# Greenhouse Gas Emissions in 2019

## Stationary installations and aviation subject to emissions trading in Germany (2019 VET report)

Umwelt Bundesamt

DEHSt
Deutsche Emissionshandelsstelle

# Imprint

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City Campus
Buidling 3, entrance 3A
Buchholzweg 8
D-13627 Berlin
Phone: +49 (0) 30 89 03-50 50
Telefax: +49 (0) 30 89 03-50 10
emissionstrading@dehst.de
Internet: www.dehst.de/Englisch

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English by Nigel Pye, npservices4u@gmail.com

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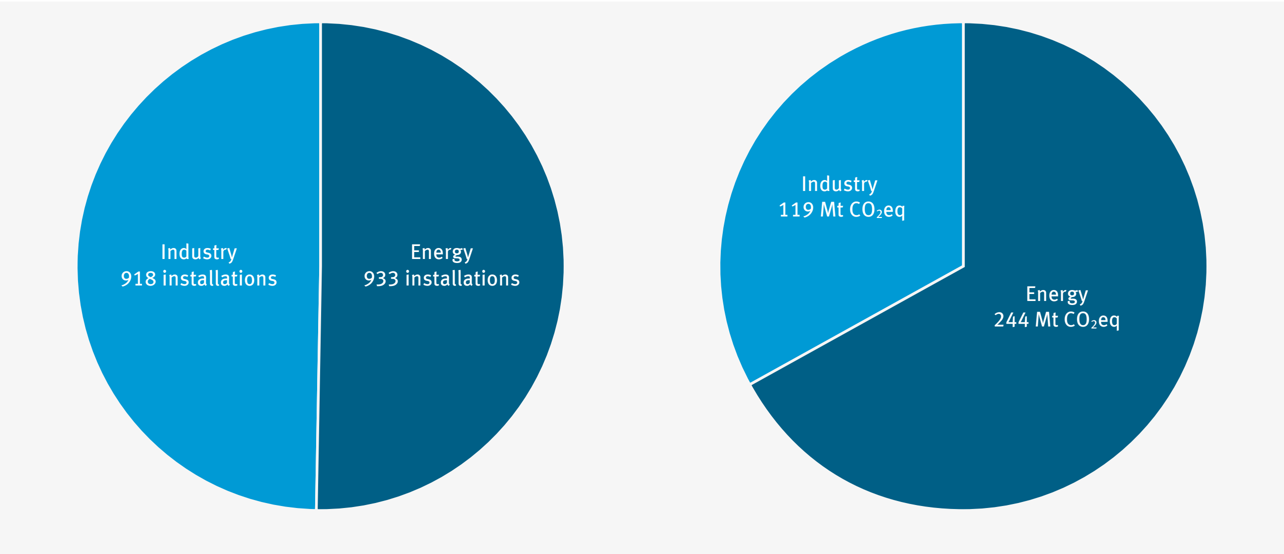
# Summary

## Energy and industrial sectors in Germany

In 2019, the European Emissions Trading Scheme (EU ETS) covered 1,851 stationary installations in Germany. These installations emitted around 363 million tonnes of carbon dioxide equivalent ($CO_2$eq), which represents a 14.2 percent decrease compared to 2018 and for the first time since the beginning of the EU ETS in 2005, emissions from German installations dropped below 400 million tonnes $CO_2$eq. In 2018, the decrease was 3.5 percent.

The economic impact of the Covid 19 pandemic, which began in spring 2020, did not affect the emissions situation in 2019 as presented in this report.

Figure 1 provides an overview of the distribution of emissions and installations within the energy and industrial sectors.



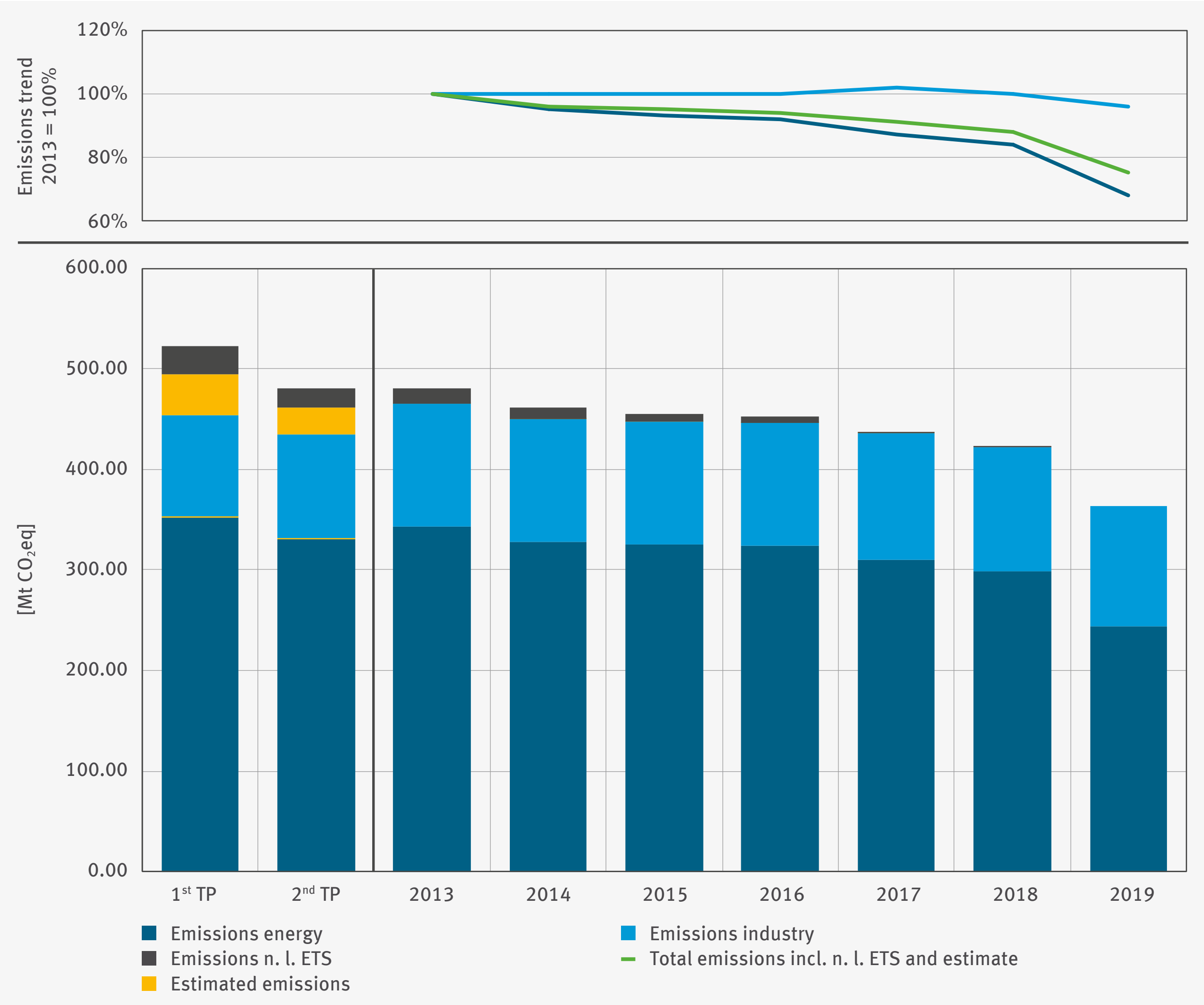

As of 04/05/2020

Figure 1: Distribution of emissions and installations subject to emissions trading in the energy sector (Activities 2 to 6 as per Annex 1 TEHG) and the industrial sector (Activities 1 and 7 to 29 as per Annex 1 TEHG) in Germany in 2019

While the number of installations is divided about half and half between the industrial and the energy sectors, energy installations dominate the field of emissions: about 70 percent of emissions from Germany's stationary installations subject to emissions trading is generated by energy installations and 30 percent from industrial installations.

