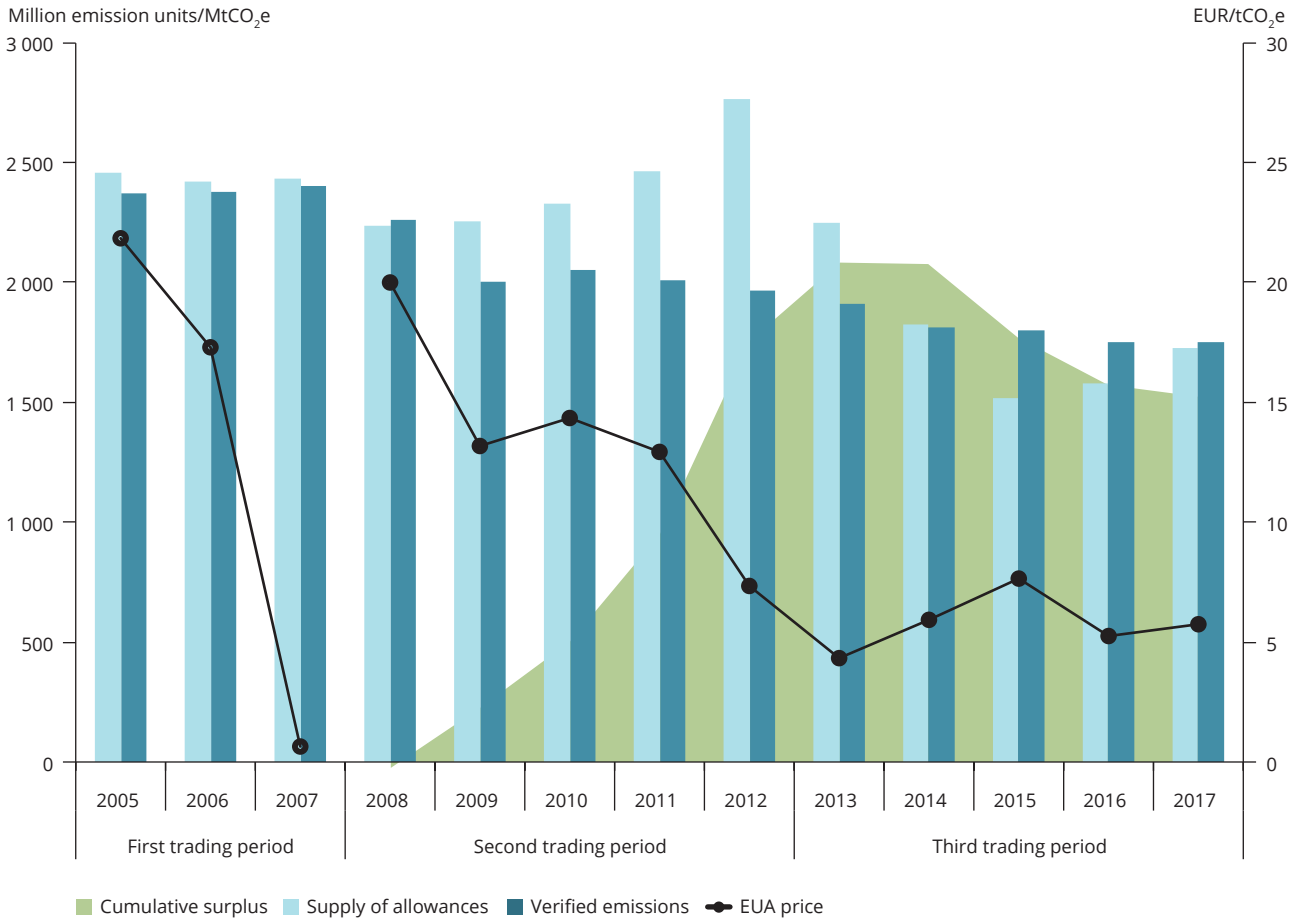
In response to this situation, a number of allowances originally planned to be allocated through auctioning between 2014 and 2016 (corresponding to 900 million allowances in total) were not allocated. As a result of this so-called 'backloading' measure, the cumulative surplus of allowances has declined considerably.

In 2017, the overall surplus of allowances continued to decline for the third consecutive year. It is now around 1.6 billion allowances (EC, 2018d). Despite an increase in auctioning volumes compared with 2016 (due to the end of the backloading measure), the overall supply of allowances in the EU ETS remained lower than the overall annual demand. This was due to a 0.2 % increase in total verified emissions (driven primarily by industrial growth), combined with lower volumes of allowances being allocated free (reflecting the planned annual reduction of the ETS cap) and the limited use of international offsets that installations can use for compliance.

The surplus of allowances remains substantial. To ensure the orderly functioning of the market and address the structural supply-demand imbalance, the Market Stability Reserve (MSR) will start operation in 2019. The MSR will function based on a set of pre-determined rules that place into a reserve a proportion of the total allowances in the carbon market when the number of allowances is above a certain threshold in order to reduce the surplus over time. The MSR is also expected to make the EU ETS more resilient to future unanticipated shocks. Following the agreement on the revision of the EU ETS Directive, which enhances the ambition of the MSR (EU, 2018a), the price of EU allowances (EUAs) increased by over 10 % in 2017 ([3]). The EUA price has continued to rise in 2018, reaching approximately EUR 20 per unit at the start of September.

([1]) Data on verified emissions and compliance by operators under the EU ETS for the years up until 2017 are based on an extract of the EU Transaction Log from 10 July 2018.
([2]) Projections of EU ETS emissions until 2030, reported in 2017 under the EU Monitoring Mechanism Regulation.
([3]) 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, 2005-2017**




**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. Refer to the 2017 report for further information (EEA, 2017b).

$MtCO^2e$, Million tonnes of $CO_2$ equivalent; $tCO_2e$, Tonnes of $CO_2$ equivalent.

**Sources:** Point Carbon, 2012; EEA, 2018; EEX, 2018; ICE, 2018.

***Over halfway through the third trading period, power generation continues to drive emission reductions in the EU ETS. Emissions trends for industrial installations have been more variable, reflecting the economic developments observed in Europe over the last three trading periods. Aviation emissions continue to grow year on year.***

Between 2005 and 2017, emissions from stationary installations declined by 26 %. By 2014, emissions were already lower than the cap set for 2020 ([4]). This reduction was largely the result of changes in the mix of fuels used to produce heat and electricity, in particular less use of hard coal and lignite fuels, and an increase in electricity generation from renewables, which almost doubled over the period 2005-2017.

For industrial installations outside the energy sector, the emission reductions observed since the start of the second trading period are primarily due to lower levels of output following the economic recession in 2008. 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 volumes were relatively flat at the beginning of the third trading period, but over the previous 2 years emissions have started to increase as economic conditions have improved and output has begun to rise.

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.

***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. The overall projected reduction is not yet in line with EU objectives for emission reductions by 2030.***

According to the projection scenarios reported by EU Member States up until June 2018 under EU legislation, EU ETS stationary emissions are projected to continue decreasing, with existing measures (WEM) in place, by 8.7 % between 2015 and 2020, and by a further 6.4 % between 2020 and 2030. Based on these projections, and on the agreed rules governing the MSR, the EEA estimates that the current surplus of allowances will quickly reduce in the coming years. As EU ETS emissions are projected to be higher than the cap from 2025 onwards, based on the WEM scenario, the demand for allowances will contribute to further reducing the number of allowances in circulation in the carbon market.

([4]) The emission reduction between 2005 and 2017 is estimated based on the current scope of the EU ETS in the third trading period (EEA, 2018).

# 1 Recent trends

- Between 2016 and 2017, the total European Union (EU) Emissions Trading System (ETS) emissions for stationary installations increased by about 0.2 %. Emissions from combustion installations (mainly power plants) continued to decline, which partly reflects the phasing out of coal use in several Member States. In contrast, emissions from industrial installations grew by an average of 1.1 % ([5]), primarily due to increased production output.
- The supply of EU allowances (EUAs) increased by 9.4 % in 2017, compared with the previous year, following the end of the backloading measure, despite the decline in the number of free EUAs allocated and in the use of international credit offsets.
- Most power plants had to buy their EUAs in 2017, while industrial installations, deemed to be exposed to a risk of 'carbon leakage' (i.e. the increase of emissions outside of the EU because production is relocated to places where there are no or lower carbon costs than in the EU), received EUAs for free. For the majority of industrial sectors, verified emissions were higher than the number of allowances received for free in 2017. This was due to increased emission levels, driven by economic growth and the continuous reduction of free allocation.
- Emissions from the aviation sector increased by 4.5 % in 2017, compared with the previous year, as the number of passengers continued to grow for many operators.
- The number of allocated EU aviation allowances (EUAAs) in 2017 was smaller than the emissions from the aviation sector. Aircraft operators therefore had to purchase EUAs from the stationary sector to comply with their emissions cap, set separately from the EU ETS cap for stationary installations.
- For the third year in succession, the overall annual demand for EUAs in 2017 was higher than the supply of EUAs. This led to a further reduction in the cumulative surplus, which is now around 1.6 billion allowances (EC, 2018d). At the same time, EUA prices increased by 9.8 % in 2016/2017.

This chapter presents developments for stationary installations and aviation separately, focusing first on emission trends in the past year and second on the implications for the supply and demand of allowances. Given that aircraft operators can purchase allowances from stationary installations, there is a degree of interaction between stationary installations and aviation, which is discussed throughout the chapter.

## 1.1 Stationary installations

### *1.1.1 Emission trends*

***Status in 2016***

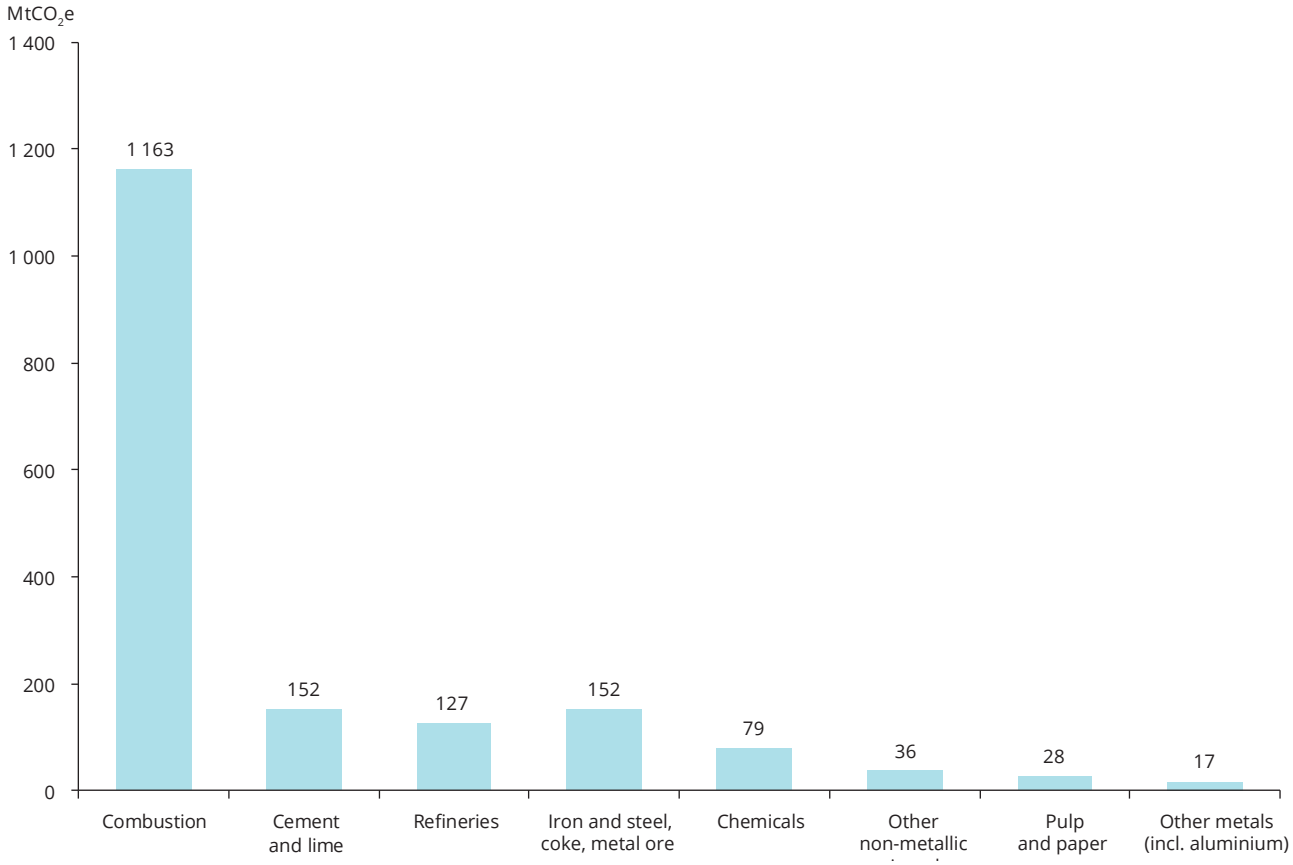
In 2017, the greenhouse gas emissions covered by the EU ETS accounted for around 40 % of

([5]) This is the average increase by ETS activity codes 21-99, which cover specific industries, and does not include the industrial installations without specific ETS activity, which are covered under combustion (ETS activity code 20).

the total greenhouse gas emissions of the EU. Combustion installations ([6]) are the main source of EU ETS emissions, emitting 1 163 $MtCO_2e$ ([7]) in 2017 (Figure 1.1), 66 % of the total verified emissions.

Emissions from iron and steel installations accounted for 152 $MtCO_2e$ in 2017 ([8]), followed by cement and lime installations (152 $MtCO_2e$), refinery installations (127 $MtCO_2e$) and chemical installations (79 $MtCO_2e$).

**Figure 1.1 EU ETS emissions by main activity type in 2017**



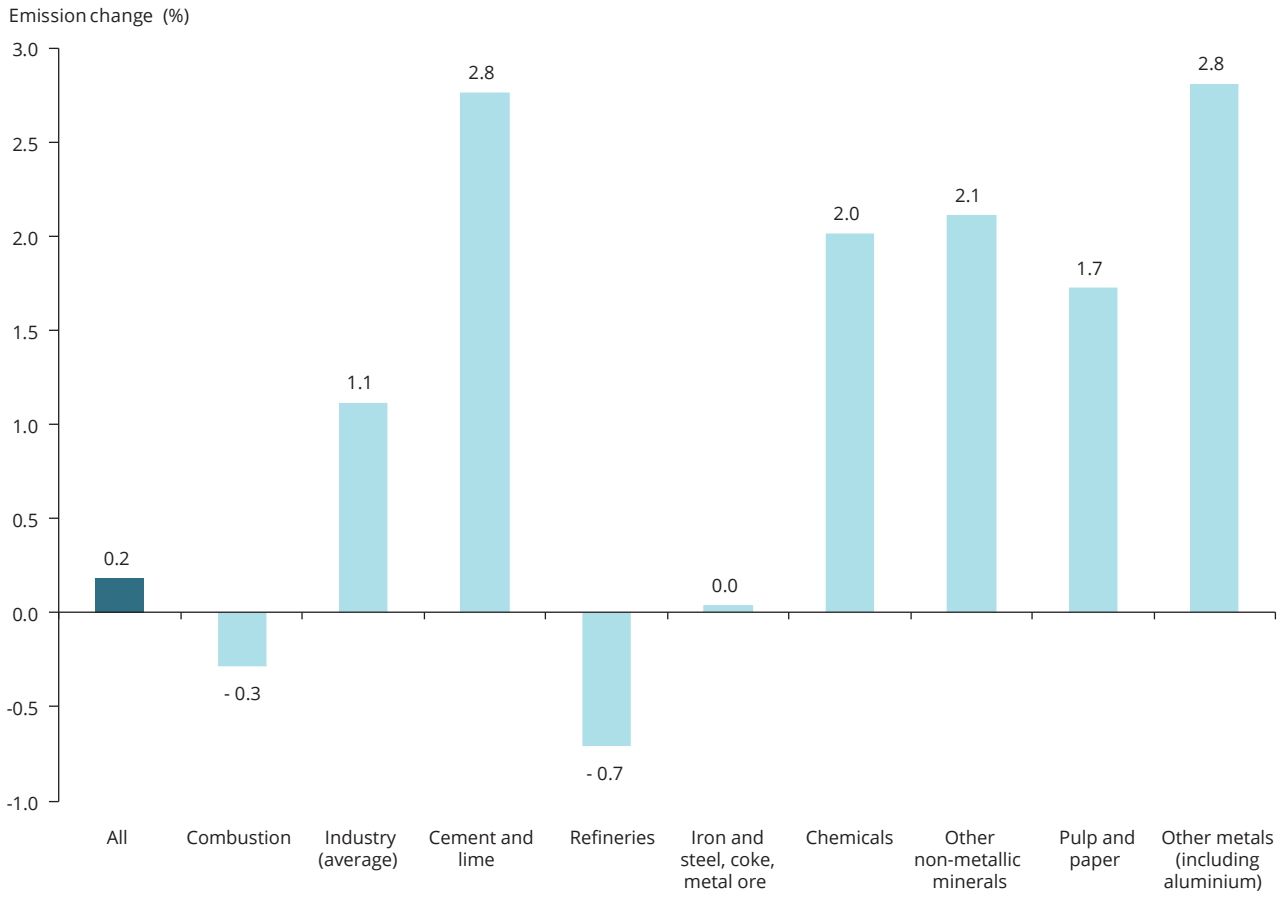

**Note:** The emissions cover all 31 countries that currently participate in the EU ETS. EU Transaction Log (EUTL) activity codes have been aggregated for certain sectors throughout the report (refer to Table A1.1).

**Source:** EEA, 2018.

Overall emissions in the EU ETS rose by 0.2 % in 2017 compared with last year. Although emissions from the combustion sector declined by 0.3 %, emissions from the industrial sector increased by 1.1 % (Figure 1.2). The overall increase in industrial emissions in 2017 primarily reflects higher levels of production. Indeed, the volume index of production from Eurostat (2018a) shows that, in 2017, the output from EU-28 manufacturing increased by 3.6 %, on average, compared with the previous year ([9]).

([6]) Combustion installations refers to those involving 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 waste gas scrubbing (EC, 2010).
([7]) $MtCO_2e$ refers to million tonnes of carbon dioxide equivalent.
([8]) 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.
([9]) Manufacturing is reported under code C of NACE rev. 2, the statistical classification of economic activities in the European Community. The increase in production output for manufacturing in 2017 for the EU-28 is calculated based on the annual average of the monthly index values for both 2016 and 2017.

**Figure 1.2 Change in EU ETS emissions by main activity, 2016-2017**




**Source:** EEA, 2018.

All industrial sectors, with the exception of refinery installations, reported an increase in their annual emissions. Emissions from both cement and lime installations and other metals (including aluminium) installations increased fastest in 2017 (i.e. by around 3 % compared with 2016 levels). Emissions in 2017 were around 2 % higher than in the previous year for chemicals, other non-metallic minerals and pulp and paper installations. These increases were likely to have been driven by higher production output in 2017 (Figure 2.4 in Section 2.1.1). Although the increase in production output from refineries was more modest than that from other sectors ([10]), their emissions decreased by around 1 % relative to 2016 levels.

### *Top 30 emitters*

In 2017, the 30 highest emitting power plants alone emitted 338.4 $MtCO_2$, 29 % of the total combustion emissions in that year (Table 1.1). The top emitting power plants are located mainly in either Poland or Germany and burn lignite fuel.

([10]) The manufacture of refined petroleum products increased by only 0.8 % in 2017 compared with the previous year based on the average annual value for both 2016 and 2017 (Eurostat, 2018a).

The largest emitter of all EU ETS installations is the lignite-fired power plant in Bełchatów, Poland, which emitted 37.6 $MtCO_2$ in 2017 ([11]). This represents an 8 % increase in emissions compared with the previous year due to an increase in electricity production. Bełchatów is followed in the list by six German lignite-fired power plants: Neurath, Niederaußem, Jänschwalde, Weisweiler, Schwarze Pumpe and Lippendorf. Together, these plants emitted 122 $MtCO_2$ in 2017. In total, ten German power plants were included in the top 30 emitters in 2017 and accounted for 46 % of the emissions from this top 30 list of installations. Polish power plants, including Kozienice (hard coal), Turów (lignite), Połaniec (hard coal), Rybniku (hard coal), Opole (hard coal) and Jaworzno (hard coal), as well as Bełchatów, account for 24 % of the emissions from this top 30 list of installations.

All of the seven highest emitting power plants in 2017 were lignite fired (Table 1.1). Lignite-fired power plants have higher specific emissions than hard coal- or natural gas-fired power plants. The $CO_2$ intensity of the top seven emitting lignite-fired power plants in 2017 averaged 1 100 g $CO_2$/kWh ([12]).

The emission intensity of hard coal-fired power plants ranges between 700 and 1 000 g $CO_2$/kWh (Table 1.1). For the several hard coal-fired plants that also use additional fuel inputs, their emission intensity varies above or below this range. For example, the Drax hard coal power station, which also co-fires a substantial share of biomass, had a considerably lower emission intensity of 300 g $CO_2$/kWh. This is a further 3 % reduction in the plant's specific emissions in 2017 compared with the previous year. In contrast, the Aboño hard coal power station 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 1 400 g $CO_2$/kWh. This represents a 1 % increase in the plant's specific emissions in 2017 compared with last year.

Several power plants no longer belong in the top 30 list in 2017 ([13]); for example, the Aberthaw coal power plant is no longer among the top 30 following an announcement from the operator, RWE Npower, that it was reducing operations at the 1.6 GW plant in Wales from 1 April 2017 as a result of 'challenging market conditions' for coal generation in the United Kingdom. The other power plant no longer in the top 30 list in 2017 is Mátrai, which produced less electricity in 2017 compared to the previous year.

In 2017, the 30 highest emitting industrial plants that are not power plants ([14]) emitted 145.7 $MtCO_2e$, 25 % of the total industrial emissions (Table 1.2). The highest emitting industrial plants are spread out across Europe, with no single country dominating the list. However, all of the top seven industrial emitters belong to the iron and steel sector. Overall, this sector accounted for 74 % of the total emissions by the 30 highest emitting industrial plants ([15]), followed by refinery installations with 22 % and chemical installations with 4 %.