Figure 2 shows the German ETS emissions since 2005, broken down to industrial and energy installations. The figure shows the reported emissions for the individual years from 2013 onwards, but only the average of the first (2005 to 2007) and second (2008 to 2012) trading period for 2005 to 2012. Emissions from installations that are no longer subject to emissions trading (n. l. ETS)[1] are also taken into account. These are predominantly emissions from energy installations, which is why they have not been divided into the energy and industrial sectors. In addition, an estimated correction term (scope estimate) was added to emissions prior to 2013 in order to reflect the current scope of emissions trading for previous trading periods. This estimate mainly affects emissions from industrial installations, while the estimated emissions from energy installations are as low as to be barely visible in the figure.

1 Cf. Explanation for "Taking into account installations no longer subject to emissions trading (n. l. ETS)" in Chapter 1 Introduction.

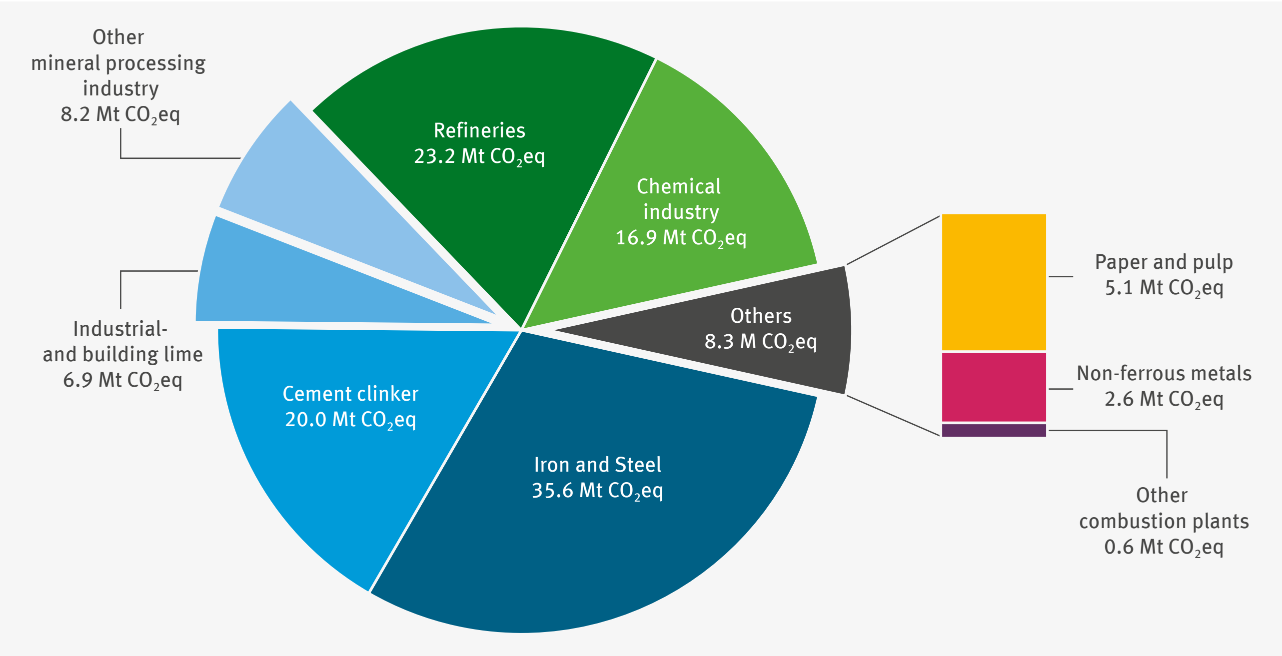



As of 04/05/2020

Figure 2: ETS emissions from the energy and industry sectors in Germany since 2005

Compared to the previous year, emissions from energy installations in 2019 dropped by around 18 percent to 244 million tonnes of carbon dioxide. This strongly reinforces the downward trend of the previous year (2018 was minus 4.5 percent), which is due to a major reduction in lignite and hard coal emissions. In 2019, hard coal emissions decreased by 30 percent and lignite emissions by 22 percent. The main reasons for the decrease in hard coal emissions were a significant increase in wind power feed-in and an increasing displacement by natural gas power stations. In addition, several hard coal-fired units with a capacity of around one gigawatt were shut down. The economic efficiency of hard coal-fired plants deteriorated compared to the previous year due to relatively low natural gas prices on the one hand and a significant increase in the price of emission allowances on the other. The economic efficiency of lignite-fired power plants also deteriorated last year due to higher $CO_2$ prices. In October 2019, one unit each of the Neurath power plant (308 megawatts, MW) and the Jänschwalde power plant (500 MW) were also transferred into security reserve. Natural gas emissions rose by five percent compared to the previous year, but this had only a very minor impact in offsetting the decrease in hard coal and lignite emissions. The rising natural gas emissions are mainly due to the increasing fuel switch from coal to natural gas in power generation. Since the beginning of the third trading period in 2013, emissions from energy installations have dropped by around 32 percent.

Emissions from the industry with high energy consumption hardly changed at all from 2013 to 2018 and were each between around 123 and 126 million tonnes of carbon dioxide equivalents. It was not until 2019 that at 119 million tonnes of carbon dioxide equivalents dropped for the first time below the 2013 level, with emissions falling by four percent compared to both 2013 and the previous year. The 25 percent decline in total German ETS emissions since 2013 is thus mainly due to the reduction in emissions from energy installations.




As of 04/05/2020

**Figure 3:** Distribution of emissions among individual industrial sectors in 2019

Figure 3 shows the distribution of the total emissions from individual industrial sectors. The iron and steel industry accounts for the largest share of industrial emissions at around 30 percent, followed by refineries (19 percent), cement clinker production (17 percent) and the chemical industry (14 percent). The remaining industrial emissions can be attributed to four further sectors and sub-sectors: other mineral processing industries (seven percent), which includes glass and ceramics production, industrial and building lime (six percent), the paper and pulp industry (four percent) and non-ferrous metals industry (two percent). Other combustion plants that cannot be assigned to any of the aforementioned sectors generate only about half a percent of the total industrial emissions.

Figure 4 summarises the different development of emissions in selected industrial sectors compared to the previous year. In addition, the relative annual changes since 2013 are also shown. In 2019, emissions fell in almost all sectors compared to the previous year, they only remained roughly unchanged year-on-year in the cement industry. This also reflects the production trend in the individual sectors, with the cement industry recording slight increases in production.

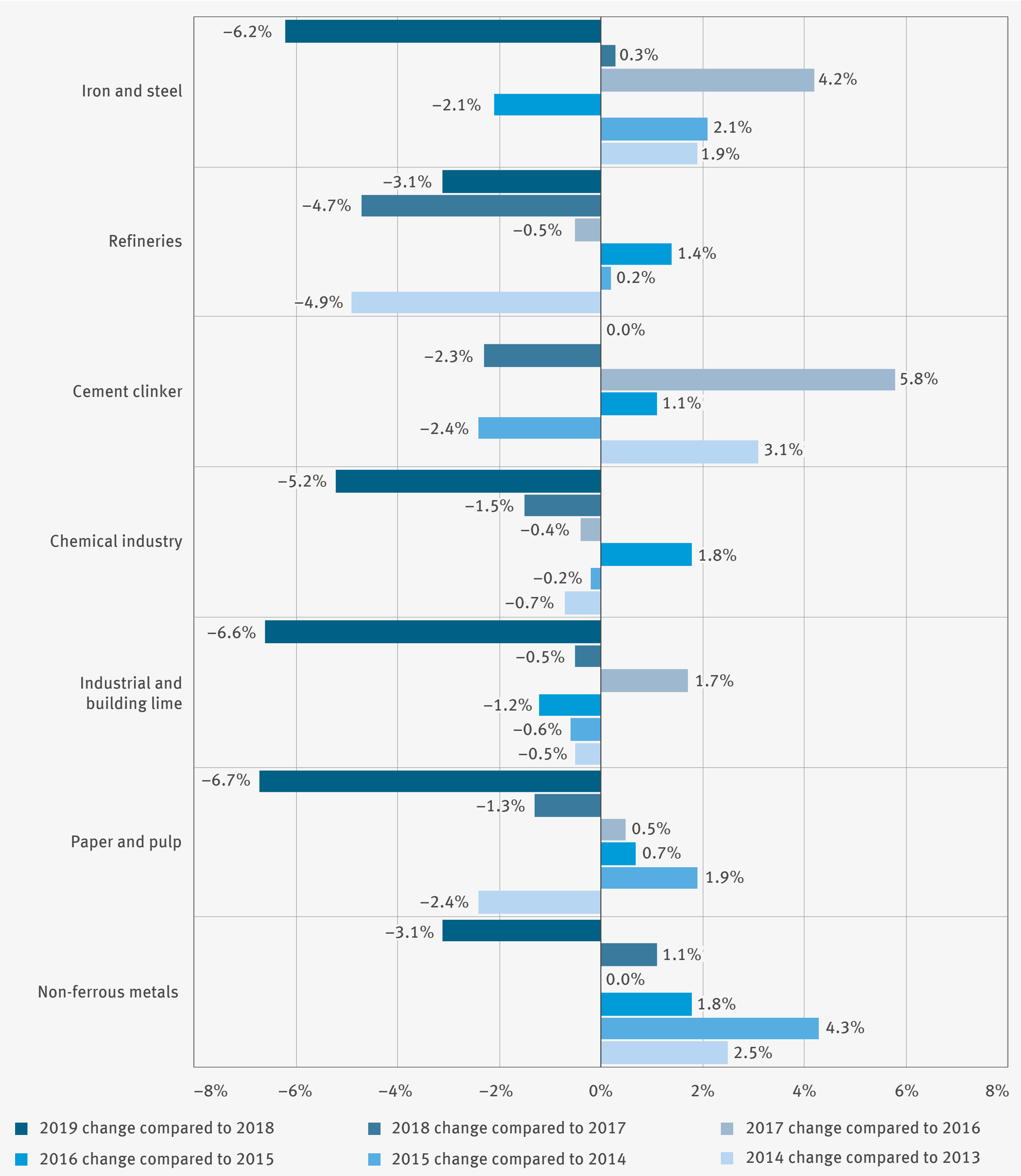



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Figure 4: Changes in the industrial sector's annual emissions since 2013

## The largest installations in the energy and industrial sectors

Table 1 shows the largest emitters among the energy installations. The Boxberg III and Boxberg IV installations are combined into one power plant in Table 1. In total, these ten power plants or eleven installations with somewhat less than 124 million tonnes of carbon dioxide equivalents cause about one third (34 percent) of the emissions subject to emissions trading in the stationary sector and about half (51 percent) of the emissions from energy installations. These ten power plants thus emit a total of even more carbon dioxide equivalents than all 918 German industrial plants combined.

Table 1: The ten largest power plants (Activities 2 to 6) by emissions

| Installation (operator) | 2019 VET [kt $CO_2$eq] | Change against 2018 |
|---|---|---|
| Neurath Power Plant (RWE Power AG) | 22,597 | ▼ −30% |
| Boxberg III and IV Power Plant (Lausitz Energie Kraftwerke AG) | 18,656 | ▼ −2% |
| Niederaußem Power Plant (RWE Power AG) | 18,425 | ▼ −29% |
| Jänschwalde Power Plant (Lausitz Energie Kraftwerke AG) | 17,614 | ▼ −23% |
| Weisweiler Power Plant (RWE Power AG) | 13,297 | ▼ −21% |
| Schwarze Pumpe Power Plant (Lausitz Energie Kraftwerke AG) | 10,479 | ▼ −15% |
| Lippendorf Power Plant (Lausitz Energie Kraftwerke AG)* | 8,944 | ▼ −24% |
| Mannheim Large Power Plant (GKM) (Grosskraftwerk Mannheim AG)** | 4,922 | ▼ −27% |
| Moorburg Heat and Power Plant (Vattenfall Heizkraftwerk Moorburg GmbH) | 4,740 | ▼ −24% |
| *Scholven Power Plant (Uniper Kraftwerke GmbH)* | *4,064* | ▼ *−5%* |
| **Total** | **123,738** | ▼ **−22%** |

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* Lippendorf Power Plant is a joint power plant owned by LEAG (Lausitz Energy Power Plants AG) and EnBW (Energy Baden-Württemberg AG), each of which owns a unit.

** Mannheim Large Power Plant is a joint power plant of the following companies: RWE Generation SE (40%), EnBW (32%) and MVV RHE GmbH (28%).

At around 36 million tonnes of carbon dioxide equivalents the ten largest emitters among the industrial installations emit significantly less than the ten largest power plants and come exclusively from the iron and steel industry or are refineries. Their share of emissions subject to emissions trading in the stationary sector is around ten percent, while they account for around 30 percent of emissions from industrial installations.

Table 2: The ten largest industrial installations (Activities 1 and 7 to 29) by emissions

| Installation (operator) | VET 2019 [kt $CO_2$eq] | Change against 2018 | |
|---|---|---|---|
| Integrated Iron and Steel Works in Duisburg (thyssenkrupp Steel Europe AG) | 7,818 | ▼ | −6% |
| Duisburg-Huckingen Plant, Glocke (HKM Hüttenwerke Krupp Mannesmann GmbH) | 5,108 | ▲ | 4% |
| Dillingen Plant, amalgamated installation (ROGESA Roheisengesellschaft Saar mbH) | 4,207 | ▼ | −10% |
| Salzgitter Plant, Glocke (Salzgitter Flachstahl GmbH) | 4,116 | ▼ | −6% |
| PCK Raffinerie, Glocke (PCK Raffinerie GmbH) | 3,419 | ▼ | −10% |
| Ruhr Oel GmbH – Scholven Plant (Ruhr Oel GmbH) | 3,008 | ▲ | 5% |
| Oberrhein Mineral Oil Refinery, Plant 1 and Plant 2, (Mineralölraffinerie Oberrhein GmbH & Co. KG) | 2,660 | ▼ | −1% |
| Bremen Plant, amalgamated installation (ArcelorMittal Bremen GmbH) | 2,177 | ▼ | −17% |
| Wesseling Refinery Plants including Power Plant, Rhineland Refinery (Shell Deutschland Oil GmbH) | 1,982 | ▼ | −8% |
| *Duisburg-Schwelgern Coking Plant (thyssenkrupp Steel Europe AG)* | *1,947* | ▼ | *−8%* |
| **Total** | **36,443** | ▼ | **−5%** |

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## Allocation status

In the seventh, i.e. the last but one year of the current third trading period, verified emissions of 363 million tonnes of carbon dioxide equivalents from all installations in Germany subject to emissions trading significantly exceeded the free allocation amount for that year. In 2019, around 141 million emission allowances were allocated free of charge to operators of 1,617 of Germany's 1,851 installations. The average allocation coverage was above the previous year (34.3 percent) and thus has increased for the first time since 2013 due to the significant reduction in emissions. The allocation coverage changes proportionally between the sectors taking into account transfers of waste gases from iron, steel and coke production and heat imports in the allocation amounts. As a result of this adjustment, the level of allocation coverage in the industrial sectors decreased from 100.8 to 87 percent in 2019, while allocation coverage in the energy sector increased from 8.6 to 15.3 percent, as shown in Table 3.

Table 3: Adjusted allocation coverage (taking into account waste gases from iron, steel and coke production and heat imports)

| Sector | Activity 3rd TP | No of instal-lations | 2019 allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | 2019 allocation coverage* | Adjusted 2019 allocation amount** [1000 EUA] | Adjusted 2019 allocation coverage* |
|---|---|---|---|---|---|---|---|---|
| Energy | Energy installations | 933 | 20,894 | 243,912 | −223,018 | 8.6 % | 37,331 | 15.3 % |
| | | **933** | **20,894** | **243,912** | **−223,018** | **8.6 %** | **37,331** | **15.3 %** |
| Industry | Refineries | 24 | 17,860 | 23,208 | −5,349 | 77.0 % | 17,860 | 77.0 % |
| | Iron and steel | 125 | 46,223 | 35,577 | 10,646 | 129.9 % | 32,867 | 92.4 % |
| | Non-ferrous metals | 39 | 2,300 | 2,580 | −280 | 89.1 % | 2,300 | 89.1 % |
| | Industrial and build-ing lime | 39 | 6,064 | 6,874 | −810 | 88.2 % | 6,064 | 88.2 % |
| | Cement clinker | 36 | 16,828 | 19,990 | −3,162 | 84.2 % | 16,828 | 84.2 % |
| | Other mineral processing industry | 247 | 6,279 | 8,238 | −1,958 | 76.2 % | 6,279 | 76.2 % |
| | Paper and pulp | 144 | 5,878 | 5,112 | 767 | 115.0 % | 4,257 | 83.3 % |
| | Chemical industry | 227 | 18,092 | 16,899 | 1,194 | 107.1 % | 16,633 | 98.4 % |
| | Other combustion plants | 37 | 421 | 566 | −145 | 74.5 % | 421 | 74.4 % |
| | | **918** | **119,946** | **119,043** | **902** | **100.8 %** | **103,509** | **87.0 %** |
| **Total** | | **1,851** | **140,840** | **362,955** | **−222,116** | **38.8 %** | **140,840** | **38.8 %** |