An iron and steel installation in Duisburg, owned by Hüttenwerke Krupp Mannesmann, experienced the greatest increase in verified emissions of the top 30 (i.e. a 22 % increase in 2017 compared with 2016). This is likely to reflect an increase in the plant's output following a capacity increase in 2016 (HKM, 2018). By contrast, the greatest reduction in verified emissions between 2016 and 2017 out of the top 30 industrial emitters was recorded for the Shell refinery near Rotterdam, which temporarily shut down after a blaze broke out in July 2017 at the high-voltage power station at Shell's Pernis refinery (Deutsche Welle, 2017).

([11]) 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.
([12]) Authors' calculation based on 2017 data.
([13]) Refer to the list of top 30 emitters in 2016 (EEA, 2017b).
([14]) In this report, industrial installations are understood to be 'non-combustion' installations, even though some industrial installations are included in the ETS activity combustion and most combustion installations are normally considered industrial installations as well.
([15]) 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 1.1 Top 30 emitters in 2017 (power plants)**

| EUTL ID | Power plant | Fuel | Installed capacity 2017 | Verified emissions 2017 | | Electricity generation 2017 | | Emission intensity 2017 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | MW | $MtCO_2$ | versus 2016 (%) | TWh | versus 2016 (%) | $tCO_2$/MWh | versus 2016 (%) |
| PL 1 | Bełchatów | Lignite | 5 102 | 37.6 | 8 | 32.9 | 8 | 1.1 | 0 |
| DE 1606 | Neurath | Lignite | 4 212 | 29.9 | - 5 | 27.1 | - 5 | 1.1 | 0 |
| DE 1649 | Niederaußem | Lignite | 3 398 | 27.2 | 9 | 23.6 | 11 | 1.2 | - 2 |
| DE 1456 | Jänschwalde | Lignite | 2 998 | 23.6 | - 1 | 19.6 | - 2 | 1.2 | 1 |
| DE 1607 | Weisweiler | Lignite | 2 363 | 18.9 | 1 | 15.2 | 1 | 1.2 | 0 |
| DE 1459 | Schwarze Pumpe | Lignite | 1 510 | 11.4 | - 7 | 10.1 | - 7 | 1.1 | 1 |
| DE 1460 | Lippendorf | Lignite | 1 782 | 11.4 | 6 | 11.9 | 4 | 1.0 | 1 |
| PL 4 | Kozienice | Hard Coal | 2 941 | 11.2 | - 7 | 12.0 | - 7 | 0.9 | 0 |
| DE 1454 | Boxberg Werk IV | Lignite | 1 470 | 10.6 | 9 | 10.2 | 9 | 1.0 | 0 |
| BG 50 | Maritsa East 2 | Lignite | 1 604 | 10.5 | 9 | 9.0 | 11 | 1.2 | - 2 |
| IT 439 | Torrevaldaliga Nord | Hard Coal | 1 845 | 9.7 | - 4 | 11.1 | - 3 | 0.9 | - 1 |
| GR 15 | Dimitrios | Lignite | 1 456 | 8.9 | - 1 | 6.2 | 1 | 1.4 | - 2 |
| DE 1453 | Boxberg Werk III | Lignite | 1 000 | 8.6 | - 4 | 7.2 | - 5 | 1.2 | 1 |
| PT 100 | Sines | Hard Coal | 1 180 | 8.4 | 15 | 9.4 | 16 | 0.9 | - 1 |
| EE 2 | Narva | Oil Shale | 1 369 | 8.4 | 5 | 7.3 | 7 | 1.1 | - 1 |
| ES 201 | Aboño 1 | Hard Coal, BF Gas | 878 | 8.2 | 48 | 6.0 | 47 | 1.4 | 1 |
| ES 647 | Puentes | Lignite | 1 403 | 8.1 | 17 | 8.3 | 17 | 1.0 | 0 |
| NL 205957 | Eemshaven Centrale | Hard Coal | 1 580 | 7.6 | - 9 | 10.1 | - 8 | 0.7 | - 1 |
| NL 163, 448 | Maasvlakte | Hard Coal | 2 140 | 7.3 | - 31 | 7.8 | - 37 | 0.9 | 8 |
| PL 3 | Turów | Lignite | 1 488 | 7.1 | - 9 | 6.7 | - 9 | 1.1 | - 1 |
| PL 5 | Połaniec | Hard Coal | 1 882 | 7.0 | - 9 | 9.2 | - 11 | 0.8 | 2 |
| DE 1380 | Mannheim | Hard Coal | 1 971 | 6.9 | - 13 | 7.2 | - 16 | 1.0 | 4 |
| IT 521 | Brindisi Sud | Hard Coal | 2 420 | 6.5 | - 22 | 6.2 | - 25 | 1.0 | 4 |
| PL 6 | Oddział w Rybniku | Hard Coal | 1 790 | 6.5 | - 8 | 6.8 | - 9 | 1.0 | 1 |
| GR 14 | Kardia | Lignite | 1 103 | 6.4 | 14 | 4.0 | 11 | 1.6 | 3 |
| PL 2 | Opole | Hard Coal | 1 532 | 6.3 | 6 | 6.6 | 2 | 1.0 | 4 |
| GB 381 | Drax Power Station | Biomass, Hard Coal | 3 870 | 6.2 | - 1 | 20.0 | 2 | 0.3 | - 3 |
| DE 206180 | Moorburg | Hard Coal | 1 600 | 6.2 | 11 | 7.6 | 11 | 0.8 | 0 |
| PL 9 | Jaworzno III | Hard Coal | 1 345 | 6.0 | 33 | 5.8 | 32 | 1.0 | 1 |
| RO 87 | Rovinari | Lignite | 1 238 | 5.8 | 6 | 5.9 | 5 | 1.0 | 1 |

**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.

Electricity generation of Drax power plant was cross-checked with the company source (https://www.drax.com/investors/full-year-results-for-the-twelve-months-ended-31-december-2017/; downtime due to construction works affected gap filling of data from the European Network Transmission System Operators for Electricity).

**Sources:** Platts, 2014; EEA, 2018.

**Table 1.2 Top 30 emitters in 2017 (industrial plants, excluding combustion)**

| EUTL ID | Company | Installation | Activity code | Verified emissions 2017 | |
|---|---|---|---|---|---|
| | | | | $MtCO_2$ | versus 2016 (%) |
| AT 16 | Voestalpine Stahl | Linz | 24 | 9.2 | 6 |
| SK150, 208904 | U.S. Steel Košice and Ferroenergy | Košice | 24 | 9.2 | 3 |
| FR 956 | ArcelorMittal Atlantique et Lorraine | Dunkerque | 24 | 8.2 | 12 |
| DE 69 | Thyssenkrupp Steel Europe | Duisburg | 24 | 8.0 | - 6 |
| FR 628 | ArcelorMittal Mediterranee | Fos sur Mer | 24 | 7.9 | 10 |
| NL 144 | Tata Steel Ijmuiden | Velsen | 24 | 6.8 | 10 |
| GB 325 | Tata Steel UK | Port Talbot | 24 | 6.7 | 0 |
| IT 575 | Sarlux Srl | Sarroch (Cagliari) | 21 | 6.4 | - 2 |
| IT 515 | ILVA | Taranto | 24 | 6.4 | - 7 |
| ES 212 | ArcelorMittal España | Aviles y Gijon (Asturias) | 24 | 5.3 | - 7 |
| DE 53 | Hüttenwerke Krupp Mannesmann | Duisburg | 24 | 5.1 | 22 |
| GB 321 | British Steel | Scunthorpe | 22 | 5.0 | - 5 |
| DE 52 | Rogesa Roheisengesellschaft Saar | Dillingen/Saar | 24 | 4.6 | 18 |
| BE 203912 | ArcelorMittal Belgium | Gent | 24 | 4.4 | - 3 |
| DE 43 | Salzgitter Flachstahl Gmbh | Salzgitter | 24 | 4.3 | - 1 |
| RO 44 | ArcelorMittal Galati | Galati | 24 | 3.9 | - 9 |
| DE 19 | PCK Raffinerie | Schwedt | 21 | 3.8 | 2 |
| NL 99 | Shell Nederland | Hoogvliet- Rotterdam | 21 | 3.8 | - 10 |
| FI 445 | Ssab Europe Oy | Raahe | 24 | 3.8 | - 8 |
| BE 127 | Total Raffinaderij Antwerpen | Antwerpen | 21 | 3.7 | - 1 |
| DE 4 | Ruhr Oel | Gelsenkirchen | 21 | 3.3 | 3 |
| BE 203830 | BASF | Antwerpen | 42 | 3.3 | 11 |
| AT 13 | Voestalpine Stahl | Donawitz | 24 | 3.1 | 11 |
| FR 253 | Total Raffinage France | Gonfreville l'Orcher | 21 | 3.0 | 19 |
| LT 18 | AB Achema | Katilinė | 41 | 2.8 | 16 |
| DE 11 | Mineralölraffinerie | Karlsruhe | 21 | 2.8 | 0 |
| FI 533 | Neste | Porvoon jalostamo | 21 | 2.8 | - 2 |
| AT 26 | Omv Refining & Marketing Gmbh | Schwechat | 21 | 2.7 | - 2 |
| PL 886 | ArcelorMittal Poland S.A. | Dabrowa Gornicza | 24 | 2.7 | - 2 |
| CZ 114 | Třinecké železárny | Trinec - Stare Mesto | 24 | 2.6 | 5 |

**Note:** We have identified three iron and steel installations with major emissions wrongly classified under ETS activity 20 combustion. Following confirmation from the competent authorities of the respective Member States the following installations have been re-classified under the iron and steel sector: FR 956 (Dunkerque), IT 515 (Taranto) and SK 150 (Košice).

Up to 2016 the power plant fueled by blast furnace gas belonging to the iron and steel plant in Košice, Slovakia, was reported jointly in the EU ETS registry under ID SK 150. From 2017 onwards emissions from the U.S. Steel Steelwork continue to be reported under EUTL ID SK 150 whereas emissions from the Ferroenergy power plant are reported separately under the installation ID SK 208904. Emissions are summed up in order to compare 2017 to 2016 emissions.

**Sources:** Platts, 2014; EEA, 2018.

### *1.1.2 Balance of allowances*

*Supply and demand*

The total supply of 1 726.2 million allowances in 2017 increased by 9.4 % compared with the previous year. This comprised free allocation, allowances auctioned ([16]) and the exchange of international credits (Table 1.3).

The supply of free allowances allocated (without transitional allocation for the modernisation of electricity generation) was 4.3 % lower than in 2016. This reduction reflects the fact that free allocation to existing installations is reducing every year, depending on the linear reduction factor and the cross-sectoral correction factor, as well as the carbon leakage status relevant for allocation ([17]). Furthermore, some of the free allowances normally allocated to existing installations under Article 10(a)(1) of the ETS Directive were not allocated as a result of installation closures or reductions in production levels ([18]).

The number of transitional allowances allocated to electricity generators in eligible lower income Member States to enable them to modernise their energy sector (Article 10(c) of the ETS Directive) decreased by 29.4 % in 2017 compared with the previous year. The use of international credits was reduced by 3.2 % in 2017 compared with 2016, as the maximum limit for the exchange of certified emission reduction (CER) or emission reduction unit (ERU) for allowances until 2020 has been almost entirely used up (Table 1.3 and see Article 11(a)(8) of the ETS Directive).

**Table 1.3 Summary of EU ETS developments in stationary installations, 2016-2017**

| | 2016 | 2017 | Change (%) |
|---|---|---|---|
| **Verified emissions ($MtCO_2$)** | **1 750.6** | **1 753.9** | **0.2** |
| Combustion emissions | 1 166.0 | 1 162.7 | - 0.3 |
| Industrial emissions | 584.7 | 591.2 | 1.1 |
| **Total supply of allowances (Millions of EUAs)** | **1 578.5** | **1 726.2** | **9.4** |
| Free allocation (incumbents, new entrants) | 771.7 | 738.8 | - 4.3 |
| For existing installations | 750.9 | 717.7 | - 4.4 |
| For new entrants and capacity extensions | 20.8 | 21.1 | 1.3 |
| Transitional free allocation for electricity generation | 61.0 | 43.1 | - 29.4 |
| Auctioned amounts/primary market sales | 733.8 | 932.7 | 27.1 |
| International credits exchanged | 12.1 | 11.7 | - 3.2 |
| **Supply/demand balance (Millions of EUAs)** | | | |
| Balance stationary installations only | - 172.1 | - 27.6 | - 84.0 |
| Net demand in EUAs from aviation | 23.7 | 26.7 | 12.6 |
| Annual balance all ETS | - 148.3 | - 0.9 | - 99.4 |
| **EUA price (EUR)** | **5.2** | **5.8** | **9.8** |

**Notes:** The distinction between combustion and industrial emissions 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. The auctioned amounts are based on a redistribution approach that allocates volumes as originally expected in the auctioning calendar. For the auctioned amounts that were actually concluded (taking into account any unforeseen delays), refer to Table A1.3.

EUTL data were extracted on 10 July 2018.

**Sources:** EEA, 2018; EEX, 2018; ICE, 2018.

([16]) The auctioned amounts are based on a redistribution approach; for details refer to Table A1.3.

([17]) 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 in 2013. This proportion will decrease gradually year on year, down to 30 % in 2020. For sectors and subsectors deemed to be exposed to a significant risk of carbon leakage, this carbon leakage factor will remain 100 %.

([18]) 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).

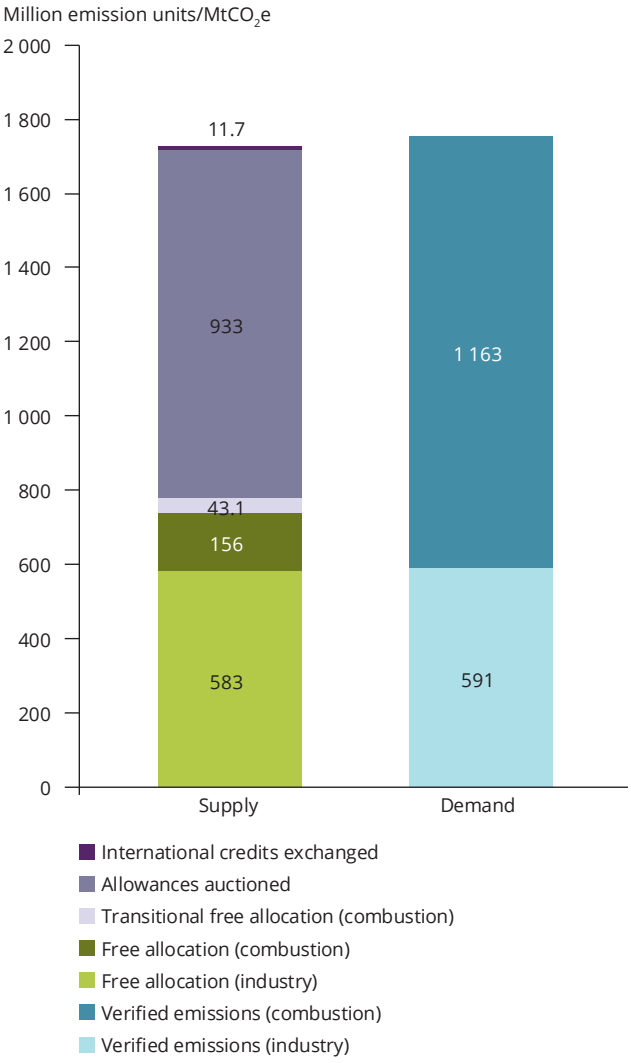
However, these reductions in allowance supply were offset by the 27.1 % increase in the allowances auctioned in 2017 compared with the previous year. The number of allowances sold in the primary market (such as through auctioning) was greater in 2017 than in the previous year as a consequence of the end of allowances being withdrawn from auctions under backloading ([19]).

The total demand in 2017 was made up of 1 753.9 $MtCO_2e$ from stationary installations and a net demand of 26.7 $MtCO_2e$ from aviation operators. In the same year, verified emissions from stationary installations increased by 0.2 % compared with the previous year, increasing the demand for allowances. The cumulative surplus continued to decline in 2017, albeit more slowly than in the previous year, due to a relatively large increase in the supply of allowances compared with previous years. An allowance surplus of around 1.6 billion allowances remains (EC, 2018d), which continues to have an impact on the price. Nevertheless, the EUA price increased by 9.8 % between 2016 and 2017, and it has increased even faster during 2018 (Figure 2.6 in Section 2.1.2).

### *Supply and demand by main activity type*

Overall, the demand for allowances was greater than the supply in 2017 (Figure 1.3). However, this mainly affected combustion installations, which had to buy most of their allowances to cover their emissions through auctions, from other market participants or through the purchase of international credits. In the third trading period there is generally no free allocation for electricity generation ([20]). This is due to the fact that this sector passed through costs to costumers and in the past gained windfall profits. Industrial installations received a larger number of free allowances in 2017, although not enough to completely cover their verified emissions ([21]). However, these allowances were not distributed evenly across all industrial sectors.

**Figure 1.3 Supply and demand balance, combustion and industry in 2017**




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

**Source:** EEA, 2018.

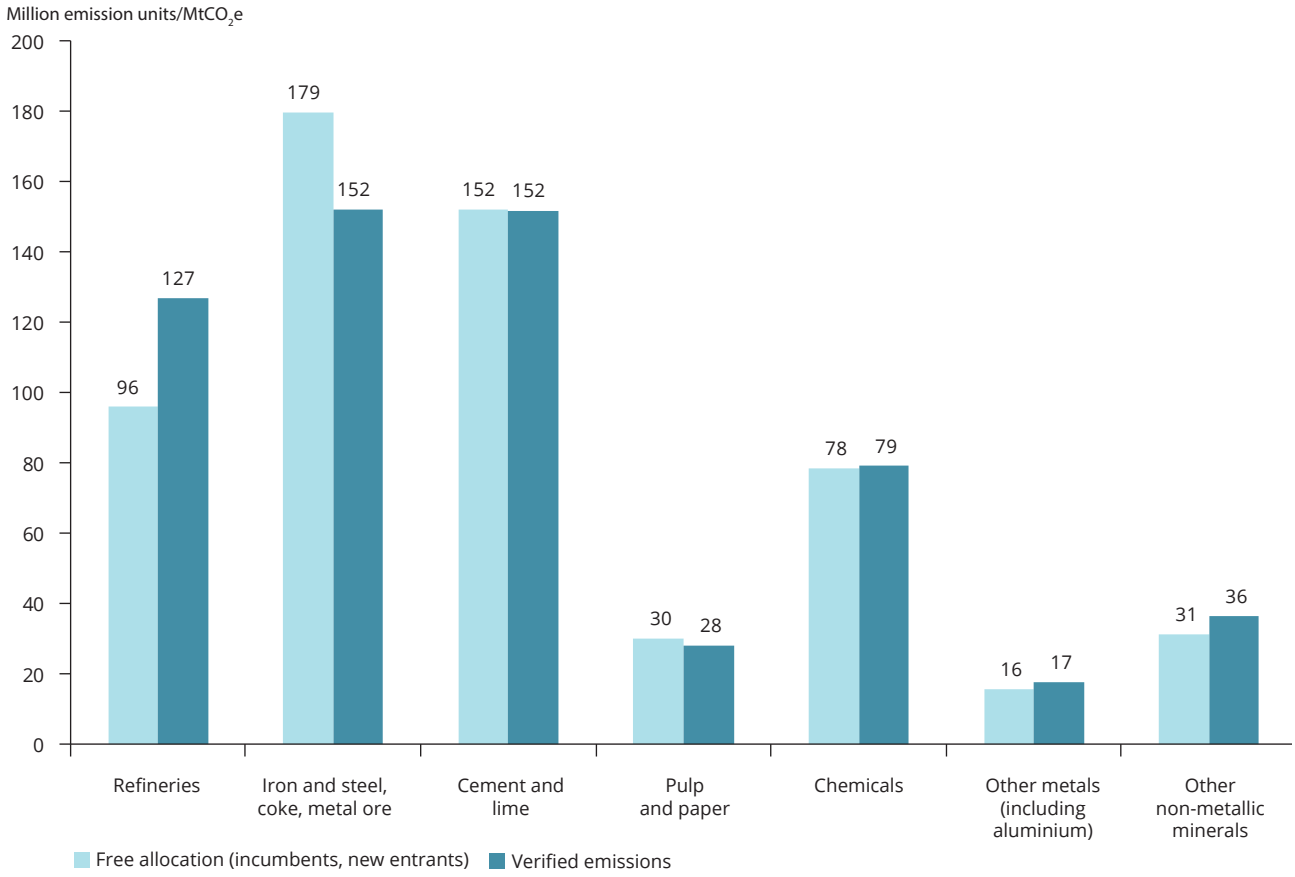
([19]) The backloading decision postponed the auctioning of a total of 900 million allowances until 2019-2020. A total of 400 million allowances were removed in 2014, while 300 million were removed in 2015 and 200 million were removed in 2016. It has subsequently been decided that these allowances will not re-enter the market, as originally planned under the backloading decision, but will instead be transferred to the MSR (EU, 2015).

([20]) Under Article 10(a)(4) of the ETS Directive, electricity generators are eligible for free allowances for heat production only. Furthermore, electricity generators in certain countries are eligible for transitional free allowances under Article 10(c) of the ETS Directive, to enable those countries to modernise their electricity systems

([21]) The higher share of free allocation to industry reflects concerns about the exposure of industrial sectors to international competition. Free allowances to industrial installations under Article 10(a)(1) of the ETS Directive were distributed by applying harmonised allocation rules that were based on EU ETS-wide benchmarks and on historical production levels, as well on as whether or not the sector is recognized as exposed to a significant risk of carbon leakage.

Based on activity classifications under the EUTL, Figure 1.4 shows that in 2017 the iron and steel sector received around 28 Mt more free allowances than it emitted, whereas the refinery sector received around 31 Mt fewer free allowances than it emitted. Emissions have also been higher than allowances (albeit to a lesser extent) in sectors such as chemicals, other metals (including aluminium) and other non-metallic minerals. However, the balance between free allocation and verified emissions by sector importantly depends upon the way in which waste gases are reported under the EU ETS. The fact that the majority of the sectors had less emission allowances allocated for free in 2017 than their verified emissions shows that the cap on emissions and thus the level of free allocation is continuously tightened through the so-called cross-sectoral correction factor whereas industrial growth returns to the EU. Industrial installations, however, continue to receive a large number of free allowances (based on historical production volumes, product-specific benchmarks and an installation's carbon leakage status) and industries could build up a reserve of allowances over several years after lower than expected output following the economic recession.

**Figure 1.4 Balance of free allocation and emissions, industrial sectors, 2017**




**Note:** ETS activity types have been aggregated for certain sectors (Table A1.1). 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, 2018.