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* Without considering possible adjustments for transfers of waste gases and heat imports
** Considering possible adjustments for transfers of waste gases and heat imports

## Germany and Europe

The emissions from all installations participating in the EU ETS in 2019 (28 EU Member States and Iceland, Liechtenstein, Norway) also decreased but to a lesser extent than in Germany. According to European Commission data, emissions fell by nine percent in 2019 and amounted to 1.53 billion tonnes of carbon dioxide equivalents. As in Germany, the main reason for this trend was a decline in emissions from electricity generation (15 percent reduction), while the emissions from industrial installations showed a two percent decrease.

However, over a longer period of time, ETS emissions in Europe have fallen more than in Germany: while emissions from installations in Germany have fallen by around 30 percent since the beginning of emissions trading in 2005, ETS emissions in Europe have fallen by around 36 percent below the 2005 baseline. The decline in emissions in the period from 2013 to 2019 has slowed down Europe-wide: in 2019 emissions were around 20 percent below the 2013 baseline. The decline in emissions in Germany was 25 percent greater compared to 2013 over the same period.

As in all years since the beginning of the third trading period, emissions from stationary installations in the EU ETS in 2019 were around 1.53 billion tonnes of carbon dioxide equivalents, thus significantly lower than the maximum available quantity of emission allowances (nominal cap) of 1.86 billion allowances over the same period. The reduction in emissions compared to the previous year of around 155 million carbon dioxide equivalents was thus almost four times as large as the annual reduction in the cap (minus 38 million emission allowances).

In 2019, the actual supply of allowances made available was significantly below the nominal cap, in particular due to reductions in the auction volume through the Market Stability Reserve (MSR). The provisional emissions from the ETS installations exceeded this offer of emission allowances made available by free allocation, auctioning and exchange quotas for project credits. The volume of surplus emission allowances, which has been accumulating in the stationary sector since 2008, thus declined and, according to the European Commission, amounted to around 1.39 billion at the end of 2019. However, the surplus remains above the upper MSR threshold (833 million emission allowances). This value is decisive for the auction volume reduction by the MSR from 01/09/2020 to 31/08/2021. During this period, around 333 million emission allowances will not be auctioned as planned but will be moved to the MSR. The European Commission will determine the market surplus and publish it as TNAC or Total Number of Allowances in Circulation.

## Aviation

For 2019, 66 aircraft operators subject to emissions trading administered by Germany reported emissions of 9 million tonnes of carbon dioxide. This means that emissions have decreased by around four percent compared to the previous year. The average allocation coverage in 2019 was around 40 percent, slightly above the 2018 figure of 38 percent. This is due to the reduced emissions.

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# Abbreviations

| | |
|---|---|
| **AA** | Allocation amount |
| **AGEB** | Working Group on Energy Balances (Arbeitsgemeinschaft Energiebilanzen) |
| **AR** | Activity rate |
| **BNetzA** | Federal Network Agency (Bundesnetzagentur) |
| **BImSchV** | Federal Exposure Control Ordinance (Bundes-Immissionsschutzverordnung) |
| **BMWi** | Federal Ministry for Economic Affairs and Energy |
| **BV Kalk** | Association of the German Lime Industry (Bundesverband der Deutschen Kalkindustrie e. V.) |
| **CER** | Certified Emission Reductions (from CDM projects) |
| **CHP** | Combined heat and power |
| **CORSIA** | Carbon Offsetting and Reduction Scheme for International Aviation |
| **$CO_2$** | Carbon dioxide |
| **$CO_2$eq** | Carbon dioxide equivalent |
| **CS** | Clean spread |
| **DEHSt** | German Emissions Trading Authority at the German Environment Agency |
| **EA** | Emission allowance |
| **EEX** | European Energy Exchange |
| **EHRL** | Emissions Trading Directive (Emissionshandels-Richtlinie) |
| **EM** | Emissions |
| **ER** | Emissions report |
| **ERU** | Emission Reduction Units (from JI projects) |
| **EU 25** | Austria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden |
| **EU 28** | EU 25 plus Bulgaria, Croatia, Romania |
| **EU 31** | EU 28 and Iceland, Liechtenstein, Norway |
| **EU-ETS** | European Emissions Trading Scheme |
| **EUA** | EU emission allowance |
| **EUAA** | EU Aviation Allowances |
| **EEA** | European Economic Area (the same as EU 31) |
| **FGD** | Flue gas desulphurisation plant |
| **GW** | Gigawatt |
| **HC** | Hard coal |
| **ICAO** | International Civil Aviation Organisation |
| **ICE** | Intercontinental Exchange |
| **kt** | Kilotonne or one thousand tonnes |
| **LF** | Linear factor |
| **MSR** | Market Stability Reserve |

| | |
|---|---|
| **Mt** | Million tonnes |
| **MW** | Megawatt |
| **NER** | New Entrant Reserve |
| **NG** | Natural gas |
| **$N_2O$** | Dinitrogen monoxide, nitrous oxide |
| **n. l. ETS** | No longer subject to emissions trading |
| **PFC** | Perfluorocarbons |
| **RegO** | EU Registry Ordinance |
| **RTI** | Rated thermal input |
| **TEHG** | German Greenhouse Gas Emission Allowance Trading Act (Treibhausgas-Emissionshandelsgesetz) |
| **TNAC** | Total Number of Allowances in Circulation (amount in circulation determined by the European Commission) |
| **TWh** | Terawatt-hour |
| **UK** | United Kingdom |
| **VCI** | German Chemical Industry Association (Verband der Chemischen Industrie) |
| **VDP** | German Pulp and Paper Association (Verband Deutscher Papierfabriken e. V.) |
| **VDZ** | German Cement Works Association (Verein Deutscher Zementwerke) |
| **VE** | Verified emissions |
| **VET** | Verified Emissions Table (table of VEs entered into the EU Registry) |
| **VET Report** | For an explanation of how to use this short name of the report, see below |
| **WSA** | World Steel Association |
| **WSB** | Growth, Structural Change and Employment Commission (Wachstum, Strukturwandel und Beschäftigung) |
| **WV Metalle** | Metal Industry Association (Wirtschaftsvereinigung Metalle e. V.) |
| **WV Stahl** | German Steel Federation (Wirtschaftsvereinigung Stahl) |
| **WVZ** | Sugar Economic Association (Wirtschaftliche Vereinigung Zucker e. V.) |
| **ZuV 2020** | Allocation Ordinance (Zuteilungsverordnung) 2013 to 2020 |

## VET Report: why is VET the short name for this report?

The VET Report's analyses are mainly based on the previous year's verified emissions in the form as recorded in the Union Registry. The verifiers enter this data in the registry annually by 31 March. In the first and second trading periods, the verified emissions were still reported to the European Commission by transferring the Verified Emissions Table (VET) from the national registry. The term VET report has prevailed and been retained due to the original data source i. e. the Verified Emissions Table. Another reason for this short name is the need to be able to distinguish between emission reporting in emissions trading and emissions reporting for the national greenhouse gas inventory, for which the short name of national emission reporting has already been introduced.

# 1 Introduction

Chapter 1 explains the data underlying the evaluations in the 2019 VET Report. Chapter 2 addresses the emissions from stationary installations subject to emissions trading according to sectors. The last section of Chapter 2 addresses the cross-sectoral allocation status of stationary installations in Germany. Chapter 3 looks beyond Germany at EUA price trends, EU ETS emissions in Europe and the surplus in the carbon market. Chapter 4 describes emissions subject to emissions trading in the aviation sector administered by Germany. The appendix contains additional information organised in summary tables.