## 1.2 Aviation

### *1.2.1 Emission trends*

***Status in 2017***

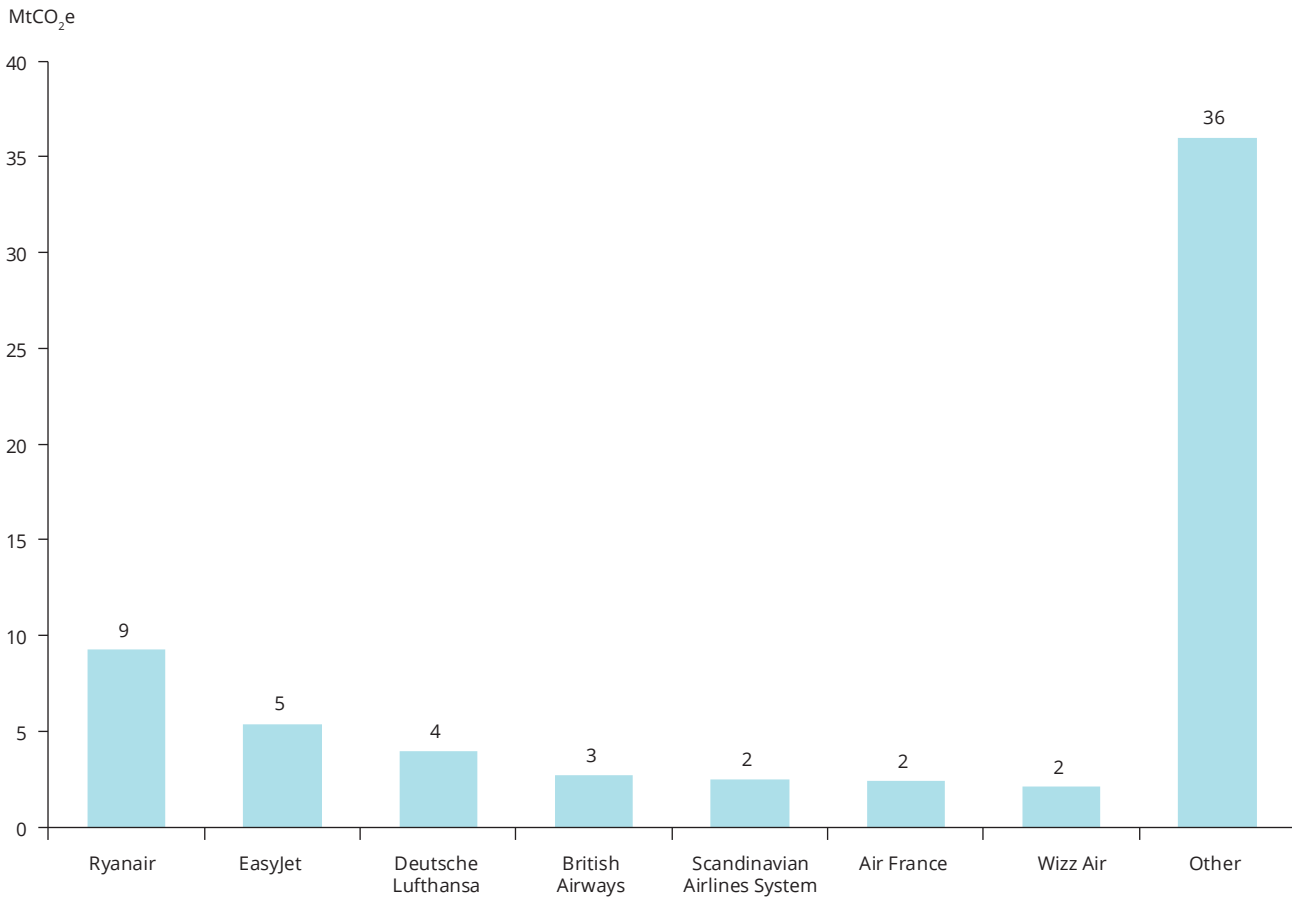
In 2017, the aviation sector covered by the EU ETS emitted 64.2 $MtCO_2e$, which represents an increase of 4.5 % compared to the previous year. The seven largest aircraft operators were responsible for 44 % of these emissions. Ryanair and EasyJet were the two highest emitters in the aviation sector in 2017, accounting for around 9 $MtCO_2e$ and 5 $MtCO_2e$ respectively (Figure 1.5). Ryanair and EasyJet increased their emissions by 9.6 % and 5.8 % respectively compared with 2016 levels (Figure 1.6). The increase in aviation emissions was driven by a 13 % growth in passenger numbers for Ryanair, up to 120 million passengers (Ryanair, 2018), and by a 9.6 % growth for EasyJet, up to 81.6 million (EasyJet, 2018).

### *1.2.2 Balance of allowances*

***Supply and demand***

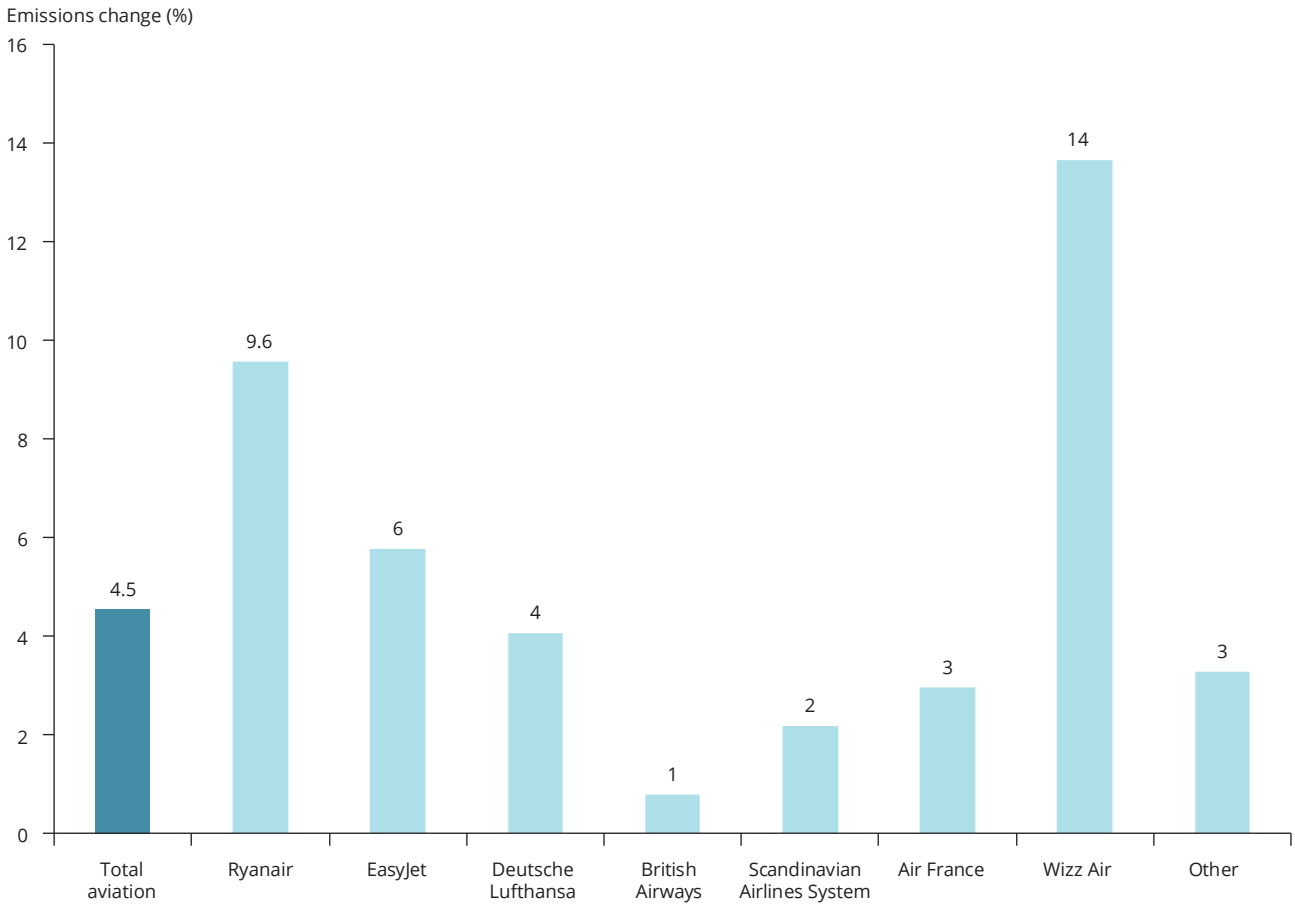
In 2017, aviation emissions covered by the EU ETS increased by 4.5 % compared with the previous year. At the same time, the supply of EUAAs remained relatively stable because the emission cap has stayed the same in each year of the third trading period. The shares of this supply are fixed, with 82 % of allowances distributed free, 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).

**Figure 1.5 Aviation emissions by carrier, 2017**




**Source:** EEA, 2018.

**Figure 1.6 Relative change in ETS aviation emissions, 2016-2017**




**Source:** EEA, 2018.

**Table 1.4 Summary of EU ETS developments for aviation operators, 2016-2017**

| | 2016 | 2017 | Change (%) |
|---|---|---|---|
| **Total demand ($MtCO_2e$)** | **61.5** | **64.2** | **4.5** |
| Aviation emissions | 61.5 | 64.2 | 4.5 |
| **Total supply (Millions of EUAAs)** | **37.7** | **37.5** | **- 0.5** |
| Aviation free allocation | 31.6 | 31.6 | 0.0 |
| Aviation free allocation (NER) | | 1.1 | |
| Average estimates/auctioned amounts | 6.0 | 4.7 | - 21.1 |
| International credits exchanged | **0.134** | **0.129** | **- 3.2** |
| **Annual supply/demand balance (Mio EUAA)** | **- 23.7** | **- 26.7** | **12.6** |
| **EUAA price (EUR)** | **5.5** | **7.2** | **31.3** |

**Notes:** Refer to EEA (2017a) for further information.

NER, New Entrants Reserve.

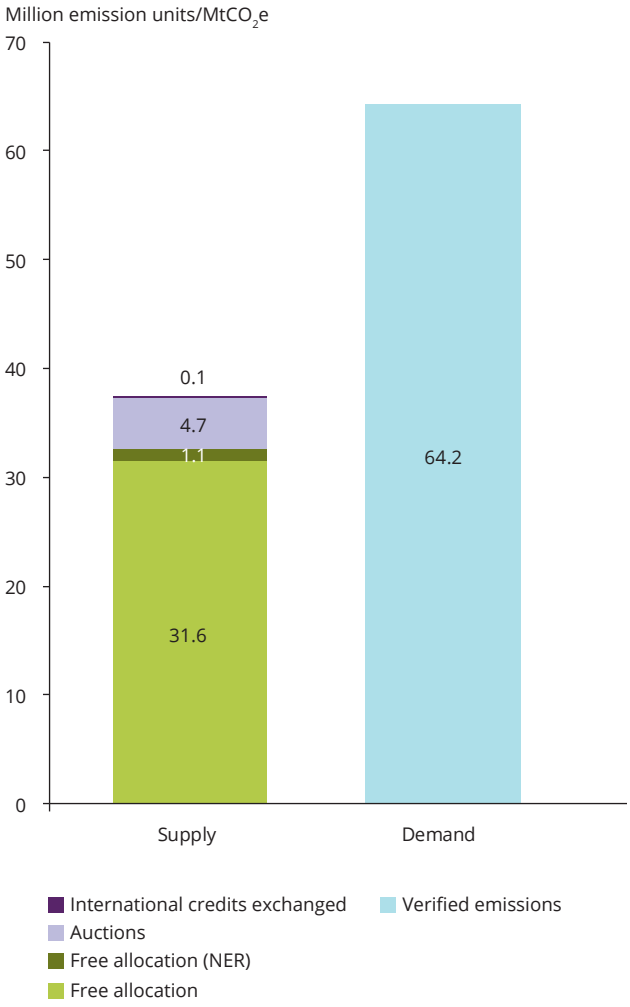
**Sources:** EEA, 2018; EEX, 2018; ICE, 2018.

Table 1.4 shows that 4.7 million allowances were auctioned in 2017, 21.1 % lower than in the previous year. This was due to a delay in the auctioning of EUAAs that year, as a prolongation of the 'stop-the-clock' decision ([22]) had to be decided upon following the ICAO assembly in October 2016 ([23]). 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 (EC, 2017a). Within 12 months of the adoption of ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), the Commission shall present a report to the European Parliament and to the Council.
Among other aspects, the Commission shall, in that report, also consider the rules applicable in respect of flights within the EEA, as appropriate. It shall also examine the ambition and overall environmental integrity of CORSIA.

The use of international credits also decreased further, as the remaining budget for CER/ERU use between 2012 and 2020 is now almost entirely depleted.
As a consequence, the net demand for allowances increased to 26.7 million, requiring the aviation sector to purchase EUAs in order to comply with its emissions cap.

In 2017, aircraft operators were allocated 32.7 million free EUAAs, and an additional 4.7 million EUAAs were auctioned (Figure 1.7). These allowances covered 51 % of the total aviation emissions (64.2 $MtCO_2e$). The difference in allowances necessary for compliance had to be purchased on the carbon 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 during the third trading period). Furthermore, aircraft operators are allowed to exchange international credits for EUAAs (up to 1.5 % of verified emissions).

**Figure 1.7 Supply and demand balance for aviation in 2017**




**Note:** International credits exchanged (aviation) estimated based on total CER/ERUs exchanged.

**Sources:** EC, (2018h); EEA, 2018.

([22]) 'The 'stop-the-clock' scope that was applied to the 2013-2016 period under which flights to and from outermost regions and third countries were derogated, while flights between EEA airports remain fully covered' (Green Air Online, 2017).
([23]) Because of this delay, the average annual EUAA price in 2017 was higher than the annual EUA price, as EUAAs were auctioned less frequently and later in the year when the value of EUAs was greater.

# 2 Long-term trends

- Stationary EU ETS emissions decreased by 26 % between 2005 and 2017. The decrease was mostly driven by emission reductions in power generation, which was largely the result of lower electricity generation from hard coal and lignite fuels and a large increase in electricity generation from renewables over the same period.
- Emissions from industrial activities covered by the EU ETS have also decreased since 2005, but have remained relatively stable during the third trading period. However, in 2017 industrial emissions increased compared to the previous year in response to higher levels of production output.
- Aviation emissions have increased year on year during the third trading period, reflecting the large growth in passenger numbers.
- The supply of EUAs freely allocated to installations has reduced over time. In contrast to the earlier trading periods of the EU ETS, the majority of installations in the power sector must now purchase allowances via auctions or on the secondary market. Eight central and eastern EU Member States remain eligible for transitional free allocations to support the modernisation of their power sector. Over half of the budget (68 %) for these allowances was used between 2013 and 2017. The New Entrants Reserve (NER) provides allowances to new installations or any significant increase in capacity to existing installations during the third trading period. After 5 years of the current 8-year trading period, 31.9 % of the allowances in the NER have been either used or reserved for future use. Most of the NER allowances used have been allocated to support capacity extensions.
- The number of EUAs auctioned to installations has increased in the third trading period, although the backloading measure withdrew 900 million EUAs from the market between 2014 and 2016. The number of EUAs auctioned in 2017 increased considerably following the end of the backloading measure. However, delays to the auctioning of aviation allowances (EUAAs) in 2017 resulted in a smaller number than in the previous year. The revenues Member States received in the third trading period from the auctioning of EUAs and EUAAs have varied in response to these changes.
- The EUA and EUAA price increased considerably until September 2018, reflecting the recent political agreement on reforms to the EU ETS for the fourth trading period, which has led to increased market speculation on the rising demand for allowances in the future. In addition, increased levels of industrial output and extreme weather conditions during the summer of 2018 have also led to further demands for allowances, with the EUA price surpassing EUR 20 per unit in September 2018.
- The use of international emission credits declined for the fourth consecutive year, which reflects the setting of maximum limits up to which operators under the EU ETS may use eligible international credits for compliance.

This chapter discusses stationary installations and aviation separately, focusing first on the development of emission trends between 2005 and 2017 and second on the implications for the supply and demand of allowances. As aircraft operators can also purchase EUAs, the interaction between stationary installations and aviation is discussed throughout the chapter.

## 2.1 Stationary installations

### *2.1.1 Emission trends*

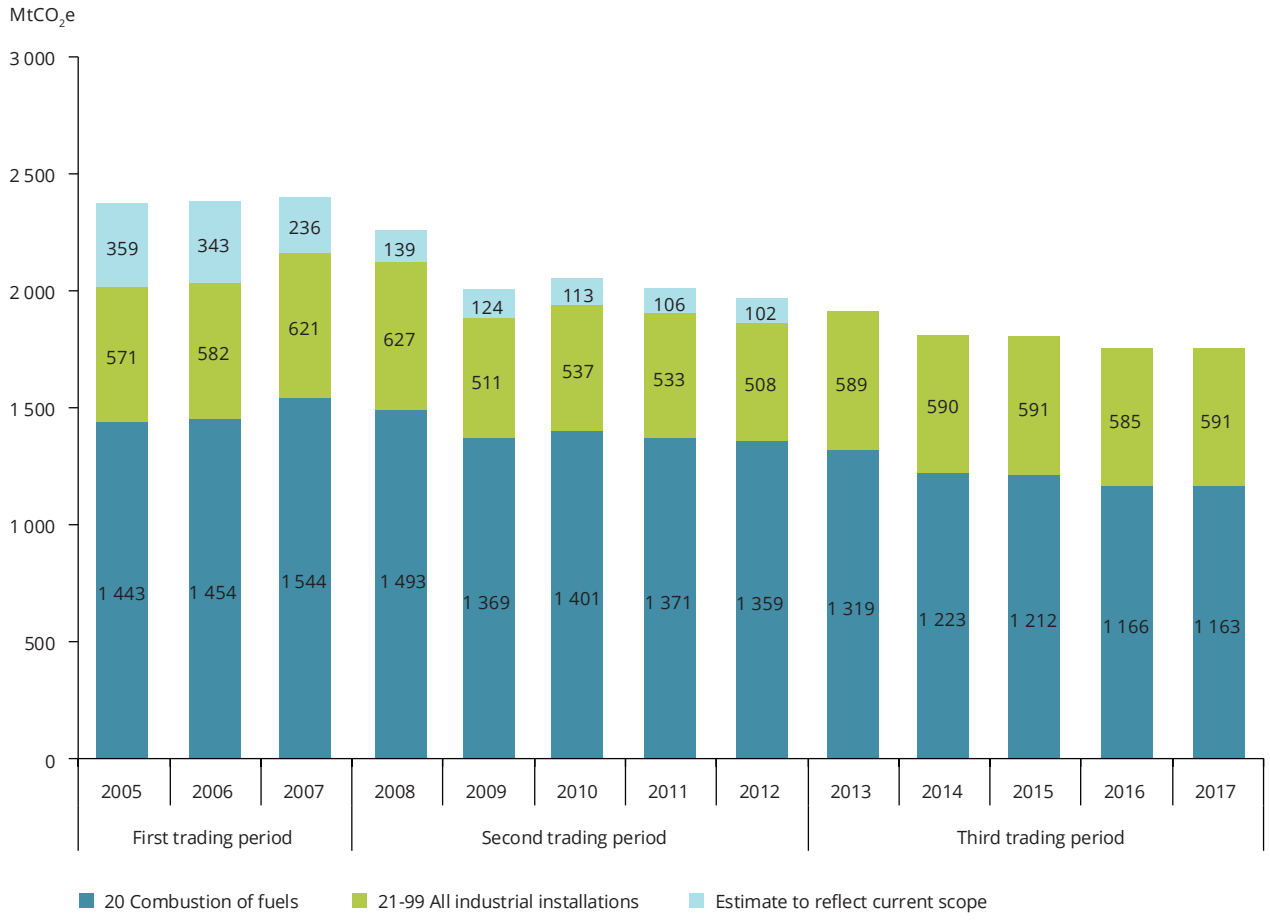
***Total EU ETS emissions***

By the end of the second trading period, EU ETS emissions had fallen to 17 % below 2005 levels (Figure 2.1). After 5 years of the third trading period, emissions are now 26 % below 2005 levels. This is below the 2020 target of a 21 % ETS reduction below 2005 levels, as set out in the climate and energy package (EC, 2018a). Changes in emissions depend on changes in both activity levels and the emissions intensity of production, both of which are influenced by policy and non-policy factors. This makes it difficult to ascertain the extent to which emission reductions are directly attributable to the EU ETS.

Combustion-related emissions, which accounted for 66 % of the total EU ETS emissions in 2017 and have been the main driver of the decline in emissions in the third trading phase, depend directly on primary energy consumption levels and fuel mix:

- Primary energy consumption depends on the demand for energy by end users (electricity consumption by households and industry), transformation efficiency and overall economic activity (the extraordinary economic situation during the second trading period). Climatic conditions play an important role in annual variations in energy consumption for heating and cooling; and, therefore, emissions. However, the impact of this factor is less relevant over a longer period, as it is not cumulative. Policies promoting energy efficiency also have a direct impact on energy consumption.

**Figure 2.1 Verified emissions (2005-2017) 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 additional emissions (not split by activity) for the period 2005-2012 to provide a consistent time series for the coverage of emissions in the third trading period.