The figures presented in the tables are rounded while the calculations used exact values so that infrequent discrepancies may occur in the representation of the totals.

### Relationship between VET emissions, annual emissions and number of installations since 2005

The operators must submit their electronic emissions report in which the monitoring and calculation of emission volumes is recorded to the German Emissions Trading Authority (DEHSt) at the German Environment Agency by 31/03 of the year following the reporting year at the latest. The data in the emissions report must be verified by independent accredited verifiers who must also enter the aggregated emission data by 31/03 in the European Union Registry. The operator then needs to surrender the same number of emission allowances equal to the emissions volume of the previous year by 30/04. Subsequently the emission reports will be checked by DEHSt. If it detects deficiencies or errors in the reported emissions, DEHSt may correct figures, factors or emission volumes. Table 4 shows the sums of VET entries and the annual emissions for 2005 to 2019. The first registry entry at the cut-off date of 31/03 in one of the years following the reporting year is considered a VET entry. Figures that result from the emissions report – possibly with subsequent changes to the data up to the cut-off date – are referred to as annual emissions. The figures showing the 2019 annual emissions will be available for the first time in the autumn of 2020 after DEHSt has reviewed the emission reports but may vary due to new information and necessary corrections. The number of reports gives the unchecked number of VET entries regardless of the currently existing emissions trading obligation of the installations because closed or decommissioned installations are still subject to reporting and are obliged to make a VET entry, therefore the operator must surrender the appropriate allowances for the year of closure or decommissioning.

Table 4: VET entries and annual emissions of the verified reports and the respective number of installations

| Year | Initial report by 31/03 of the subsequent year | | Verified reports, as of 28/02/2020 | |
|---|---|---|---|---|
| | Number of reports | VET [kt $CO_2$eq/a] | Number of installations | Annual emissions [kt $CO_2$eq/a] |
| 2005 | 1815 | 473,681 | 1830 | 474,990 |
| 2006 | 1824 | 477,382 | 1777 | 478,068 |
| 2007 | 1882 | 487,050 | 1744 | 487,166 |
| 2008 | 1660 | 472,599 | 1672 | 472,593 |
| 2009 | 1651 | 428,198 | 1658 | 428,295 |
| 2010 | 1628 | 453,883 | 1642 | 454,865 |
| 2011 | 1631 | 450,267 | 1649 | 450,351 |
| 2012 | 1629 | 452,586 | 1622 | 452,596 |
| 2013 | 1929 | 480,937 | 1921 | 481,010 |
| 2014 | 1905 | 461,173 | 1904 | 461,267 |
| 2015 | 1889 | 455,528 | 1884 | 455,592 |
| 2016 | 1863 | 452,873 | 1858 | 452,858 |
| 2017 | 1833 | 437,647 | 1830 | 437,651 |
| 2018 | 1870 | 422,294 | 1866 | 422,852 |
| 2019 | 1851 | 362,955 | | |

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The significant increase in emissions between 2012 and 2013 can be traced back to the expansion of the EU ETS's scope at the beginning of the third trading period. For example, installations for non-ferrous metal processing and aluminium, adipic acid, nitric acid and ammonia production started participating in emissions trading from 2013.

### Scope correction before 2013 (Scope correction or estimated emissions before 2013)

An estimate of emissions prior to 2013 to correct the scope over the individual trading periods (scope estimation) has so far only been shown in the emissions trend figures within the sector chapters but not in general figures. For example, the total emissions of installations subject to emissions trading in Germany. In addition, the estimate of the scope correction used in the 2013-2020 allocation report has been improved since the 2017 VET report. This now also includes a scope adjustment from the first to the second trading period. This adjustment was determined based on the emission data from the allocation applications and from the 2020 data acquisition. For installations where new partial activities were added, the difference between historical emissions and data from the allocation application or 2020 data acquisition was determined. The scope estimate has been determined by linear interpolation for years where data is not available (especially for 2011 and 2012).

### Taking into account installations no longer subject to emissions trading (n. l. ETS)

In previous VET reports (up to and including 2016), the chapters on the emissions trend of the sectors have only shown the trend for installations subject to emissions trading in the respective reporting year. Starting with the 2017 VET report, the figures on emissions trends take into account the emissions from installations no longer subject to emissions trading (n. l. ETS installations) within the sectors as well as in the total. This enables us to show the actual emissions trend in European emissions trading in Germany since 2005 and not just the installations subject to emissions trading in the respective reporting year. Installations no longer subject to emissions trading include decommissioned installations and installations that still exist but are no longer subject to emissions trading because they fall below the 20 Megawatt (MW) rated thermal input (RTI) limit as an energy installation.

### Free allocation in 2019

Free allocation as approved for 2019 by the European Commission prior to 28/02/2020, is the basis for the assessment of the allocation status, i. e. comparison of emissions and free allocations. At this time not all allocation changes that are relevant for 2019 are necessarily approved. That is, the representation of the allocation status does not include any potential allocation corrections made after 28/02/2020.

The allocation amount approved by the European Commission is included in the National Allocation Table[2] (NAT), which specifies the free basic allocation for 1,763 incumbent installations and the corrections of this basic allocation for individual installations as approved by the European Commission by 28/02/2020. There are some allocation changes resulting from (partial) shutdowns or changes in capacity. In addition, allocation amounts for new market entrants approved by the European Commission by 28/02/2020 are taken into account, i. e. for new installations or a capacity increase in incumbent installations which became operational from 01/07/2011. 1,617 installations of those considered in the 2019 VET report received free allocations for 2019 totalling around 141 million allowances as of 28/02/2020.

### Emissions and production trends

Emissions and production trends for some sectors and activities have been compared. To do this, activity rates (AR) of the respective (product) benchmarks acquisitioned by the DEHSt during the allocation procedure for the third trading period and/or reported by the operators in the annual operational reports since 2012, have been used. Since no activity rates are available for 2011, that year’s figure has been estimated by linear interpolation or is not shown in the relevant figures. The production volume reported in the emission report and calculated from the material flows has been used for cement clinker, industrial and building lime instead of activity rates.

The activity rates have been supplemented by external data as far as possible, for instance by production data from the respective industrial associations. The relative changes in activity rates and production volumes between 2005 and 2018 compared to 2005 (2005 = 100 percent) and the corresponding emissions (also as relative changes compared to 2005) have been shown.

It should be noted that the production volumes are usually determined using different methods, especially when comparing activity rates and external data. For example, the requirements of uniform EU allocation rules must be observed when determining activity rates. These, of course, do not apply to the acquisition of data from associations. In addition, there may be differences in the total population considered since not all companies organised into an association necessarily operate installations subject to emissions trading and vice versa. Also, data on activity rates only stems from those installations that are currently subject to emissions trading and have received a basic allocation as incumbent installations or new market entrants.

External data sources are generally expected to take account of the historical data of all installations in a sector or association. In contrast to activity rates, they also include data on installations which were decommissioned before 2018 or which were never subject to emissions trading due to small capacities.

2 See DEHSt 2013b

### EU data

The evaluation at the EU level was primarily based on the allocation and emission data processed by the European Environment Agency (EEA) (see EEA 2020). This refers to both Sector Chapters 2.1 to 2.8 and Section 3 'Germany and Europe: emissions trend, surpluses and prices'.

For 2019, these are supplemented with excerpts (15/04/2020 and 04/05/2020) from the Union Registry published by the European Commission (COM 2020a and COM 2020b) and the Press Release of 04/05/2020 (COM 2020d). Information on auction volumes has been provided by the European Energy Exchange (EEX) and the Intercontinental Exchange (ICE).

The evaluations in the Sector Chapters are based on a summary of the installations by activities in the EU Union Registry (see Table 37, Chapter 7), thereby differences may occur in the emission volumes per sector for Germany. The boundaries of activities as per TEHG are in line with those in the EU Union Registry in most sectors, in some cases however, such as the energy installations, this agreement is not fully given. EU registry activities have been used for EU comparisons in the respective Sector Chapters because the classification is somewhat different. The emissions between Germany, the EU 25 states and the new post-2005 EU ETS entrants (Bulgaria, Croatia, Romania, Iceland, Liechtenstein, Norway) have been compared.