**Source:** EEA, 2018.

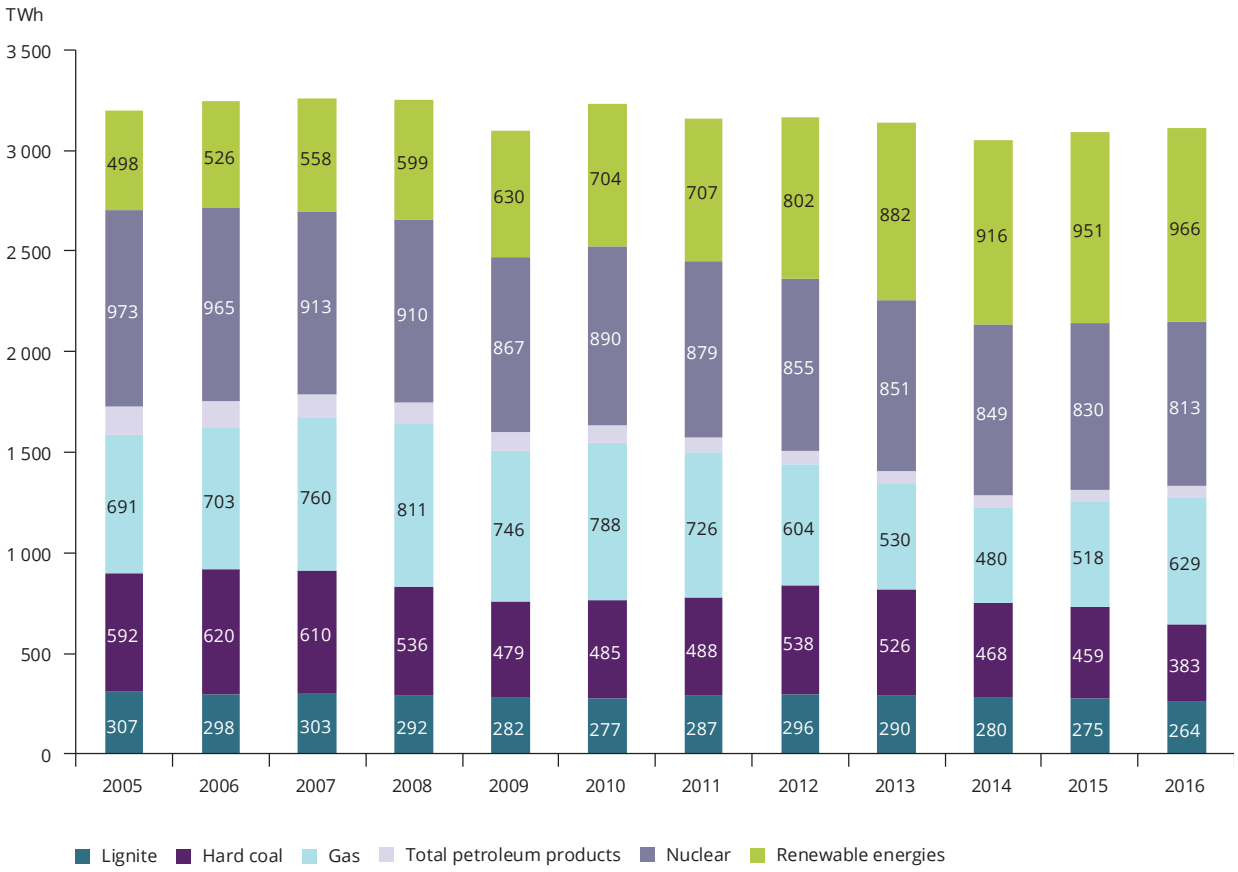
- The fuel mix used to transform primary energy into electricity or heat is also a determinant. It depends on energy infrastructure and is affected by relative variations in fuel prices. Energy policies also play a key role in modifying fuel mixes, for example by promoting the deployment of renewable energy sources (EEA, 2014).

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 (based on installations in the top 10 % for efficiency).

***Energy sector***

The decline in verified emissions in the combustion sector over recent years has been influenced by considerable changes to the fuel mix. Between 2005 and 2016, electricity generation for the 25 Member States of the EU as of 2005 (EU-25) from hard coal, lignite and nuclear power declined by 35 %, 14 % and 17 %, respectively (Figure 2.2). These reductions in electricity generation were partly offset by a 94 % increase in electricity generation from renewables over the same period. The Renewable Energy Directive has encouraged the uptake of renewables, which has also been driven by reductions in technology costs. 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.

**Figure 2.2 Gross electricity generation by fuel in the EU-25**



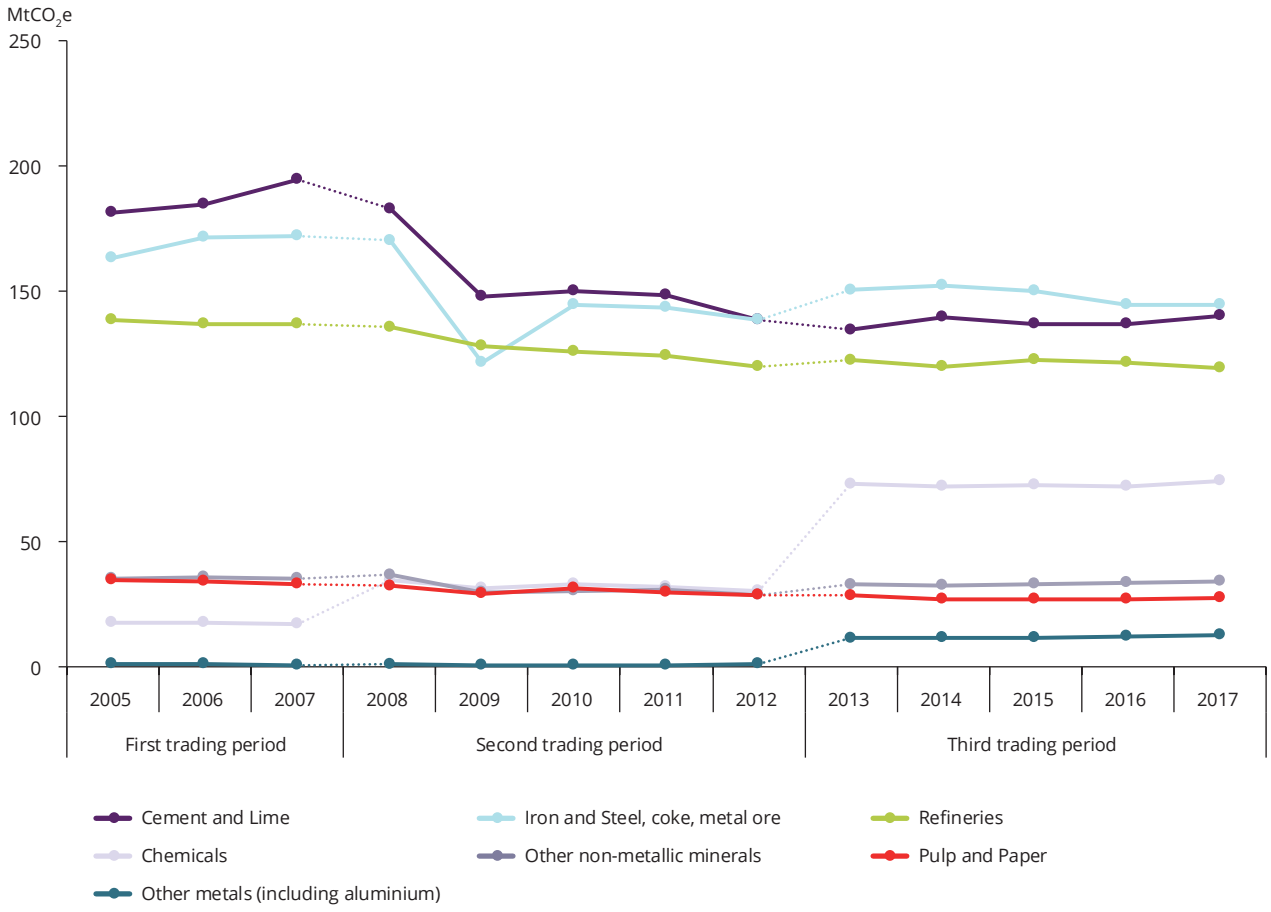

**Note:** Data aggregated by fuel type based on Eurostat guidance. Includes electricity generation not covered by EU ETS (i.e. plants producing less than 20 MW of thermal energy); however, this is a very small share of the total emissions from electricity generation.

**Sources:** Eurostat, 2018b.

*Industry sector excluding energy utilities*

In the first trading period, the verified emissions of installations in the cement and lime sector and the iron and steel sector increased by 7 % and 6 %, respectively (Figure 2.3). The verified emissions of most of the remaining sectors were more stable during the first trading period. All of the industrial activities covered by the EU ETS for the EU-25 ([24]) experienced a decline in their verified emissions during the second trading period. The iron and steel sector and the cement and lime sector also experienced a sharp drop in verified emissions of 29 % and 19 %, respectively, in a single year (2009). During the third trading period, emissions across the various industrial sectors have stabilised at levels similar to those observed at the end of the second trading period ([25]).

**Figure 2.3 EU ETS emissions by main industrial activity in the EU-25 (2005-2017)**




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

**Source:** EEA, 2018.

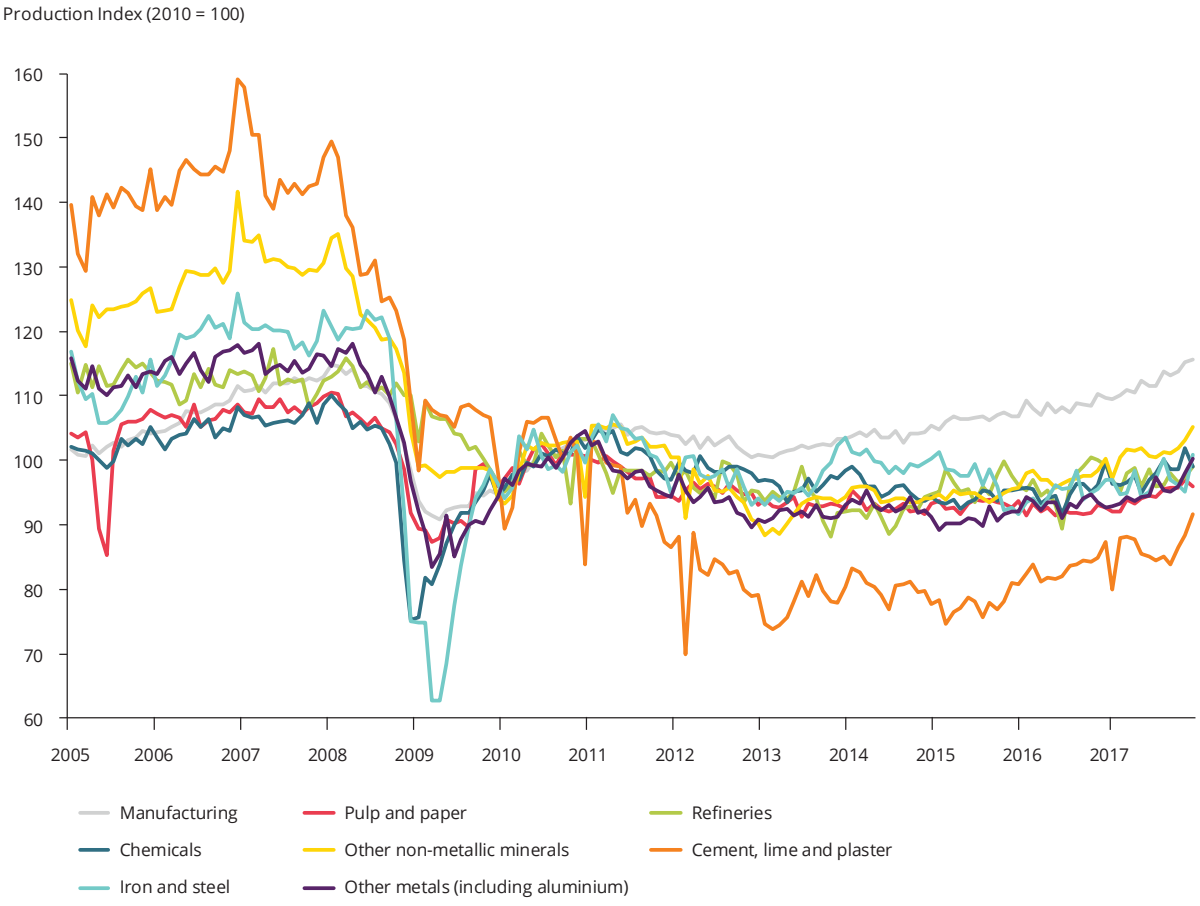
([24]) Gross electricity generation is shown for only the EU-25 to provide a consistent number of Member States during the period 2005-2017.

([25]) Notable differences in verified emissions are observed in the chemicals industry and the production of other metals (including aluminium), for which the scope of the EU ETS increased considerably between the second and third trading periods. For both activities, the EU ETS now 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 aluminium.

The emission reductions of industrial installations since the start of the second trading period are primarily due to lower levels of output following the economic recession in 2008. This can be clearly observed in the 2008/2009 changes to the production volume index for all sectors in Figure 2.4. Secondary explanatory 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 emissions levels ([26]). During the third trading period, the emissions and production volumes were relatively flat, but over the past 2 years emissions have started to increase as output has risen in response to improved economic conditions.

The lower abatement by industrial installations than by combustion installations may reflect both higher abatement costs than the current EUA prices and relatively lower output levels in previous years, which have somewhat reduced the need for abatement in the short term. However, to ascertain the extent to which the EU ETS reduced specific emissions of production, a comprehensive review of transparent

**Figure 2.4 Monthly volume index of production by main activity in the EU-28 (2005-2017)**




**Notes:** Volume index of production (seasonally and calendar adjusted data for the EU-28).

**Source:** EEA, 2018.

([26]) Attributing output changes to emission changes at the right level of disaggregation requires a detailed assessment that is beyond the scope of this report.

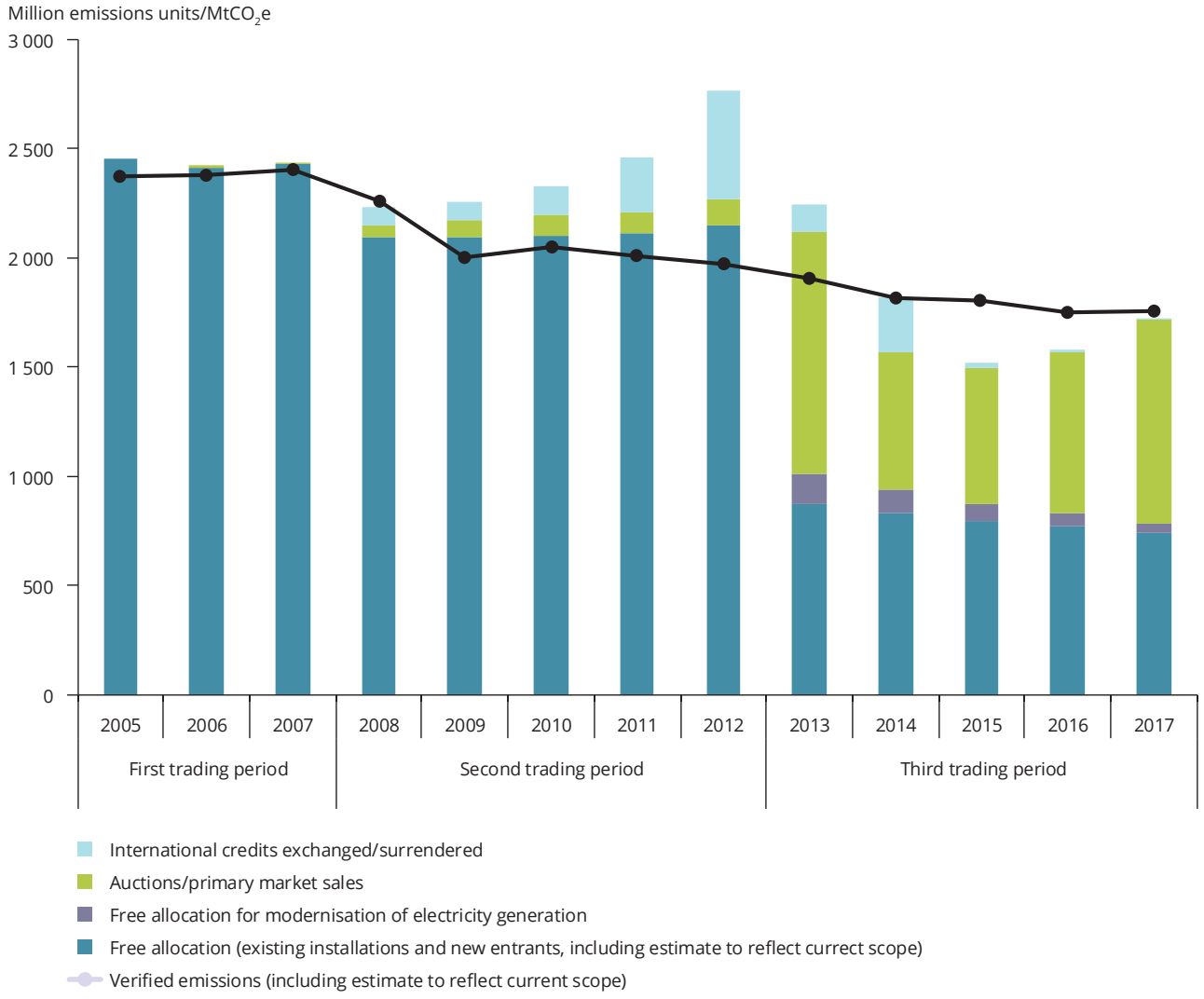
and comparable data on both production levels and verified emissions would be required for each of the industrial sectors.

### 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 were slightly below the total quantity of EU allowances allocated (mainly for free) by governments (Figure 2.5). The price of EUAs peaked at around EUR 30 (Figure 2.6), but this was before the release of verified emissions data in April 2006, which showed that the number of allowances available to EU ETS operators was higher than necessary, to cover verified emissions, and that this situation would remain until the end of the first trading period. Consequently, the EUA price dropped abruptly, and it remained close to zero until the end of 2007, as it was not possible to 'bank' surplus allowances between the first and the second trading periods.

After more stringent caps were set for the second trading period, verified emissions exceeded the supply of allowances in 2008, resulting in a price of around EUR 20 per EUA. After 2008, activities covered by the EU ETS were greatly affected by the economic recession, with the result that the supply of allowances exceeded verified emissions between 2009 and 2012. Coupled with a fixed supply of allowances (set by the EU ETS cap), this put downward pressure on the EUA price, which was reduced to around EUR 7 per EUA

**Figure 2.5 Supply and demand balance for stationary installations (2005-2017)**




**Note:** Refer to EEA (2017a) for further information.

**Sources:** EEA, 2018.

by the end of the second trading period. The surplus was further exacerbated by the increased use of CERs and ERUs, especially between 2010 and 2012, because many of them could no longer be used in the third trading period. As a consequence, international credits were being traded at less than EUR 1 per unit by the end of the second trading period.

By the start of the third trading period, the cumulative surplus stood at around 2 billion allowances. The backloading of allowances between 2014 and 2016 (a postponement in the overall quantity of allowances to be auctioned in a certain year) had an impact on the supply and demand balance, reducing the overall surplus, and, as a consequence, the EUA 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 a political agreement in November 2017 with regard to revising the EU ETS for the fourth trading period (EC, 2018e), the EUA price increased rapidly and had exceeded EUR 20 per unit by the start of September 2018. 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 and (2) the Market Stability Reserve (MSR) removing surplus allowances in circulation from 2019 onwards faster than originally proposed and that from 2023 onwards holdings in the reserve above the auction volume of the previous year will lose their validity (EC, 2018f). Apart from market speculation driving up the EUA price, demand for allowances has increased in 2018 due to increased levels of economic activity and extreme weather conditions across Europe. Indeed, the summer heatwave resulted in a high demand for energy for cooling as well as lower wind and hydropower production, which led to a rise in the use of fossil fuel sources, further increasing EUA prices.

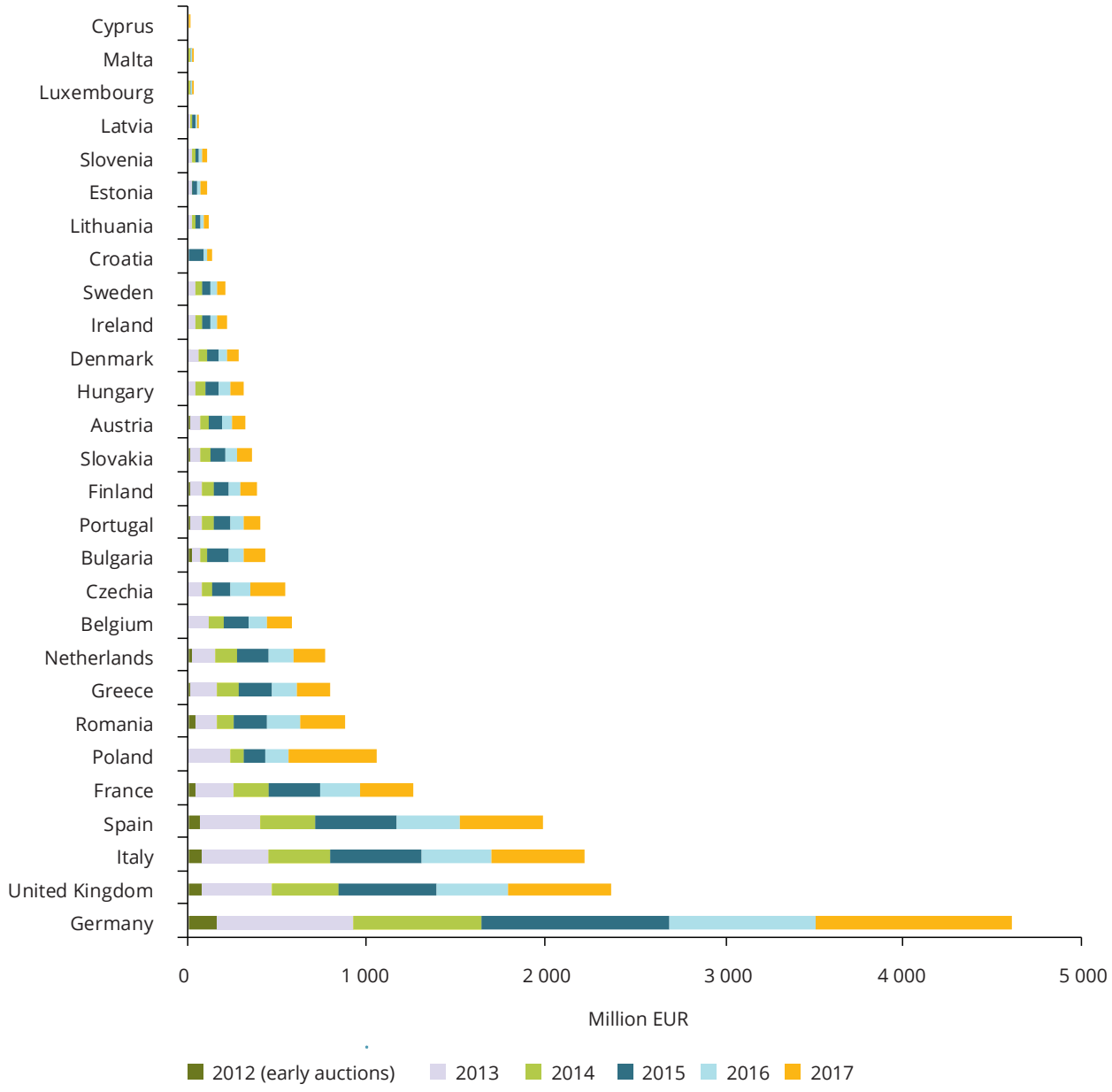
**Figure 2.6 Price trends for EUAs and certified emission reductions**


**Sources:** Point Carbon, 2012; EEX, 2018; ICE, 2018.

### *2.1.3 Auctioned allowances and auctioning revenues*

The level of auction revenue depends on many factors, including the number of allowances to be auctioned and the timing of auctions. Germany has so far received the highest revenue from EUAs (EUR 4.8 billion) in the third trading period, followed by the United Kingdom (EUR 2.5 billion) and Italy (EUR 2.3 billion) (Figure 2.7). These three Member States collectively account for 45 % of the EUA revenue generated so far in the third trading period (including early auctions in 2012). The impact of the backloading decision was particularly noticeable in 2014, with reduced auctioning revenues resulting from both lower volumes and lower EUA prices than in both 2015 and 2016. The increase in EUA revenues in 2017, compared with previous years, is due to both the end of the backloading measure increasing the number of allowances being auctioned and the EUA price increasing over the past year.