# 2 Evaluation by Sectors – Activities 1 to 29 as per Annex 1 TEHG

## 2.1 Energy installations

933 energy installations (Activity 2 to 6 Annex 1 TEHG installations) were subject to emissions trading in 2019. Participation in emissions trading thus decreased by six installations compared to 2018.

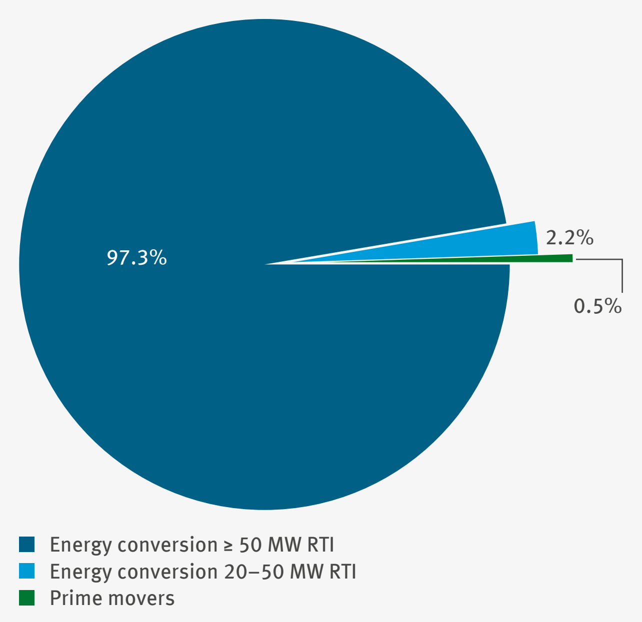
Compared to the previous year, emissions from these installations have decreased significantly by almost 55 million tonnes of carbon dioxide (minus 18.2 percent), by far the largest reduction since emissions trading began in 2005. 2019 emissions were just under 244 million tonnes (see Table 5).

### Emissions

The majority, i. e. 97 percent, of the emissions from energy installations can be attributed to large combustion plants, i. e. power plants, combined heat and power plants and heat plants with a rated thermal input (RTI) exceeding 50 MW (Activity 2 as per Annex 1 TEHG), see also the following Figure.

Overall, emissions from all large combustion plants have decreased by more than 18 percent.
This reflects the fact that power generation from hard coal and lignite has strongly declined.

On the other hand, energy installations with an RTI between 20 and 50 MW (Activities 3 and 4 as per Annex 1 TEHG) produced somewhat higher emissions compared to 2018. In contrast to large combustion plants, Activity 3 and 4 installations include many heat and power plants and district heating boilers so that the emissions also depend on weather-related heat demand. 2019 was on average somewhat colder than 2018 but considerably warmer than the long-term average measured by the number of degree days.




As of 04/05/2020

Figure 5: Shares of 2019 emissions from energy installations (Activities 2 to 6)

Although the 400 installations amount to a similar order of magnitude as in Activity 2, the emissions from Activity 3 and 4 installations were significantly less than those from large combustion plants in 2019. This was about 5.3 million tonnes of carbon dioxide, i. e. only 2.2 percent of the amount emitted by combustion plants in total.

Only 0.5 percent of the total emissions from energy installations can be attributed to prime mover engines and turbines (Activities 5 and 6 as per Annex 1 TEHG). Emissions from these installations, which are used for the transport, storage and processing of natural gas, decreased significantly by around eight percent compared to the previous year. This is also noticeable in view of the fact that emissions had increased in the previous years. The operation of these installations depends on the conditions in the natural gas network. Although natural gas consumption in Germany increased by around three percent last year, Germany's natural gas imports (minus 3.4 percent) and exports (minus 14.5 percent) again decreased compared to the previous year, thus leading to a decline in emissions from these installations.[3]

3 AGEB 2020

Table 5: Energy installations (Activities 2 to 6), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries and allocation coverage

| No. | Activity | No. of instal-lations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 2 | Energy conversion ≥ 50 MW RTI | 478 | 291,685 | 237,387 | 17,682 | 7.4 % |
| 3 | Energy conversion 20–50 MW RTI | 387 | 5,050 | 5,113 | 2,673 | 52.3 % |
| 4 | Energy conversion 20–50 MW RTI, other fuels | 13 | 150 | 149 | 92 | 61.8 % |
| 5 | Prime movers (engines) | 3 | 22 | 38 | 8 | 21.0 % |
| 6 | Prime movers (turbines) | 52 | 1,356 | 1,225 | 439 | 35.9 % |
| | N. l. ETS | *14** | 162 | – | – | – |
| **Total** | | **933** | **298,426** | **243,912** | **20,894** | **8.6 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

## Allocation status

While energy installations had received around 50 percent of the total free allocation for installations subject to emission trading for the product ‘electricity’ in the second trading period – an average of around 200 million per year – the free allocation for electricity generation was replaced by full auctioning in the third trading period (see Figure 6). Accordingly, only around 21 million emission allowances were allocated free of charge to energy installations for heat generation in 2019. These cover less than nine percent of the obligation to surrender emission allowances from these installations (Table 5).

Apart from the lack of allocation for electricity generation in the third trading period, three other factors are responsible for the low allocation coverage in the energy installations:

1. In particular large lignite- and hard coal-burning combustion plants use high-emission fuels, while the allocation rules for heat generation assume the use of lower-emission natural gas.
2. In addition, the free allocation for energy recovery of waste gases from iron, steel and coke production is given to the producers of the waste gases and a part of the allocation for heat generation is given to the heat consumers (cf. Chapters 2.4, 2.7 and 2.8). An estimated 13.5 million emission allowances in 2019 could be allocated to the industrial installations for transfer of waste gases from iron, steel and coke production to energy installations, and an allocation of about 3.1 million emission allowances to the export of heat from industrial to energy installations. Assuming that these allocations were offset between the operators in the industrial sectors and the energy sector, this results in a slightly higher allocation coverage of around 15 percent (see Table 6 and Figure 6).

3. In addition to the decline in allocation due to the application of the budget securing factors (linear reduction factor and cross-sectoral correction factor), the allocation for products with no carbon leakage risk will continue to be gradually reduced. 0.8 of the benchmark value was still granted for allocations with no carbon leakage risk in the first year of the third trading period but only 0.37 in 2019 and this value will drop to 0.3 in 2020, the last year of the third trading period. While EU regulations assume free allocation to be almost entirely given to industrial installations with carbon leakage risk, in 2013 about half of the free allocation to energy installations was allocated to those with no carbon leakage risk. This share has decreased continuously and will only be in the order of about 30 percent of the total allocation for energy installations in 2020.[4]

Table 6: Energy installations (Activities 2 to 6), number of installations, allocation amounts, 2019 VET entries and adjusted allocation coverage

| Sector/ activity | No. of installations | 2019 adjusted allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | Adjusted allocation coverage |
|---|---|---|---|---|---|
| Energy installations | 933 | 37,331 | 243,912 | −206,581 | 15.3 % |