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




**Note:** 2012 (early auctions) refers to amounts that pertain to the year 2013, but were already auctioned a year earlier.

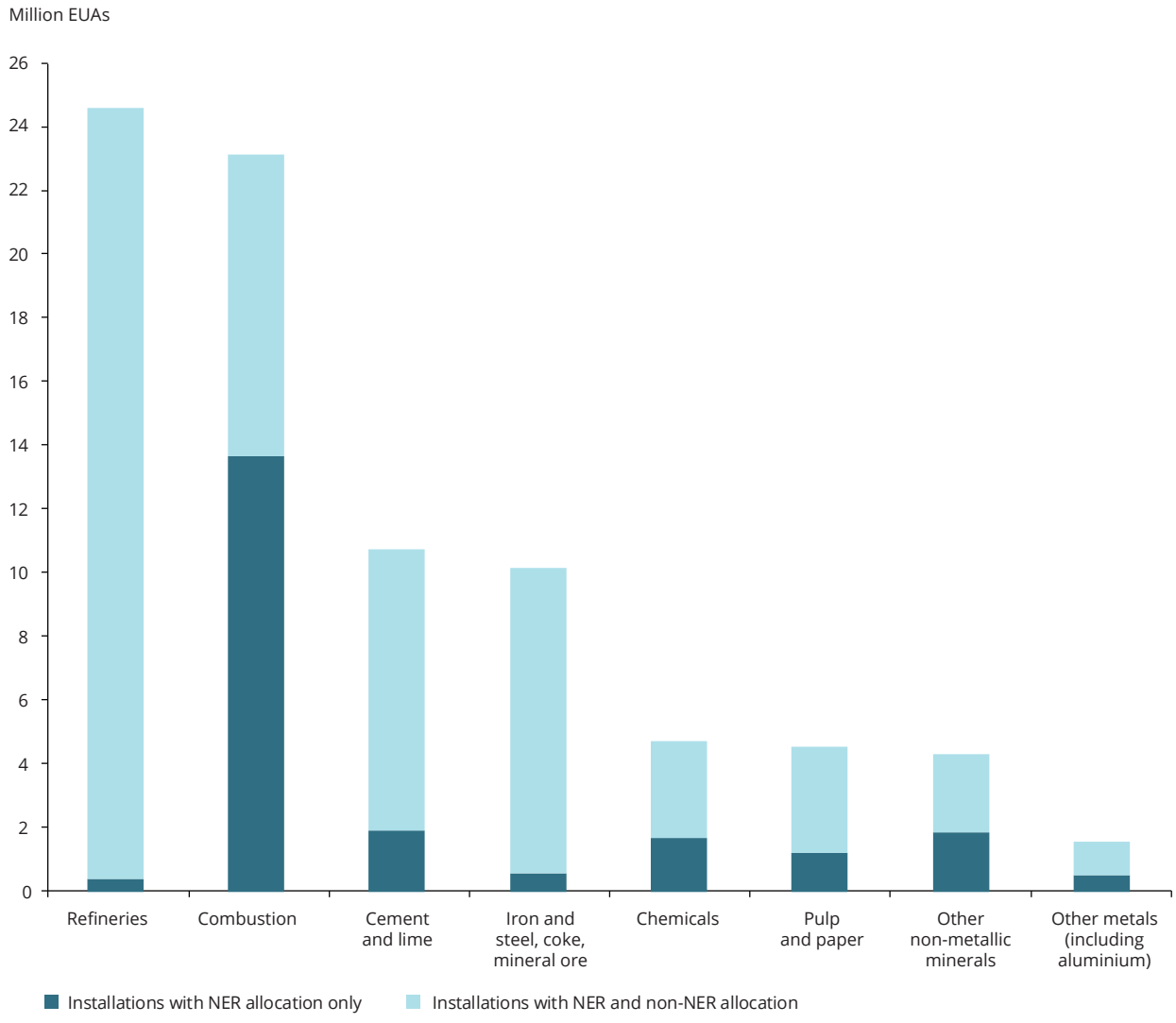
**Sources:** EEX, 2018; ICE, 2018.

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

To ensure a level playing field between new entrants and incumbents, a NER of 480 million ([27]) EUAs was set aside at the start of the third trading period for new installations ([28]) and existing installations achieved a 'significant' increase in capacity ([29]).

In the combustion sector, 59 % of the NER allowances allocated so far (i.e. 14.0 Mt of the 23.6 Mt) 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 the NER allowances have primarily been used for capacity extensions (i.e. installations with NER and non-NER allocations). For example, installations with capacity

**Figure 2.8 NER allocation (2013-2017) by sector and by eligibility type**




**Source:** EU, 2018b; authors' calculation.

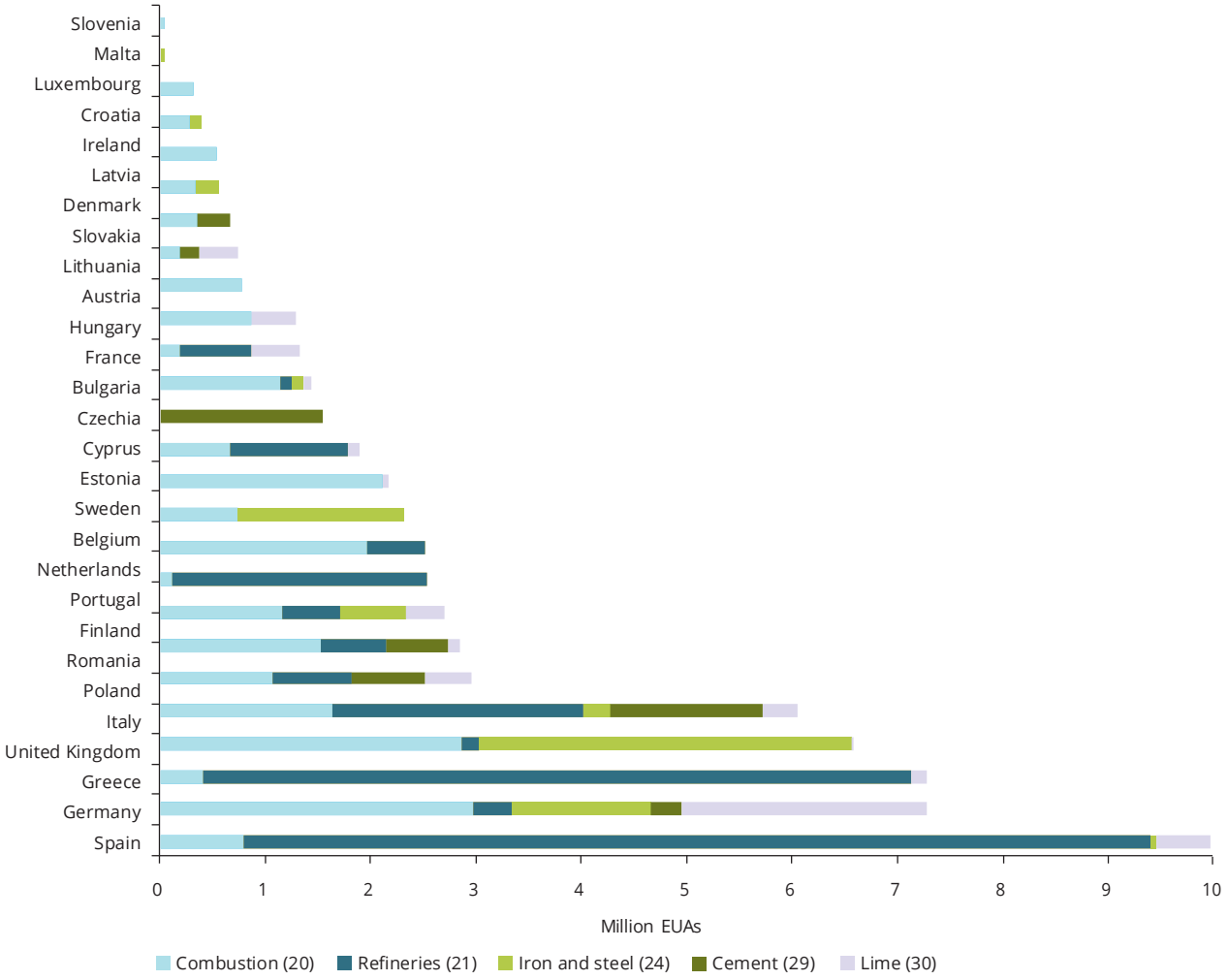
([27]) The original amount was 780 million allowances, from which 300 million were deducted for the NER 300 funding programme. NER 300 aims to establish a demonstration programme comprising the best possible projects on carbon capture and storage and renewable energy sources and involving all Member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

([28]) 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.

([29]) 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).

extensions accounted for 98 % of the NER allowances that the refinery sector received (i.e. 24.7 Mt out of the 25.1 Mt) between 2013 and 2017. The majority of these NER allowances were allocated to refineries in Spain, Greece and Portugal (Figure 2.9). Similarly, the majority of the 11.0 Mt of NER allowances provided for 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 10.4 Mt of NER allowances between 2013 and 2017, again primarily to installations with capacity extensions, this time based in Belgium and the United Kingdom.

**Figure 2.9 Cumulative NER allocation (2013-2017) by sector and by country**




**Note:** Covers 78 % of the NER allowances issued between 2013 and 2017. Represents NER allowances provided to EU-28 Member States for five EUTL activities only.

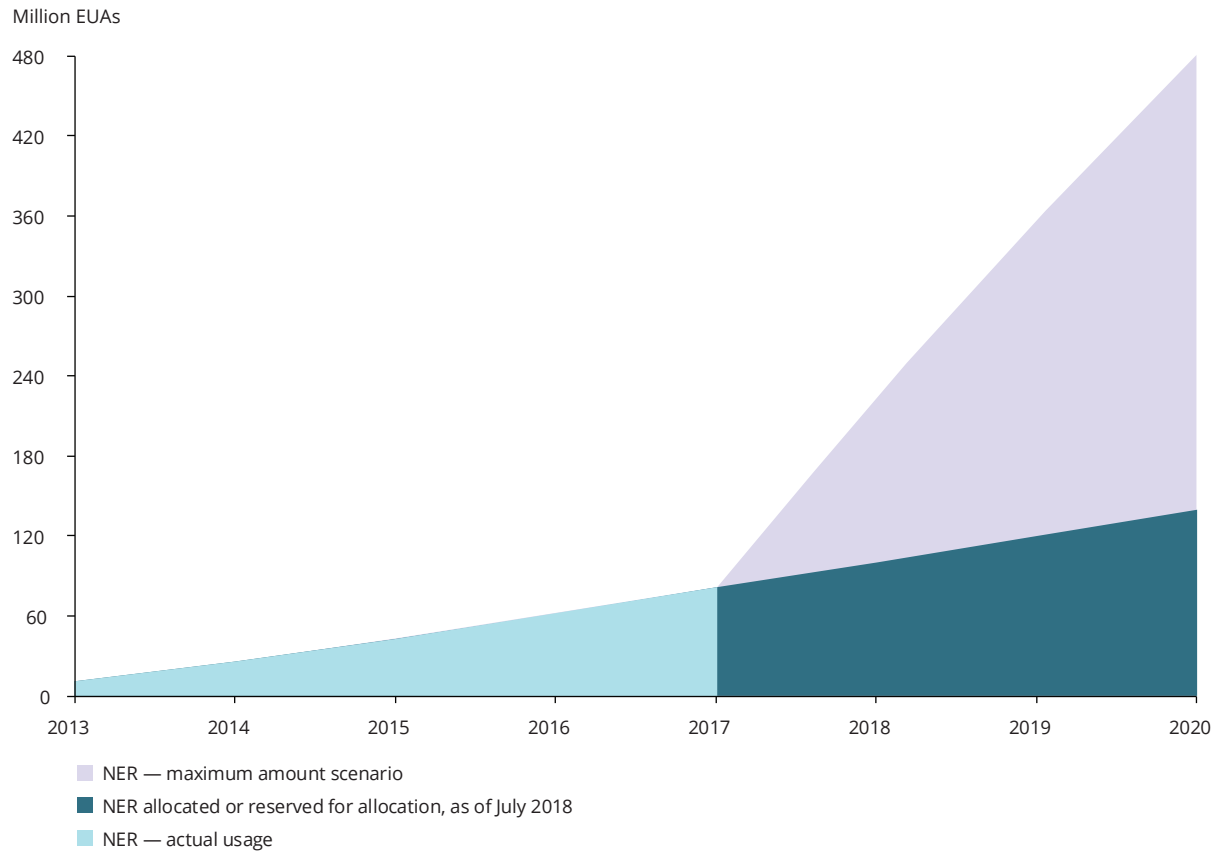
**Source:** EU, 2018b; authors' calculation.

Figure 2.10 shows that by the end of July 2018 only 31.9 % of the allowances available in the NER for the third trading period had been allocated. In absolute terms, 327.1 million EUAs remain available from the NER until 2020 (EC, 2018c). The allowances that will remain unallocated until 2020 are to be put into the MSR.

### *2.1.5 Transitional free allocation to modernise electricity generation*

The free allocation of up to 680 million allowances under Article 10(c) is contingent upon the value of these allowances being invested in efforts to

**Figure 2.10 Extrapolation of the cumulative use of the New Entrants Reserve budget**




**Note:** The maximum amount scenario is calculated by taking the remaining budget between 2017 and 2020 and distributing this evenly over the remaining years of the period up to 2020 to show how much of the NER is still available.

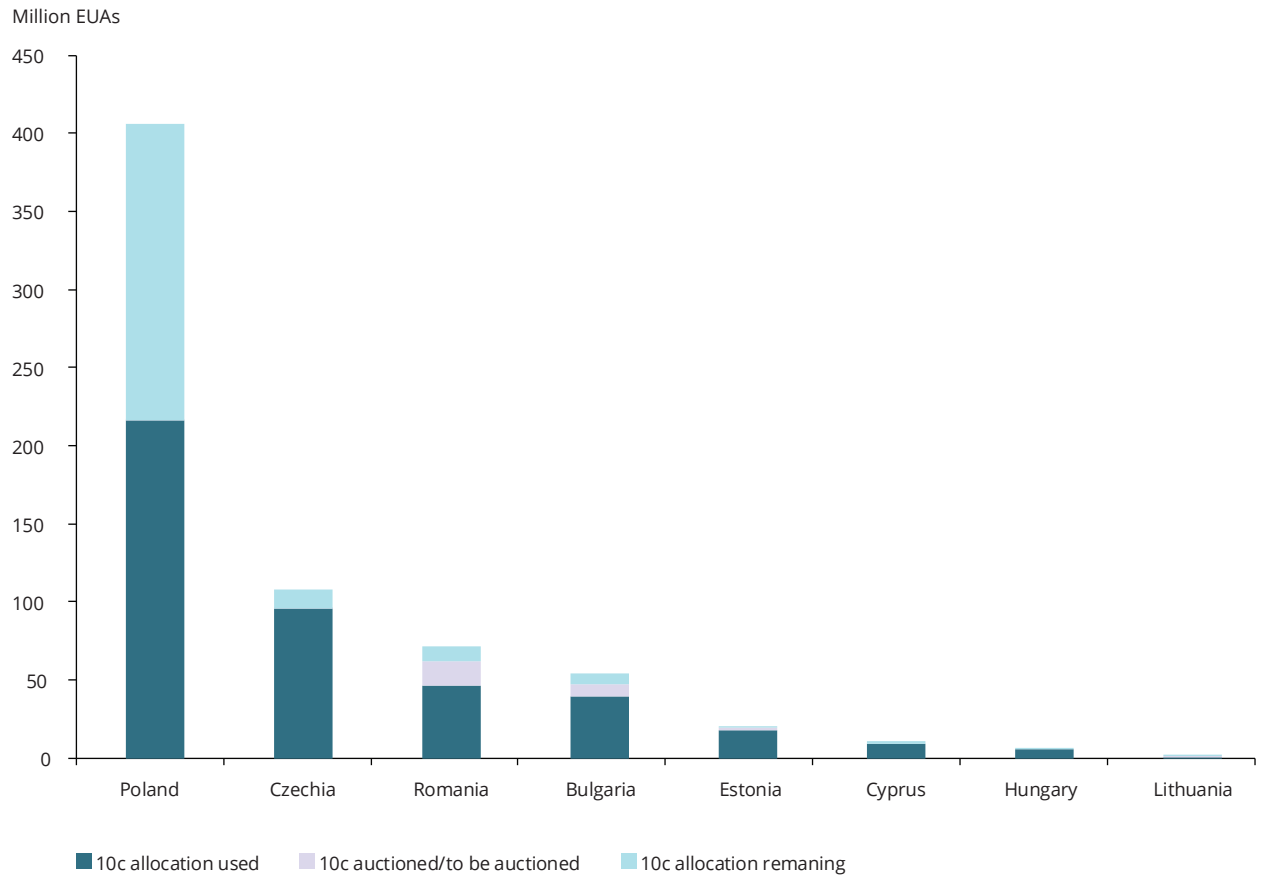
**Sources:** EU, 2018b; EC 2018c; authors' calculation.

modernise the electricity generation of the eligible Member States and diversify its fuel mix. Over half of the maximum budget (68 %) for Article 10(c) allowances was used between 2013 and 2017 (Figure 2.11). Poland has the largest number of allowances that have not yet been used (i.e. 34 % of its maximum Article 10(c) allocation up until 2017 has so far not been used). These could be used by the power sector in future years (provided that a sufficient number of investments included in the National Investment Plan for Article 10(c) allocation are realised) or instead auctioned. Following reforms to the EU ETS, allowances not included in transitional free allocation up to 2020 could be transferred to the fourth trading period, to investments selected by competitive bidding.

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 (EC, 2017b). The total value of reported investment between 2009 and 2015 was around EUR 9.5 billion, with approximately 80 % of the investments dedicated to upgrading and retrofitting infrastructure (EC, 2017b). 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 Czechia (clean technologies); and

**Figure 2.11 Use of Article 10(c) allowances between 2013 and 2017, by Member State**




**Note:** Includes Article 10(c) amounts to be auctioned in 2018.

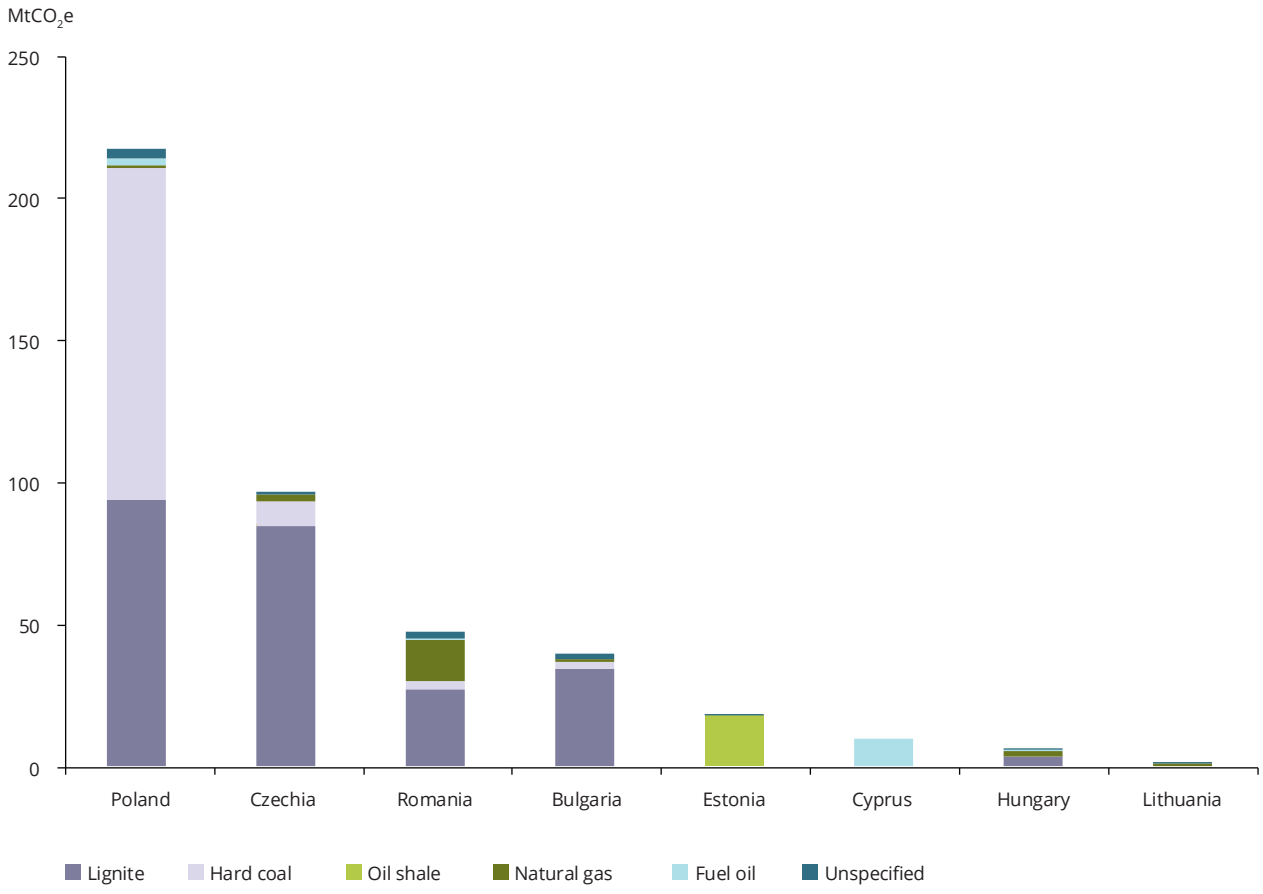
**Sources:** EC, 2012a; 2012b; 2012c; 2012d; 2012e; 2012f; 2012g; 2012h; 2018g; EU, 2018b.