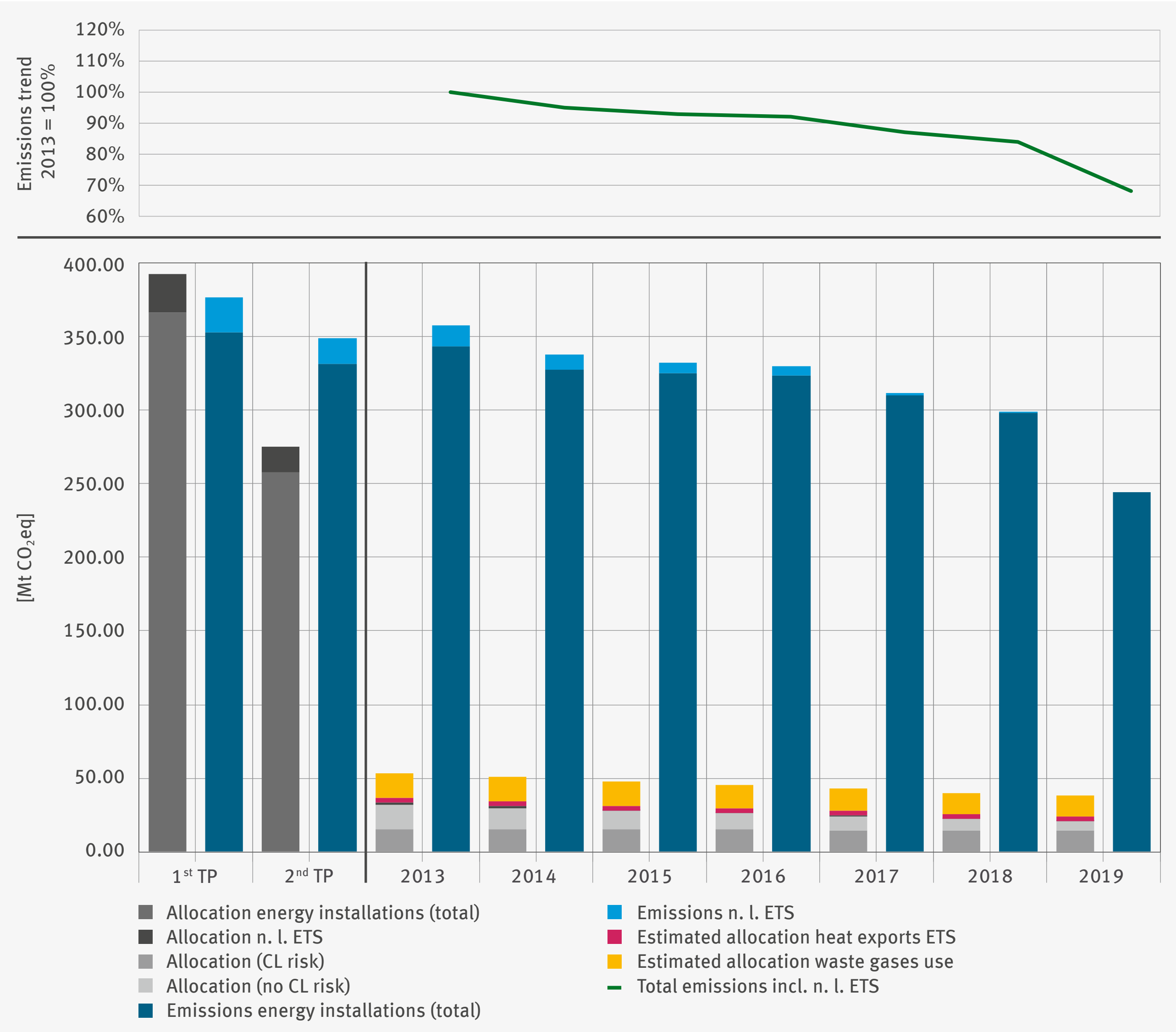
As of 04/05/2020

While the ratio of free allocation to emissions from large combustion plants was about 7 percent, the significance of heat production for energy installations with an RTI between 20 and 50 MW in terms of the allocation status is recognisable. Allocation coverage compared to large combustion plants was greater by a factor of almost ten and was equal to about 52 percent of their emissions. Activity 4 installations, in which biomass and fuels with biogenic components are used, have an even higher allocation coverage of 62 percent. Prime movers (engines and turbines) have mainly received a free allocation via the fuel benchmark for producing mechanical work.[5] The ratio of free allocation to emissions from prime movers was on average around 36 percent. This figure is almost identical to the 2019 carbon leakage reduction factor (CL reduction factor) (37 percent). This means that the 2019 fuel consumption of prime movers was almost identical to the consumption in the baseline period (2005 to 2008 or 2009 to 2010), which was used to calculate the free allocation. This group of installations would have had an allocation coverage of nearly 100 percent without taking into account the reduction factor due to the lack of carbon leakage risk.

## Trends in the third trading period

The following figure shows the emissions trend of energy installations since the beginning of emissions trading. Installations no longer subject to emissions trading (n. l. ETS) have also been taken into account. In the first trading period emissions increased steadily. Emissions decreased at the beginning of the second trading period in principle due to the influence of the financial and economic crisis, then rose again in the following years of the second trading period to between 337 and 342 million tonnes of carbon dioxide per year. In the first year of the third trading period, emissions reached about 357 million tonnes of carbon dioxide, reaching the 2008 level, but after 2014 they decreased steadily. In 2019, the sharpest drop in emissions was recorded since the start of emissions trading in 2005, dropping below 250 million tonnes of carbon dioxide for the first time.

4 DEHSt 2014a
5 See DEHSt 2014a, Chapter 'Energy installations'




As of 04/05/2020

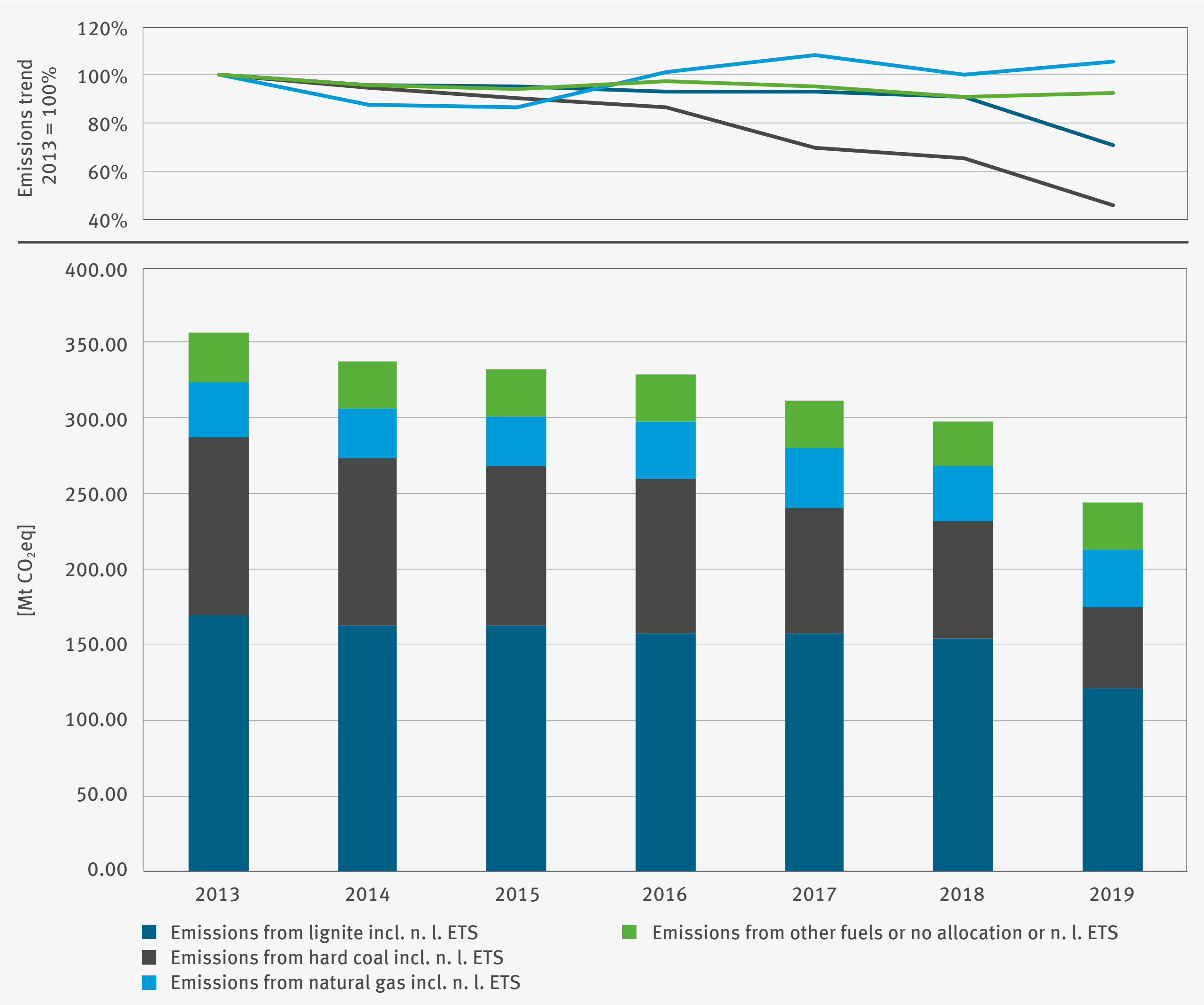
Figure 6: Energy installations (Activities 2 to 6), emissions trend and free allocation in Germany from 2005 to 2019[6]

As a result, energy installations reached their lowest emissions level since the introduction of the EU ETS, but in 2019 still caused just under 64% of the 2005 emissions.