- 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, the majority of Article 10(c) allowances have been distributed to lignite-fired and hard coal-powered plants, mainly in Bulgaria, Czechia, Poland and Romania. In fact, between 2013 and 2017, 56 % and 30 % of the Article 10(c) allowance allocation was issued to lignite and hard coal plants, respectively (Figure 2.12). 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).

In the revised directive EU 2003/87, transitional free allocation for the modernisation of the energy sector under article 10c will require 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', so that the overall electricity generation capacity becomes less carbon intensive over time.

**Figure 2.12 Free allocation for the modernisation of electricity generation, differentiated by fuel type of the receiving power plant and Member State, 2013-2017**




**Notes:** Allowances issued to only 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 was completed by the Öko-Institut.

**Sources:** EC, 2012a; 2012b; 2012c; 2012d; 2012e; 2012f; 2012g; 2012h; EU, 2018b; Platts, 2014; EC, 2018g.

### *2.1.6 Use of international credits for compliance*

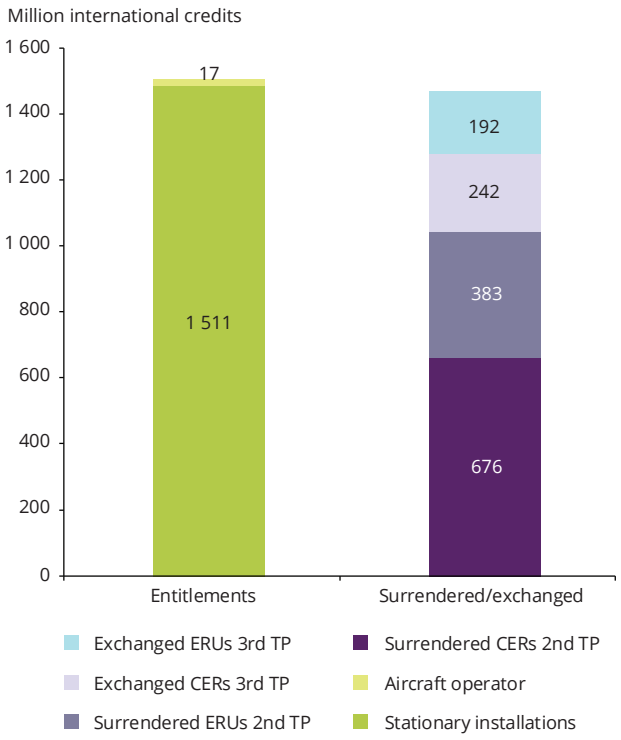
The estimated budget for international credits between 2008 and 2020, compared with the units either surrendered or exchanged during the second and third trading periods, is shown in Figure 2.13. Operators under the EU ETS are allowed to use international emission credits to comply with part of their legal obligation to surrender allowances equivalent to their verified emissions ([30]). International credits from the Clean Development Mechanism (CDM) and Joint Implementation (JI) projects can be used with certain qualitative restrictions ([31]). Since April 2015, emission reductions that occurred in the first commitment period of the Kyoto Protocol (2008-2012) can no longer be exchanged (EC, 2018i).

Based on the latest information on the CERs and ERUs exchanged, Figure 2.13 shows that a very small share of entitlements remained at the end of 2017. However, although the majority of CER/ERUs have already been surrendered or exchanged, international credit entitlements continue to be provided every year to certain installations based on their verified emissions between 2013 and 2020 ([32]).

In the third trading period, 56 % of the exchanged international credits originated in CDM projects (outside the EU) and 44 % originated in JI projects (Figure 2.14). However, the type of projects generating credits differed significantly.

Approximately one third of all international credits originated in CDM projects related to renewable electricity generation. By contrast, renewables played only a limited role in the JI project portfolio. The second largest project type is the dismantling of coal piles, which took place only under JI. The use of international credits has been under discussion because of concerns about the environmental integrity associated with some offsets and their contribution to the current surplus of allowances in the EU ETS. The European Council has decided on a domestic emission reduction target after 2020, meaning that international credits are not expected to be used in the next trading period of the EU ETS.

**Figure 2.13 Allowed and existing use of international credits (2008-2020)**




**Notes:** International credit entitlements from EUTL.
TP, trading period.

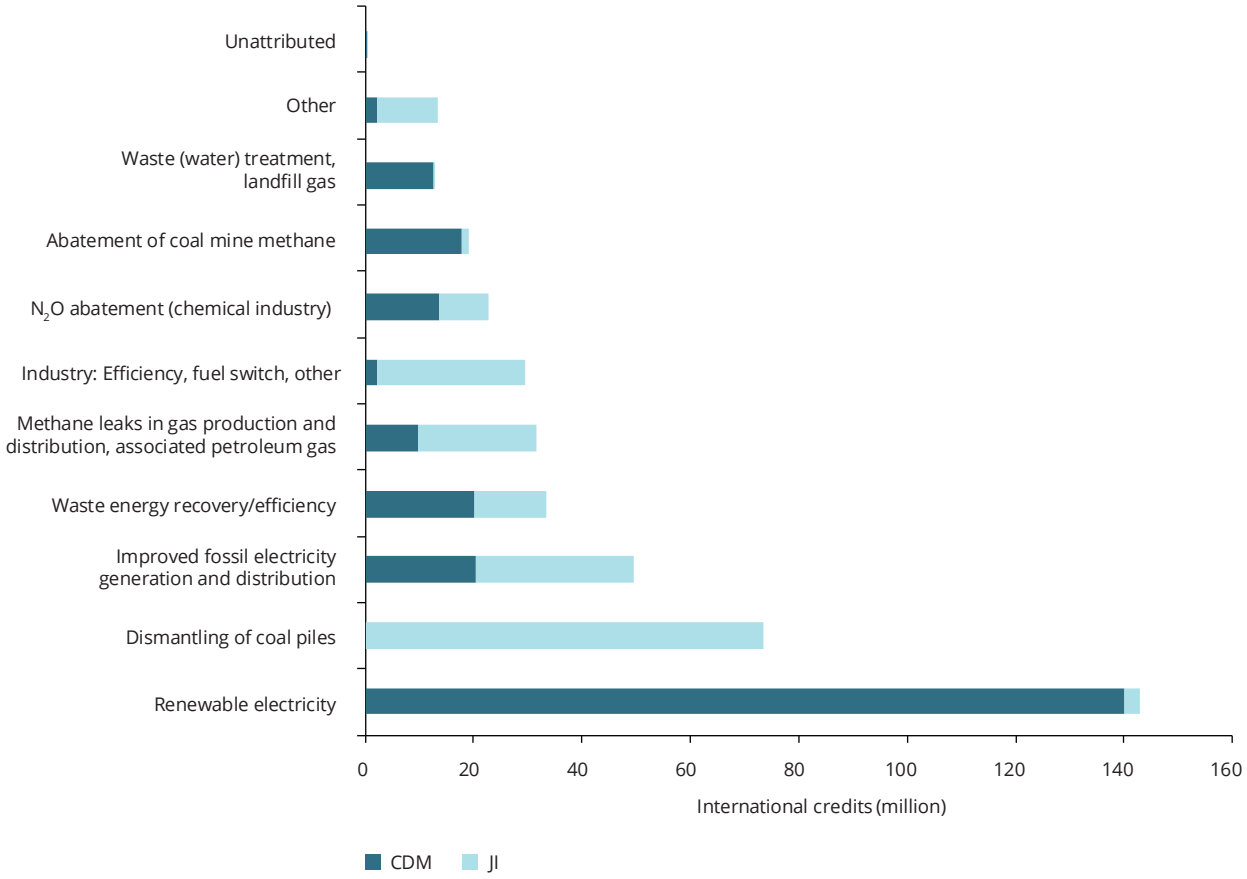
**Sources:** EC, 2018h; EEA, 2018.

([30]) These credits stem from flexible mechanisms set 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.

([31]) Excluded from the start of the scheme were nuclear energy projects and afforestation and reforestation projects; 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).

([32]) For stationary installations without free allocation between 2008 and 2012, which also received their first emissions permit after 30 June 2011, their CER/ERU usage is set based on 4.5 % of their verified emissions from 2013 to 2020. CER/ERU usage may also be based on 2013-2020 verified emissions for stationary installations that have had a 'significant capacity extension'. The overall number of entitlements available, therefore, needs to be annually updated beyond what is already fixed, based on an installation's total allocation between 2008 and 2012. Aviation operators are also eligible to use CERs and ERUs up to 1.5 % of their verified emissions between 2013 and 2020 (plus any remainder from the claims in 2012). Refer to (EU, 2013b) for more information.

**Figure 2.14 Certified emission reductions and emission reduction units exchanged for allowances in the third trading period up to 30 April 2018 by project type**




**Notes:** The international credits shown in the graph above total 434.1 million over the third trading period until 30 April 2018.

Attribution of exchanged international credits to project types was completed by the Öko-Institut.

**Sources:** UNFCCC, 2018a; 2018b; 2018c; 2018d; EC, 2018h.

## 2.2 Aviation

### *2.2.1 Emission trends*

***Status in 2016***

During the third trading period, Ryanair has been consistently responsible for the largest amount of verified emissions from an individual aircraft operator (Table 2.1). However, Wizz Air actually experienced the fastest growth in emissions during this period (i.e. emissions increased by 90% between 2012 and 2017). Some of the more established airlines experienced slower growth in emissions during the same period, with operators such as British Airways increasing their verified emissions by 5 %. An important change from the previous list of top 14 emitters is the absence of Air Berlin, which in 2017 filed for insolvency.

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

Figure 2.15 illustrates the development in the supply of and demand for EUAAs between 2012 and 2017. The difference in emissions between 2012 and 2013 was due to a change from a full to a reduced scope regarding aviation activities covered by the EU ETS ([33]).

**Table 2.1 Top 14 emitters in aviation**

| | Verified emissions ($MtCO_2e$) | | | | | |
|---|---|---|---|---|---|---|
| | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **Total Aviation** | **84.0** | **53.5** | **54.8** | **57.1** | **61.5** | **64.2** |
| Ryanair Designated Activity Company | 7.5 | 6.6 | 6.6 | 7.4 | 8.4 | 9.2 |
| EasyJet Airline Company Ltd | 4.6 | 4.3 | 4.4 | 4.7 | 5.1 | 5.4 |
| Deutsche Lufthansa AG | 4.9 | 4.4 | 4.0 | 3.8 | 3.8 | 4.0 |
| British Airways PLC | 2.5 | 2.5 | 2.5 | 2.6 | 2.7 | 2.7 |
| Scandinavian Airlines System SAS | 3.6 | 2.3 | 2.4 | 2.4 | 2.4 | 2.5 |
| Air France | 3.8 | 2.6 | 2.4 | 2.4 | 2.3 | 2.4 |
| Wizz Air Hungary Ltd | 1.1 | 1.1 | 1.3 | 1.5 | 1.8 | 2.1 |
| Vueling Airlines S.A. | 1.3 | 1.3 | 1.6 | 1.8 | 2.0 | 2.0 |
| Koninklijke Luchtvaart Maatschappij N.V. | 1.9 | 1.5 | 1.6 | 1.6 | 1.6 | 1.8 |
| Alitalia Società Aerea Italiana S.p.A. | 1.9 | 1.7 | 1.6 | 1.5 | 1.5 | 1.4 |
| Norwegian Air International Ltd | 0.0 | 0.0 | 0.0 | 0.1 | 1.0 | 1.3 |
| Eurowings GmbH | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 | 1.3 |
| Norwegian Air Shuttle Asa | 1.7 | 1.8 | 2.1 | 2.0 | 1.4 | 1.2 |
| Transportes Aéreos Portugueses, S.A. | 1.3 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 |

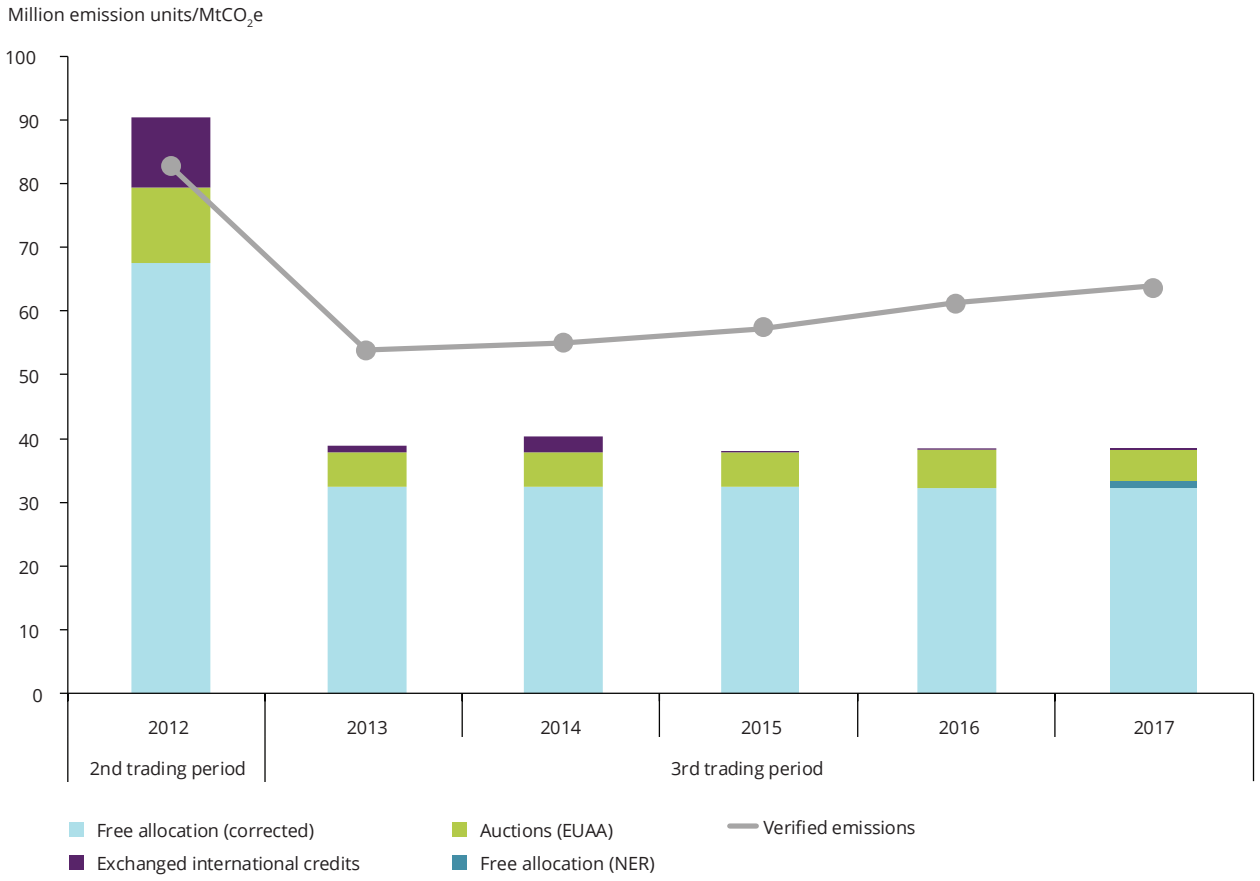
**Note:** For the period 2013-2017, only flights within the European Economic Area are covered under the EU ETS. Flights between the continental European Economic Area and its outermost regions are also exempt, for example flights between mainland Europe and the Canary Islands.

**Source:** EEA, 2018.

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

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 for allowances increased further in 2017 as verified emissions rose in comparison with the previous year. As a result, the cumulative net demand from the aviation sector had increased to 92 Mt by the end of 2017.

**Figure 2.15 Demand and supply balance for European Union Aviation Allowances (EUAAs) (2012-2016)**




**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 volumes of aviation allowances effectively released to the market in 2015 were 16.4 million EUAAs. However, in order not to distort the supply-demand balance, the allowances were distributed evenly by the European Economic Area between 2013 and 2015.

International credit use by aircraft operators in the third trading period is not reported. The overall use of the CER/ERU entitlements by operators of stationary installations and aircrafts, together, amounts to 98% in 2017. To estimate international credit use for aircraft operators, it is assumed that all operators make use of their entitlements to the same extent.

**Sources:** EC, 2014c; 2015b; 2016a; 2017d; 2018h; EEA, 2018.

The auctions of EUAAs occur less frequently than those of EUAs as a result of the smaller number of the former that are available for auction. As a consequence of the change from a full to a reduced scope regarding aviation activities covered by the EU ETS, the auction calendar was revised, resulting in no EUAAs being auctioned in 2013. When the auctioning of EUAAs resumed in 2014, the 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 recent 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 2.16). The delay in auctioning in 2017 can be clearly observed in Figure 2.16. In 2018, the EUAA price had risen rapidly to around EUR 20 per unit by the start of September.

**Figure 2.16 Price trends for EUAAs compared with EUAs (2012-2017)**

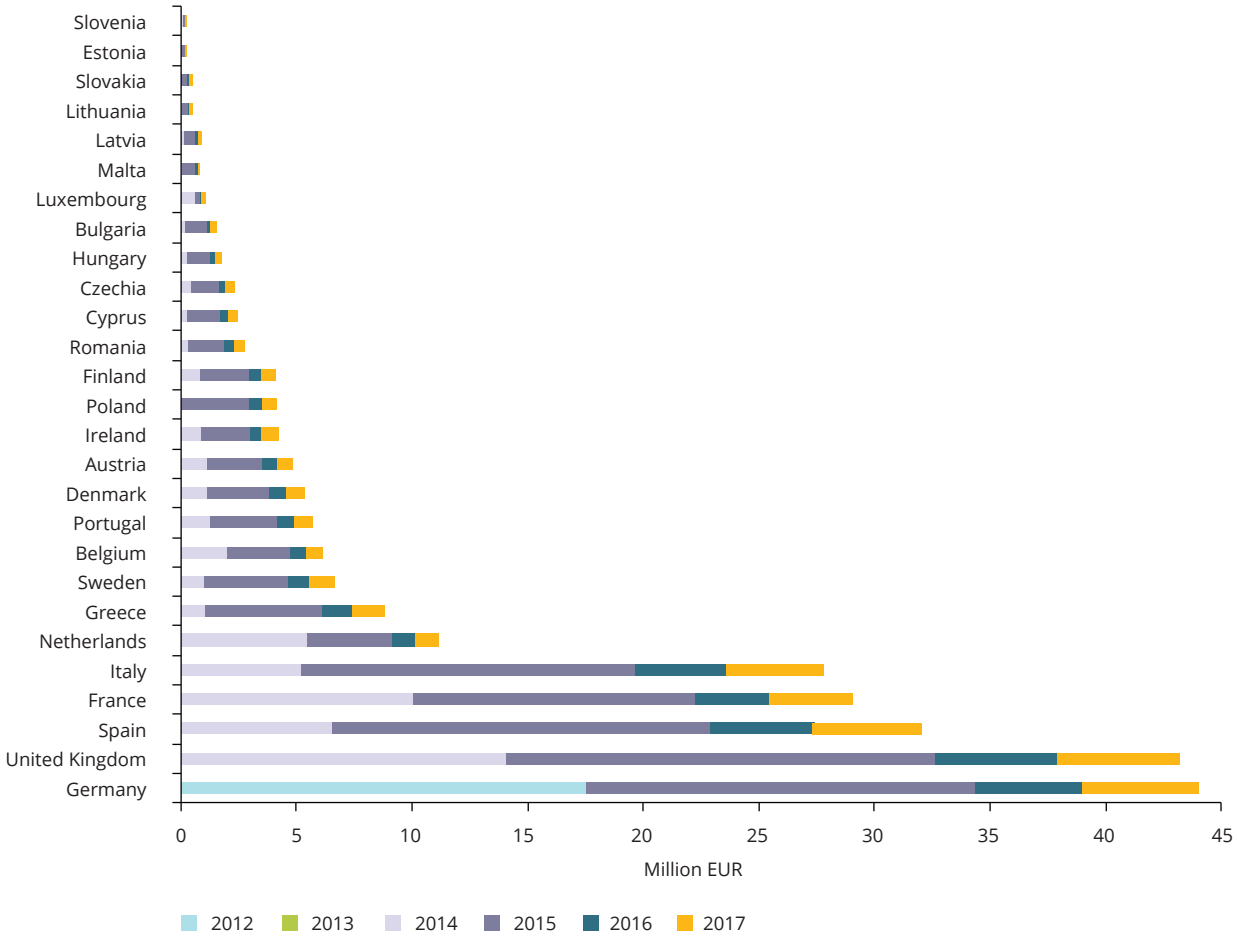

**Note:** The EUA price represents historical spot price data from the secondary market in 2012. In the third trading period, the EUA price refers to primary market auctioning data from the EEX and ICE trading platforms. This trend is compared with the shorter time series of EUAA prices from primary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

**Sources:** Point Carbon, 2012; EEX, 2018; ICE, 2018.

### *2.2.3 Auctioned allowances and auctioning revenues*

The level of auction revenue depends on a number of factors, including the number of allowances to be auctioned and the timing of auctions, which, among many other factors, influence the auction price. Germany received the largest revenues from the auctioning of EUAAs over the period (EUR 44 million), followed by the United Kingdom (EUR 43 million) (Figure 2.17). The revenues from Germany and the United Kingdom alone account for 34 % of the total revenue received by Member States. Overall, the total revenue from EUAAs in 2017 was higher than in the previous year. This is due to the price of EUAs and correspondingly the price of EUAAs increasing over the course of 2017 although the number of allowances auctioned being lower in 2017 than in the previous year.

**Figure 2.17 EUAA auction revenues by Member State, 2012-2017**




**Note:** The allowances auctioned in this graph refer to the actual amounts (not evenly distributed over the period 2013-2015) to account for delays in the auctioning calendar.

**Sources:** EEX, 2018; ICE, 2018.

# 3 Projected trends

- According to the projections that EU Member States reported in 2017 under EU legislation (and updates from Cyprus and Ireland in 2018), EU ETS stationary emissions are projected to continue decreasing with existing measures (WEM) in place, by 8.7 % between 2015 and 2020, and by a further 6.4 % between 2020 and 2030. This would be a reduction of 35 % compared with 2005. If additional measures reported by Member States are also taken into account, emissions in stationary EU ETS sectors would decrease by 38 % compared to 2005.
- The emissions projected from the WEM scenario are expected to reduce more slowly than historically, with emissions higher than the EU ETS cap from only 2025 onwards. Therefore, the overall projected reduction is not yet in line with the objectives for EU emission reductions for 2030 (- 43 % compared to 2005). However, the strengthening of the ETS price in recent months may help to encourage further mitigation efforts towards reaching the 2030 target.
- The recent revision to the EU ETS for the fourth trading period will enhance the ability of the MSR to reduce more rapidly the current surplus of allowances from 2019 when it comes into operation.
- Based on the development in emissions expected by Member States under the WEM scenario and on the agreed rules concerning the intake rate of surplus allowances by the MSR, the EEA estimates that the current surplus of EUAs in the EU ETS will decline during the fourth trading period to below the lower MSR threshold.
- The scope for aviation in the EU ETS is temporarily limited to intra-EEA flights. The derogation for extra EEA flights is prolonged until 31st of December 2023.

## 3.1 Stationary installations

### *3.1.1 Emission trends*

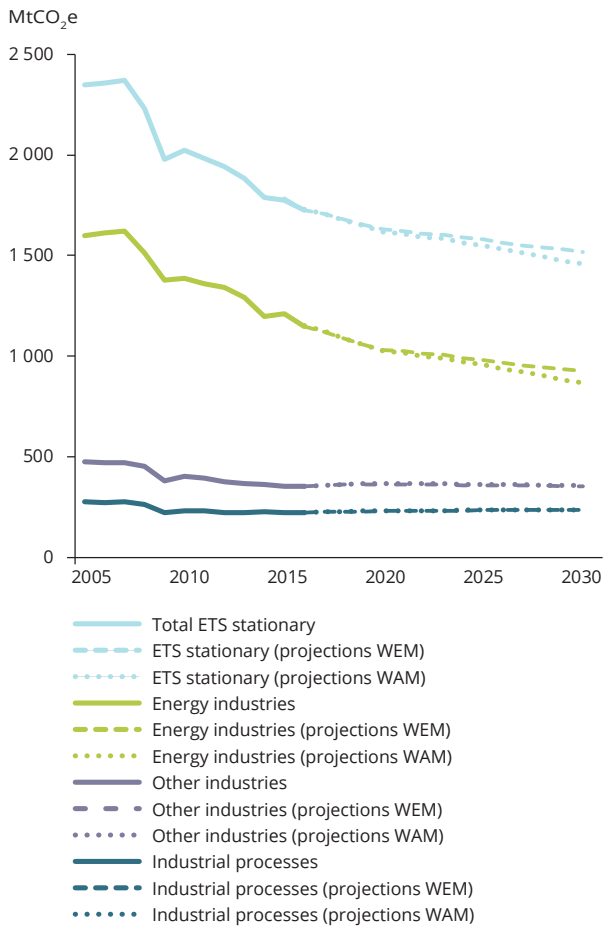
According to the projections reported by EU Member States in 2017 and 2018 under EU legislation ([34]), EU ETS emissions are projected to further decrease with the current policies and measures in place ([35]) (Figure 3.1). The decrease in EU ETS emissions is projected to take place predominantly in the energy sector ([36]), whereas EU ETS emissions in other sectors are projected to remain stable until 2030. These projected trends contrast with historical trends, which showed decreases in a number of industrial sectors, such as manufacturing, construction and industrial processes. If only existing policies and measures are considered, a reduction of 35 % compared with 2005 is estimated in Member States' submitted projections. This would not be sufficient to reach the targeted reduction of EU ETS emissions until 2030. With the additional policies and measures reported by some Member States, emissions would decrease by 38 % compared with 2005, coming closer to the EU ETS-wide reduction target of 43 %. None of these national projections take into account the latest revisions of European energy and climate targets, especially the EU ETS reform.

([34]) 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, 2013a).

([35]) The analysis is based on projections of EU ETS emissions under the WEM scenario, reported by Member States under the Monitoring Mechanism Regulation (MMR), following the structure and format provided by the Implementing Regulation (EU) No 749/2014 (EU, 2014b). The projections were compiled, assessed and quality checked by the EEA and its European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM).

([36]) 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 projected emissions between 2005 and 2030, by inventory category**




**Notes:** Solid lines represent historical greenhouse gas emissions up to 2017. Dashed lines represent projections under the WEM scenario. Dotted lines represent projections under the 'with additional measures' (WAM) scenario.

Projections of stationary EU ETS emissions cover the EU only, whereas the total reported is higher in other sections of this report as a result of including Iceland, Liechtenstein and Norway.

**Sources:** EEA, 2018; projections of EU Member States compiled by the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM) as of June 2018.

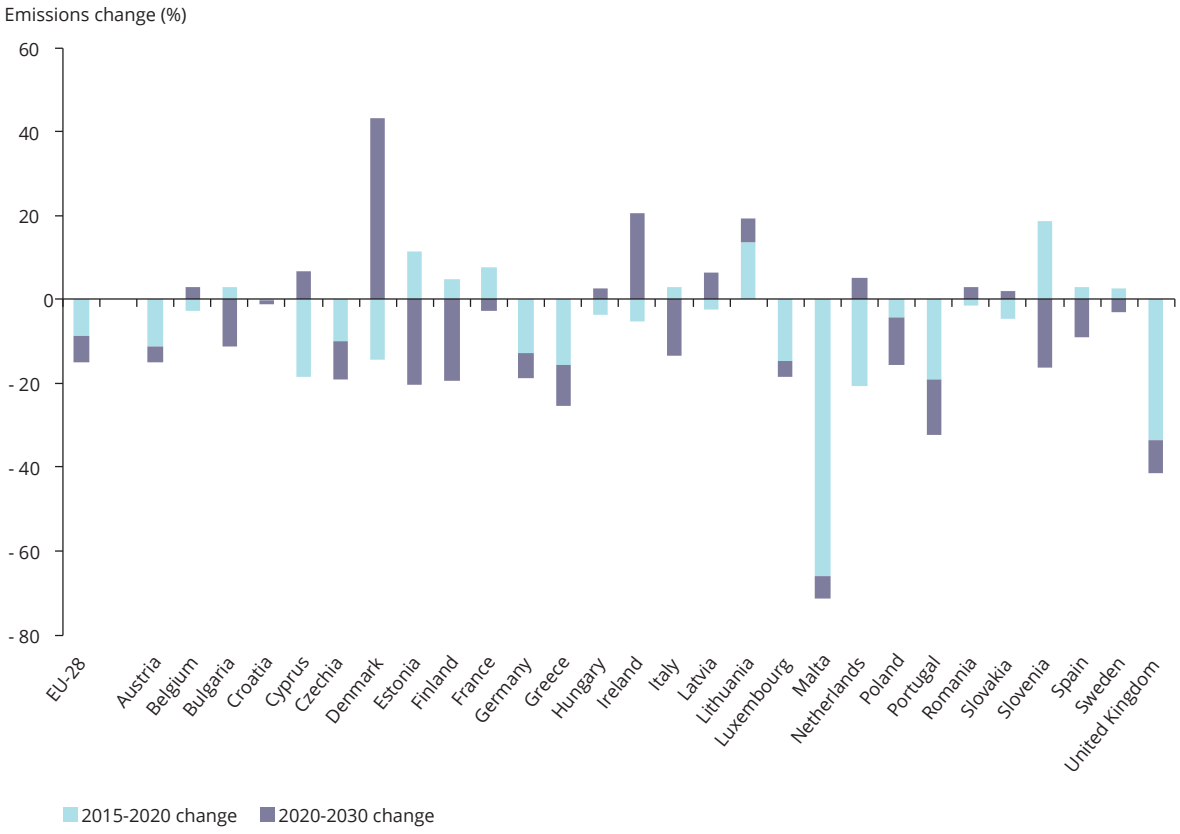
Figure 3.2 shows that emissions are expected to decline in 21 EU Member States between 2015 and 2030 under the WEM scenario, with reductions ranging from 0.4 % for Sweden to 71.4 % for Malta. Interestingly, emissions are expected to decrease more over the 5-year period from 2015 to 2020 ([37]) than over the 10-year period from 2020 to 2030 ([38]). Between 2015 and 2020, projections show decreases in EU ETS emissions in 18 EU Member States, while 19 EU Member States also project emission reductions between 2020 and 2030. Lithuania is the only Member State to project increasing EU ETS emissions in both periods.

Based on updated emission projections submitted in 2018, Ireland now also expects to achieve a reduction in EU ETS emissions between 2015 and 2030, and estimates that emissions will now be lower than in its previous projection submission in 2020 and up to 2030. Emissions in the energy sector are projected to decline under the WEM scenario as the use of peat for power generation reduces significantly and is replaced by gas. This is partly because in 2019 the Public Service Obligation (PSO) levy will end, which currently supports peat being used for power generation (Environmental Protection Agency, 2018).

Cyprus also submitted updated projections in 2018, which showed higher EU ETS emissions (than in the previous submission) up until both 2020 and 2030, but with a decreasing trend between 2020 and 2030. The increase in EU ETS emissions until 2020 in the WEM scenario reflects a delay to the start of natural gas utilisation in the country and an acknowledgement that the national target of 16 % renewable energy sources (RES) in electricity by 2020 will not be achieved without additional measures. It is expected, under the WEM scenario, that EU ETS emissions will decline between 2020 and 2030 as a result of the further promotion of RES and energy efficiency to contribute to 2030 EU-level targets (Cyprus, 2018).

([37]) Emissions projected to reduce by 8.7 % on 2015 levels between 2015 and 2020.
([38]) Emissions projected to reduce by 6.4 % on 2015 levels between 2020 and 2030.

**Figure 3.2 Changes in EU ETS emissions projected by EU Member States for 2015-2020 and 2020-2030 relative to 2015 emission levels under the WEM scenario**




**Sources:** EEA, 2018; projections of EU Member States, compiled by ETC/ACM as of June 2018.

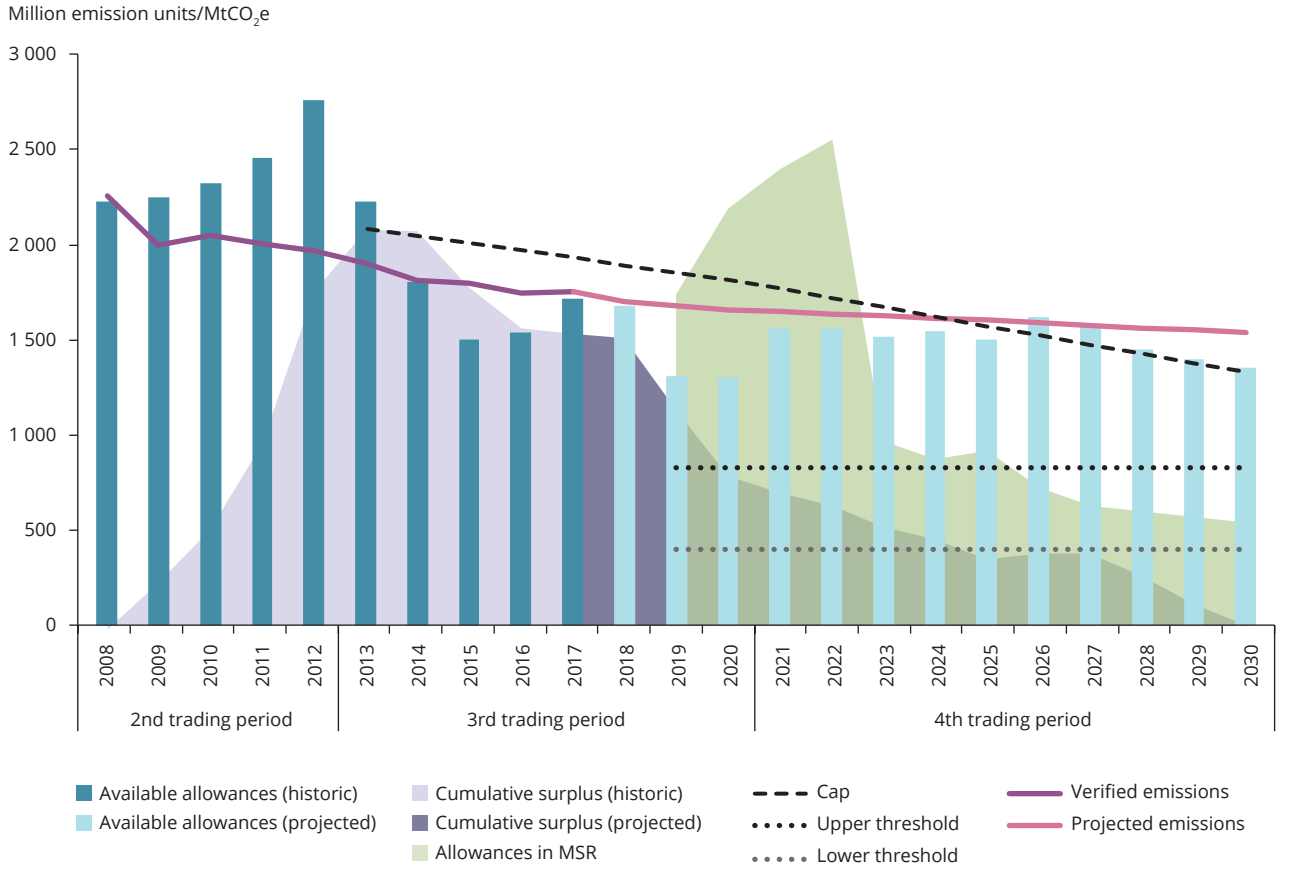
### *3.1.2 Balance of allowances*

The surplus of allowances accumulated in the EU ETS stood at around 1.6 billion by the end of 2017 (EC, 2018d). Figure 3.3 shows how the supply and demand of allowances could develop until 2030, based on combining static data from different Member State projections with a supply profile including assumptions that reflect changes to the ETS Directive after 2021. This reflects both the impact of backloading auction volumes ([39]) between 2014 and 2016, through the Auctioning Regulation (EU, 2014a), and the future impact of the MSR ([40]), as decided by the EU (2015) and the changes agreed on in EU (2018a). The estimated balance also takes into account the increase in the LRF from 2021 ([41]); it should, therefore, be considered illustrative, as it cannot fully reflect all future policy developments and changes in the $CO_2$ price. Figure 3.3 depicts the total allowances in circulation, which differs from the cumulative surplus shown elsewhere in this report (e.g. Figure ES.1) in that net demand from aviation is not taken into account, as it is hard to predict how this will develop.

The MSR will begin in 2019 and will address the current surplus of allowances while improving the system's resilience to major shocks by adjusting the supply of allowances to be auctioned. The outcome of the recent revision to the EU ETS for the fourth trading period (EU, 2018a) will further strengthen the MSR's ability to more rapidly reduce the surplus. The key provisions with regard to the MSR's operation include the following:

([39]) To address the imbalance in the supply and demand of allowances, the European Commission first postponed the auctioning of 900 million allowances.
([40]) The MSR is a structural measure to address the cumulative surplus in the short term and improve the system's resilience to major shocks in the long term, by adjusting the supply of allowances based on predefined rules (see Section A1.4).
([41]) The LRF is set to be increased from 1.74 % to 2.2 % starting in 2021.

**Figure 3.3 Outlook on the supply and demand of allowances until 2030**




**Notes:** Please refer to Annex 1 for a detailed description of data sources and assumptions, particularly on the development of unused/unallocated allowances until 2020. Available allowances include free allocation, allowances auctioned and sold and the use of international credits. The figure shows available allowances and verified emissions in the current scope. The total amount of allowances in circulation differs from the cumulative surplus shown in Figure ES.1. Consistent with EU (2015) it does not take into account net demand from aviation, while Figure ES.1 does.

**Sources:** Authors' calculation based on the projections of EU Member States and Norway, which were compiled by ETC/ACM as of June 2018, in addition to data sources set out in Annex 1.

1. The intake rate of the MSR (i.e. the rate at which the allowances in circulation if above the 833 Mt threshold are absorbed by the reserve) will be 24 % between the years 2019 and 2023 and will be reduced to 12 % per year afterwards.

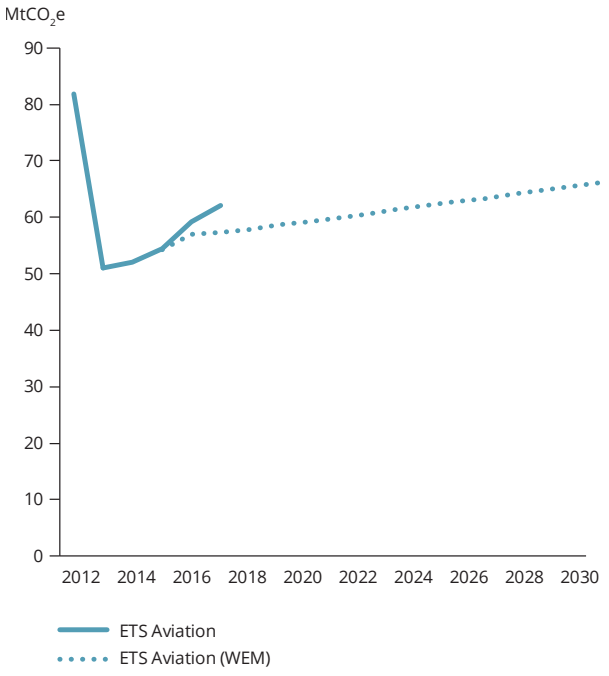
2. The invalidated allowances in the MSR from 2023 will be equivalent to the difference between the total allowances in the MSR and the number of allowances auctioned in the previous year.

3. A significant share of allowances unused in the third trading period will be added to the MSR in 2019 and 2020, and will contribute to the Innovation Fund and the NER set up in the fourth trading period.

Allowances available include those given freely and those auctioned and sold, as well as international credits used/exchanged for EUAs. During the third trading period, allowances available exceeded the cap in 2013 as a result of the significant use of international credits. Because of backloading (2014-2016), a drop in international credit use from 2015 and the fact that allowances remain unused (e.g. because of cessations and closures or because the budget available for new entrants or transitional free allocation to the electricity sector was not used up), the allowances available remained below the cap since 2014.

When the MSR starts in 2019, the number of allowances available is expected to drop significantly, as auction amounts are reduced according to the amount taken into the MSR, especially in 2019 and 2020. The modelling assumes that allowances will be added to the MSR until 2023. From 2024, allowances will be neither added to nor dispensed from the MSR and the amount of allowances available between 2024 and 2030 will follow the cap, with an additional 47 million allowances available every year from the NER for the fourth trading period (fed from allowances unused in the third trading period and assumed to be allocated in equal tranches across the fourth trading period).

**Figure 3.4 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 of aviation emissions cover only the EU, whereas the total reported is higher in other sections of this report because of the inclusion of Iceland, Liechtenstein and Norway.

The reference year for the projection for the EU-28 is 2015, meaning that projections are calibrated to this year. In addition, at the time of processing, data for aviation emissions in 2017 were not available, which is why the increase in emissions could not be reflected in projections.

**Sources:** EEA, 2017; projections of EU Member States, compiled by ETC/ACM in 2015 and 2017.

Based on the projections under the WEM scenario reported by Member States in June 2018, the EEA estimates that the total allowances in circulation could be under the intake threshold from 2022 onwards and, therefore, no further allowances would be added to the reserve from 2024 onwards (the 2023 intake into the MSR would be based partly on the allowances in circulation in 2021) ([42]). Between 2018 and 2030, the projected EU ETS emissions would be higher than the allowances expected to be available in most years, resulting in the total allowances in circulation declining year on year. By the end of 2030, the total allowances in circulation would be lower than the minimum threshold. This threshold acts as a trigger for reintroducing 100 Mt of allowances back into the market, which would then start in 2031.

## 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). These projections are based upon the continuation of the current reduced scope of aviation activities covered by the EU ETS.

### *3.2.1 Balance of allowances*

Aviation emissions are projected to increase continuously until 2030; therefore, the net demand for allowances in the aviation sector is also expected to rise during this period. This net demand is accounted for in the estimation of the future supply of and demand for allowances in the stationary sector (Section 3.1.2).

([42]) This is because the amount of allowances in circulation in a particular year, e.g. 2021 is published in May of the following year, e.g. 2022. Based on this publication, auction calendars are adjusted starting in September of the same year, e.g. 2022 and until August of the following year, e.g. 2023 (EU, 2015, 2018a).

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# Annex 1 Background information and data

This annex provides additional supporting information for the EU ETS report, focusing on changes that occurred during 2017.

## A1.1 Activities covered by the EU ETS

### *A1.1.1 Stationary installations*

In 2017, the EU ETS covered 11 781 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 2017 were 1 754 $MtCO_2e$ (EEA, 2018).

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:

- fuel combustion (mainly electricity generation plus various manufacturing industries);
- refineries;
- iron and steel, coke, and metal ore production;
- cement, clinker and lime production;
- other non-metallic minerals (glass, ceramics, mineral wool and gypsum);
- production of pulp and paper;
- production of chemicals;
- other (opt-ins and capture of GHGs).

### *A1.1.2 Aviation operators*

The aviation emissions covered by the EU ETS in 2017 were 64 $MtCO_2e$ (EEA, 2018). Since its inclusion in the EU ETS in 2012, the aviation sector has had to purchase EUAs 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 per sector*

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. The operators of industrial installations as a group receive free allowances that are just under their total verified emissions in 2017. 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.

**Table A1.1 Activities and sectors covered by the EU ETS in 2017**

| Activities | Sectors | Number of entities | Verified emissions ($MtCO_2e$) |
|---|---|---|---|
| 20 Combustion of fuels | Combustion | 7 374 | 1 163 |
| 21 Refining of mineral oil | Refineries | 139 | 127 |
| 22 Production of coke | Iron and steel, coke, metal ore | 20 | 11 |
| 23 Metal ore roasting or sintering | | 9 | 3 |
| 24 Production of pig iron or steel | | 245 | 125 |
| 25 Production or processing of ferrous metals | | 245 | 13 |
| 26 Production of primary aluminium | Other metals (incl. aluminium) | 33 | 9 |
| 27 Production of secondary aluminium | | 35 | 1 |
| 28 Production or processing of non-ferrous metals | | 89 | 7 |
| 29 Production of cement clinker | Cement and Lime | 260 | 119 |
| 30 Production of lime, or calcination of dolomite/magnesite | | 302 | 32 |
| 31 Manufacture of glass | Other non-metallic minerals | 372 | 18 |
| 32 Manufacture of ceramics | | 1 076 | 15 |
| 33 Manufacture of mineral wool | | 50 | 2 |
| 34 Production or processing of gypsum or plasterboard | | 39 | 1 |
| 35 Production of pulp | Pulp and paper | 174 | 5 |
| 36 Production of paper or cardboard | | 590 | 22 |
| 37 Production of carbon black | Chemicals | 18 | 2 |
| 38 Production of nitric acid | | 37 | 5 |
| 39 Production of adipic acid | | 3 | 0 |
| 40 Production of glyoxal and glyoxylic acid | | 1 | 0 |
| 41 Production of ammonia | | 29 | 22 |
| 42 Production of bulk chemicals | | 327 | 39 |
| 43 Production of hydrogen and synthesis gas | | 42 | 9 |
| 44 Production of soda ash and sodium bicarbonate | | 14 | 3 |
| 45 Capture of greenhouse gases under Directive 2009/31/EC | Other | 2 | 0 |
| 99 Other activity opted-in under Art. 24 | | 256 | 1 |
| **Sum of all stationary installations** | | **11 781** | **1 754** |
| 10 Aviation | | 511 | 64 |

**Source:** EEA, 2018.

### *A1.2.2 Transitional free allowances*

The maximum allocation allowed under Article 10(c) will decrease from 152 million EUAs 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; EU, 2018b). In 2014, 109 million allowances were allocated to installations, 84 % of the maximum allowed amount (EC, 2015a; EU, 2018b). In 2015, 81 million allowances

were allocated to installations, 71 % of the maximum allowed amount (EC, 2016b; EU, 2018b). In 2016, 61 million allowances were allocated to installations, 62 % of the maximum allowed amount (EC, 2017c; EU, 2018b). In 2017, 43.1 million allowances were allocated to installations, 53 % of the maximum allowed amount (EC, 2018g; EU, 2018b).

## A1.3 Auctioned allowances during the third trading period

Table A1.3 and Table A1.4 present two sets of values concerning auctioned or sold allowances for EUAs and EUAAs. The section on the left of each table shows the volumes attributed to the years when allowances were actually released to the market, whereas the section on the right shows the volumes redistributed in accordance with the years to which allowances correspond (please see the notes to Table A1.3 and Table A1.4 for detailed explanations) ([43]).and, therefore, were not attributed to the number of allowances auctioned in 2016.

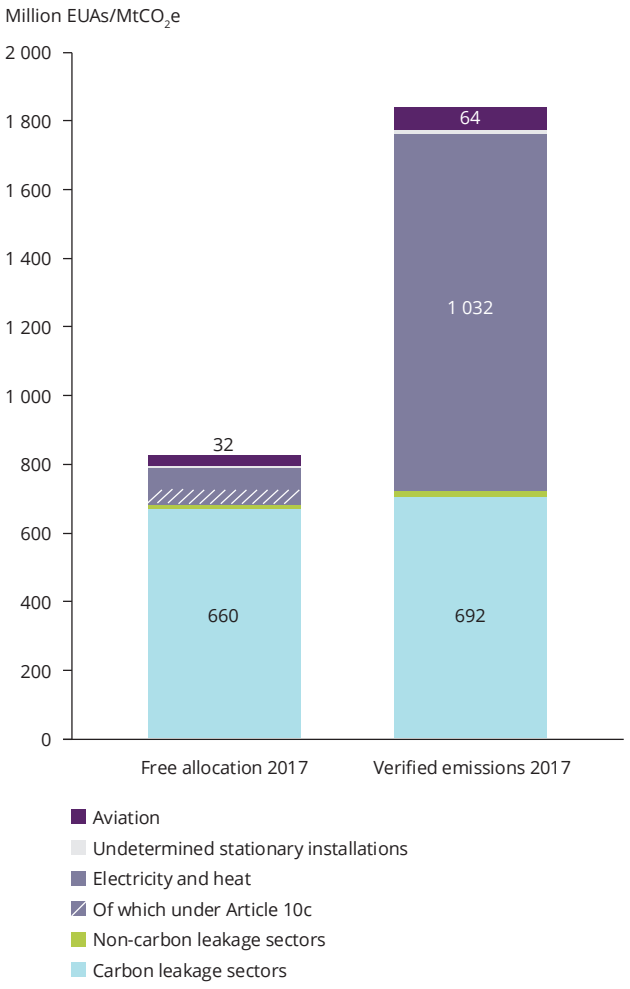
## A1.4 Method and assumptions to project the balance of allowances until 2030

Historical data on free allocation, allowances auctioned and sold and international credits surrendered/ exchanged are based on EEA (2018). To make the time series comparable across the whole period, an estimate reflecting current EU ETS scope is added to both EU ETS emission and allocated allowances for the period from 2008 to 2012.

Free allocation from 2018 to 2020 is based on the Commission Decision of 5 September 2013 (EC, 2013) and corrected for allowances expected to remain unallocated until 2020. Unallocated allowances due to cessations and closures (Articles 10(a)(19) and 10(a)(20) of the ETS Directive) in 2013-2016 are available from a European Commission report on the carbon market (EC, 2017b). The value of 64 million allowances observed for 2016 is held constant until 2020.

Regarding unallocated allowances from the NER (Article 10(a)(7) of the ETS Directive), it is projected that allocation to new entrants will continue at the rate observed from 2013 to 2017. Remaining unallocated allowances under Articles 10(a)(4) and 10(a)(5) are assumed to represent the remaining difference between planned allocation to existing installations (EC, 2013), observed allocation and unallocated allowances due to cessations and closures. Roughly half of this number of unallocated allowances is expected to feed into the new entrants reserve for the fourth trading period, while the other half is expected to be added to the MSR in 2020.

**Figure A1.1 Verified emissions and free allocation (2017), according to allocation rules**




**Notes:** Electricity and heat refers to electricity generators. 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, 2018.

([43]) Unless otherwise noted, the calculations and figures in this report refer to the redistributed amounts.

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

| | | Number of free allowances available for the modernisation of the electricity system | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Remainder 2013-2017 | Amounts for auctioning | Remaining budget up to 2020 |
| | | Million EUAs | | | | | | | | | | |
| **Bulgaria** | max allowance | 13.5 | 11.6 | 9.7 | 7.7 | 5.8 | 3.9 | 1.9 | 0.0 | 8.9 | 8.4 | 6.3 |
| | allocated | 11.2 | 9.8 | 8.2 | 6.5 | 3.8 | | | | 0.0 | 0.0 | 0.0 |
| **Cyprus** | max allowance | 2.5 | 2.2 | 1.9 | 1.6 | 1.3 | 0.9 | 0.6 | 0.0 | 0.0 | 0.0 | 1.5 |
| | allocated | 2.5 | 2.2 | 1.9 | 1.6 | 1.3 | | | | 0.0 | 0.0 | 0.0 |
| **Czechia** | max allowance | 26.9 | 23.1 | 19.2 | 15.4 | 11.5 | 7.7 | 3.8 | 0.0 | 0.3 | 0.2 | 11.6 |
| | allocated | 26.8 | 23.0 | 19.2 | 15.3 | 11.5 | | | | 0.0 | 0.0 | 0.0 |
| **Estonia** | max allowance | 5.3 | 4.5 | 3.8 | 3.0 | 2.3 | 1.5 | 0.8 | 0.0 | 0.7 | 2.1 | 0.9 |
| | allocated | 5.1 | 4.4 | 3.7 | 2.9 | 2.1 | | | | 0.0 | 0.0 | 0.0 |
| **Hungary** | max allowance | 7.0 | | | | | | | | 0.9 | 0.0 | 0.9 |
| | allocated | 6.1 | | | | | | | | 0.0 | 0.0 | 0.0 |
| **Lithuania** | max allowance | 0.6 | 0.5 | 0.5 | 0.0 | 0.4 | 0.3 | 0.2 | 0.0 | 0.6 | 0.9 | 0.2 |
| | allocated | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | | | | 0.0 | 0.0 | 0.0 |
| **Poland** | max allowance | 77.8 | 72.3 | 66.7 | 60.0 | 52.2 | 43.4 | 32.2 | 0.0 | 113.3 | 0.0 | 188.9 |
| | allocated | 71.6 | 60.4 | 38.6 | 27.2 | 18.0 | | | | 0.0 | 0.0 | 0.0 |
| **Romania** | max allowance | 17.9 | 15.3 | 12.8 | 10.2 | 7.7 | 5.1 | 2.6 | 0.0 | 16.9 | 15.4 | 9.2 |
| | allocated | 15.7 | 8.6 | 9.2 | 7.2 | 6.2 | | | | 0.0 | 0.0 | 0.0 |
| **Total** | **max allowance** | **151.5** | **129.5** | **114.6** | **98.0** | **81.1** | **62.7** | **42.1** | **0.0** | **141.6** | **27.0** | **219.3** |
| | **allocated** | **139.4** | **108.7** | **81.0** | **61.0** | **43.1** | | | | **0.0** | **0.0** | **0.0** |

**Note:** Includes Article 10(c) amounts to be auctioned in 2018.

**Sources:** EC, (2014b); 2015a; 2016b; 2017c; (2018g); EU, (2018b).

It is assumed that, under Article 10(c), Member States will continue to allocate at the average rate observed in 2013-2017, taking into account those Article 10(c) amounts already reintroduced into the market through auctioning, arriving at a total of 138 million allowances under Article 10(c) that remain unallocated at the end of the third trading period. These are then assumed to be auctioned in 2019 and 2020, with an equal amount being auctioned each year. Note that it is also possible for Member States to transfer these amounts into the fourth trading period (see Section 2.1.5). Planned auction amounts between 2018 and 2020 are taken from the European Commission report on the carbon market (EC, 2017b). Pending auctions for the European Economic Area and the European Free Trade Association (EFTA) States (i.e. 34 million allowances) are assumed to be auctioned in 2018-2020, in equal tranches. The remainder of the budget (4 million allowances) of international credits for stationary installations is assumed to be exchanged in 2018.

From 2020, available allowances are based on the decreasing cap with a LRF applied from 2021. In addition, a NER of nearly 500 million allowances is expected to be available fed by the unallocated allowances as described above. The projected emissions reflect the sum of projections from EU Member States and Norway, compiled by ETC/ACM as of June 2018, and represent emissions under the WEM scenario. The projected ETS emissions for Iceland and Liechtenstein are gap-filled based on past ETS emissions and trends of available projections (EU plus Norway).

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

| | Third trading period | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Auctions/sales concluded | | | | | | Auctions/sales redistributed | | | | | |
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Austria | 1.6 | 12.7 | 8.8 | 10.0 | 11.2 | 13.7 | | 14.3 | 8.8 | 10.0 | 11.2 | 13.7 |
| Belgium | | 26.1 | 16.1 | 18.2 | 20.4 | 24.9 | | 26.1 | 16.1 | 18.2 | 20.4 | 24.9 |
| Bulgaria | 3.3 | 12.0 | 6.1 | 15.9 | 16.2 | 22.6 | | 15.3 | 6.1 | 15.9 | 16.2 | 22.6 |
| Croatia | | | | 11.3 | 3.8 | 4.7 | | 4.9 | 3.0 | 3.4 | 3.8 | 4.7 |
| Cyprus | 0.2 | 0.1 | 0.1 | | | 1.1 | | 0.3 | 0.1 | | | 1.1 |
| Czechia | | 18.6 | 9.4 | 14.5 | 22.4 | 34.6 | | 18.6 | 9.4 | 14.5 | 22.4 | 34.6 |
| Denmark | 0.2 | 12.7 | 8.0 | 9.0 | 10.1 | 12.3 | | 12.9 | 8.0 | 9.0 | 10.1 | 12.3 |
| Estonia | | 4.1 | 1.2 | 2.8 | 4.5 | 6.8 | | 4.1 | 1.2 | 2.8 | 4.5 | 6.8 |
| Finland | 2.0 | 15.2 | 10.6 | 12.0 | 13.4 | 16.4 | | 17.2 | 10.6 | 12.0 | 13.4 | 16.4 |
| France | 6.4 | 49.9 | 34.8 | 39.3 | 44.0 | 53.8 | | 56.3 | 34.8 | 39.3 | 44.0 | 53.8 |
| Germany | 23.5 | 182.6 | 127.1 | 143.9 | 160.8 | 196.8 | | 206.1 | 127.1 | 143.9 | 160.8 | 196.8 |
| Greece | 2.3 | 33.4 | 22.0 | 24.9 | 27.9 | 34.1 | | 35.8 | 22.0 | 24.9 | 27.9 | 34.1 |
| Hungary | 0.6 | 7.8 | 9.5 | 10.8 | 12.1 | 14.8 | | 8.4 | 9.5 | 10.8 | 12.1 | 14.8 |
| Iceland | | | | | | | | | | | | |
| Ireland | | 9.6 | 5.9 | 6.7 | 7.5 | 9.2 | | 9.6 | 5.9 | 6.7 | 7.5 | 9.2 |
| Italy | 11.3 | 87.9 | 61.2 | 69.3 | 77.4 | 94.7 | | 99.2 | 61.2 | 69.3 | 77.4 | 94.7 |
| Latvia | 0.3 | 2.5 | 1.7 | 1.9 | 2.2 | 2.6 | | 2.8 | 1.7 | 1.9 | 2.2 | 2.6 |
| Liechtenstein | | | | | | | | | | | | |
| Lithuania | 0.5 | 4.5 | 2.9 | 3.7 | 3.9 | 5.4 | | 5.0 | 2.9 | 3.7 | 3.9 | 5.4 |
| Luxembourg | 0.1 | 1.1 | 0.8 | 0.9 | 1.0 | 1.2 | | 1.2 | 0.8 | 0.9 | 1.0 | 1.2 |
| Malta | 0.0 | 1.0 | 0.6 | 0.7 | 0.8 | 1.0 | | 1.1 | 0.6 | 0.7 | 0.8 | 1.0 |
| Netherlands | 3.9 | 30.6 | 21.3 | 24.1 | 26.9 | 32.9 | | 34.5 | 21.3 | 24.1 | 26.9 | 32.9 |
| Norway | | | | | | | | | | | | |
| Poland | | 51.2 | 13.3 | 17.1 | 25.6 | 85.9 | | 51.2 | 13.3 | 17.1 | 40.5 | 70.9 |
| Portugal | 1.6 | 16.5 | 11.2 | 12.6 | 14.1 | 17.3 | | 18.1 | 11.2 | 12.6 | 14.1 | 17.3 |
| Romania | 5.9 | 27.9 | 16.5 | 25.4 | 36.8 | 45.2 | | 33.8 | 16.5 | 25.4 | 36.8 | 45.2 |
| Slovakia | 1.8 | 14.0 | 9.7 | 11.1 | 12.4 | 15.1 | | 15.9 | 9.7 | 11.1 | 12.4 | 15.1 |
| Slovenia | 0.5 | 4.0 | 2.8 | 3.2 | 3.6 | 4.4 | | 4.6 | 2.8 | 3.2 | 3.6 | 4.4 |
| Spain | 10.1 | 78.8 | 54.8 | 62.1 | 69.3 | 84.9 | | 88.9 | 54.8 | 62.1 | 69.3 | 84.9 |
| Sweden | 1.0 | 8.1 | 5.6 | 6.4 | 7.1 | 8.8 | | 9.2 | 5.6 | 6.4 | 7.1 | 8.8 |
| United Kingdom | 12.3 | 95.1 | 66.2 | 75.0 | 80.3 | 106.0 | | 107.4 | 66.2 | 75.0 | 83.7 | 102.5 |
| NER300 | | 210.6 | 89.5 | | | | | 200.0 | 100.0 | | | |
| EU-28 | 89.7 | 808.1 | 528.4 | 632.7 | 715.3 | 951.2 | | 902.7 | 531.4 | 624.8 | 733.8 | 932.7 |
| **Total** | **89.7** | **1 018.7** | **617.8** | **632.7** | **715.3** | **951.2** | | **1 102.7** | **631.4** | **624.8** | **718.8** | **932.7** |

**Note:** The table presents two sets of values concerning auctioned/sold allowances. The section on the left shows volumes attributed to the years when allowances were actually released to the market, whereas the section on the right shows volumes redistributed in accordance with the years to which allowances correspond. For the third trading period, the redistribution concerned early auctions (2012) pertaining to the third trading period, Croatian auctions starting in 2015, NER sales and delays due to technical questions. The volumes of 'early auctions' of the third trading period held in 2012 are added to 2013 auctioning volumes (90 million EUAs). Croatia started auctioning in 2015: the volumes sold in 2015 are attributed to the appropriate years (4.9 million EUAs to 2013, 3.0 million EUAs to 2014 and 3.4 million EUAs to 2015). NER300 sales were carried out in two tranches; the first tranche of 200 million (sold in 2011 and 2012) is attributed to 2013, while the second tranche of 100 million EUAs (sold at the end of 2013/beginning of 2014) is attributed to 2014 (EIB, 2014). Moreover, on account of auctions being cancelled or not taking place, the United Kingdom and Poland auctioned around 3.5 million and 15.0 million EUAs from 2016 in 2017, respectively. Iceland, Liechtenstein and Norway have not yet started auctioning allowances for the third trading period.

**Sources:** EEA, 2016, 2018.

**Table A1.4 Aviation allowances auctioned/sold in the third trading period (EUAA millions)**

| | Auctions/sales concluded | | | | | | Auctions/sales redistributed | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| Austria | | | 0.20 | 0.34 | 0.12 | 0.10 | 0.20 | 0.11 | 0.11 | 0.11 | 0.12 | 0.10 |
| Belgium | | | 0.34 | 0.38 | 0.14 | 0.11 | 0.34 | 0.13 | 0.13 | 0.13 | 0.14 | 0.11 |
| Bulgaria | | | 0.04 | 0.13 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.04 |
| Croatia | | | | 0.07 | 0.03 | 0.03 | | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| Cyprus | | | 0.05 | 0.20 | 0.07 | 0.06 | 0.05 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 |
| Czechia | | | 0.08 | 0.17 | 0.06 | 0.05 | 0.08 | 0.06 | 0.06 | 0.06 | 0.06 | 0.05 |
| Denmark | | | 0.19 | 0.39 | 0.14 | 0.11 | 0.19 | 0.13 | 0.13 | 0.13 | 0.14 | 0.11 |
| Estonia | | | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Finland | | | 0.14 | 0.30 | 0.11 | 0.09 | 0.14 | 0.10 | 0.10 | 0.10 | 0.11 | 0.09 |
| France | | | 1.67 | 1.73 | 0.63 | 0.50 | 1.67 | 0.58 | 0.58 | 0.58 | 0.63 | 0.50 |
| Germany | 2.50 | | | 2.23 | 0.86 | 0.68 | 2.50 | 0.74 | 0.74 | 0.74 | 0.86 | 0.68 |
| Greece | | | 0.18 | 0.71 | 0.26 | 0.20 | 0.18 | 0.24 | 0.24 | 0.24 | 0.26 | 0.20 |
| Hungary | | | 0.05 | 0.14 | 0.05 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 |
| Iceland | | | | | | | | | | | | |
| Ireland | | | 0.15 | 0.31 | 0.11 | 0.09 | 0.15 | 0.10 | 0.10 | 0.10 | 0.11 | 0.09 |
| Italy | | | 0.87 | 2.05 | 0.75 | 0.59 | 0.87 | 0.68 | 0.68 | 0.68 | 0.75 | 0.59 |
| Latvia | | | 0.02 | 0.08 | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| Liechtenstein | | | | | | | | | | | | |
| Lithuania | | | 0.01 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Luxembourg | | | 0.11 | 0.03 | 0.01 | 0.01 | 0.11 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Malta | | | 0.02 | 0.08 | 0.03 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| Netherlands | | | 0.91 | 0.52 | 0.19 | 0.15 | 0.91 | 0.17 | 0.17 | 0.17 | 0.19 | 0.15 |
| Norway | | | | | | | | | | | | |
| Poland | | | | 0.43 | 0.12 | 0.10 | 0.11 | 0.11 | 0.11 | 0.11 | 0.12 | 0.10 |
| Portugal | | | 0.21 | 0.41 | 0.15 | 0.12 | 0.21 | 0.14 | 0.14 | 0.14 | 0.15 | 0.12 |
| Romania | | | 0.05 | 0.23 | 0.08 | 0.07 | 0.05 | 0.08 | 0.08 | 0.08 | 0.08 | 0.07 |
| Slovakia | | | 0.01 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Slovenia | | | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Spain | | | 1.09 | 2.32 | 0.85 | 0.67 | 1.09 | 0.77 | 0.77 | 0.77 | 0.85 | 0.67 |
| Sweden | | | 0.17 | 0.52 | 0.19 | 0.15 | 0.17 | 0.17 | 0.17 | 0.17 | 0.19 | 0.15 |
| United Kingdom | | | 2.71 | 2.52 | 0.92 | 0.73 | 2.71 | 0.84 | 0.84 | 0.84 | 0.92 | 0.73 |
| **Total** | **2.50** | | **9.28** | **16.39** | **6.00** | **4.73** | **11.89** | **5.43** | **5.43** | **5.43** | **6.00** | **4.73** |

**Note:** The table presents two sets of values concerning auctioned/sold allowances. The section on the left ('Auctions/sales concluded') shows volumes according to the years when allowances were actually released to the market, whereas the section to the right ('Auctions/sales redistributed') shows volumes redistributed by the European Economic Area in accordance with the years to which allowances correspond. Auctions of aviation allowances were suspended after the 'stop the clock' decision taken in 2012. Germany was the only country to auction EUAAs in 2012 (2.5 million EUAAs). All other countries except Poland started auctioning EUAAs in 2014. For these countries, 2014 auctions of EUAAs relate to volumes for 2012, whereas 2015 auctions of EUAAs relate to volumes from 2013 to 2015. Poland auctioned all EUAAs for 2012-2015 in 2015.

**Sources:** EEA, 2016, 2018.

The MSR will be implemented according to the EU (2015) and the changes agreed on in EU (2018a), for example with an increase of the intake rate/ cancellation of allowances. The projection of the future balance of demand and supply is dependent on the development of verified emissions over time. The baseline includes assumptions on (1) economic development, i.e. growth in gross domestic product has historically driven greenhouse gas emissions, and (2) policy developments, i.e. other policies that reduce greenhouse gas emissions, such as the renewable energy and energy efficiency targets adopted by the EU.

In the past, Member States' projections have tended to overestimate future emission levels and underestimate the potential size of the cumulative surplus of emission allowances. Therefore, the time taken to eliminate the surplus will vary if emissions develop differently from the projections. A static baseline is applied to calculate the effect of the MSR, i.e. the projected emissions from Member States do not respond to an expected change in EUA prices ([44]) as a consequence of the MSR.

([44]) Future EUA prices are not considered when estimating the future balance of allowances. The impact of hedging allowances is also not considered.

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