6 As in the VET reports of the second trading period, the allocation amounts of this trading period are offset by taking into account the provisions of Section 11 of the 2012 Allocation Act (Zuteilungsgesetz). According to this regulation, producers of waste gases from iron, steel and coke production were legally obliged in the second trading period to forward emission allowances to the amount of their annual waste gases transfer to the utilising installations. Though it must be assumed that there are corresponding contractual agreements between producers and users also in the third trading period, the third trading period allocation rules do not contain any obligation comparable to Section 11 of the 2012 Allocation Act.

### Emissions trend – divided by main fuels

The following figure shows the emissions from energy installations divided by fuels. For this purpose, the installations were assigned to the fuels, lignite, hard coal and natural gas, according to the largest share of total energy consumption. Installations that have no 'main fuel' assigned and installations that mainly use other fuels (e. g. heating oil and waste gases from iron, steel and coke production) are jointly illustrated.




As of 04/05/2020

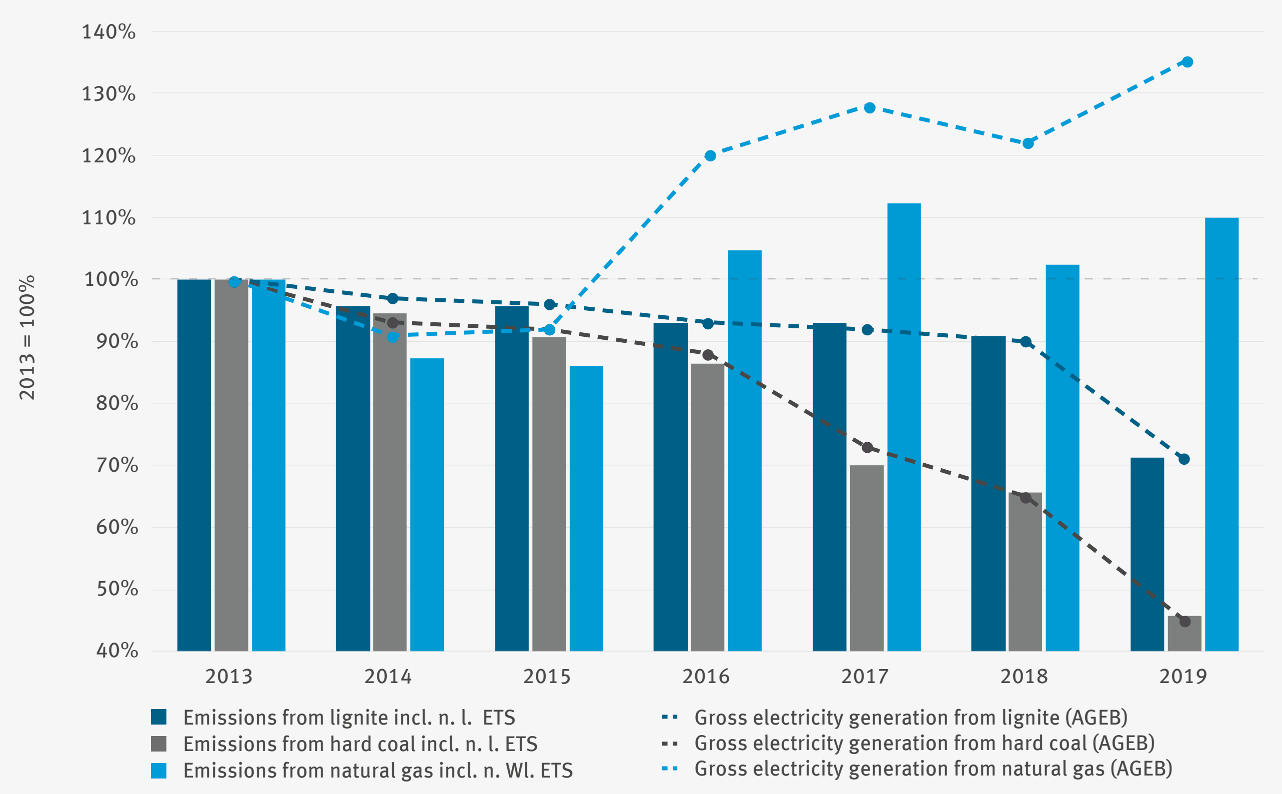
Figure 7: Energy installations (Activities 2 to 6), emissions trend in Germany from 2013 to 2019 according to fuel type

Emissions from lignite fell in 2019 to their lowest level since emissions trading began in 2005, although the 2019 decline was even far greater compared to the previous year (minus 2.4 percent or 22 percent). Emissions from hard coal decreased for the sixth year in succession, but at a minus of around 30 percent, the reduction in emissions was also more pronounced now than in previous years and even greater than for lignite. By contrast, emissions from natural gas-fired plants rose by about five percent, mainly due to the increasing fuel switch from coal to natural gas in electricity generation.

Compared to 2013, the first year of the third trading period, the emissions from installations using lignite as their main fuel fell by around 29 percent. The decline in emissions from energy installations using hard coal as their main fuel was even greater at 46 percent. Emissions from natural gas installations slightly exceeded those in 2013. Installations no longer subject to emissions trading (n. l. ETS) were also included but they are not shown separately in the diagram.

### Emissions and production trends

The following figure shows the comparison of emissions trends for large combustion plants and gross electricity generation from fossil fuels in Germany divided by lignite, hard coal and natural gas.




As of 04/05/2020

Figure 8: Large combustion plants (Activity 2), emissions and production trend in Germany from 2013 to 2019 compared to 2013

The figures of gross electricity generation and emissions from lignite and hard coal-fired installations (see Figure 8) again shows a clear downward trend in the third trading period. At the same time, it is clear that – compared to 2013 – the decrease in gross electricity generation from hard coal-fired installations was greater than the decline in emissions from these installations. This means that the specific emissions of electricity generation from hard coal-fired installations did not decrease, but actually increased to a small extent, i. e. electricity was generated from hard coal at a lower efficiency. This is surprising since the commissioning of new units in recent years was expected to increase efficiency. That the figure does not confirm this may have various reasons. For one thing, combined heat and power generation (CHP) has not been included in the consideration. If the decrease in electricity generation from hard coal-fired CHP plants is not combined with a reduction in their heat generation to the same extent, it is not to be expected that emissions will decrease in line with electricity generation. On the other hand, a reduced workload for installations, especially due to more intensive operation in the partial load range, tends to lead to efficiency losses and increased specific emissions.

Natural gas-fired installations show an opposite picture. Electricity generation from this group of installations has increased strongly compared to 2013, while emissions are only slightly above the 2013 level. This can mainly be explained by an increased use of more efficient installations for electricity generation. The 2019 figures in electricity generation and emissions from lignite-fired installations showed fairly similar trends.

Since 2013, gross electricity generation from large combustion plants using hard coal has fallen by 55 percent from 127 terawatt-hours (TWh) to 57 TWh.[7] According to preliminary estimates this means that in 2019 gross electricity generation from hard coal in Germany dropped to its lowest level for over 60 years.[8] A significant increase in the feed-in from wind power plants and increasing displacement by natural gas power plants were the main reasons for this decline. In addition, several hard coal-fired units with a capacity of around one gigawatt were shut down. The economic efficiency of hard coal-fired installations deteriorated year-on-year due to relatively low natural gas prices and the increased price of emission allowances (EUA). The calculated profit margins (or clean dark spreads) were in the negative range especially for less efficient hard coal-fired units (see also Section 'Fuel Switch/Clean Spreads'). The Federal Network Agency has also received several notifications of closures in 2020. The commissioning of the new Datteln IV power plant (1.1 GW), one of the most efficient hard coal-fired power plants in Europe, initially planned for 2018, will probably be delayed until early summer 2020.[9]

Electricity production from lignite declined for the sixth year in a row and, according to preliminary estimates, dropped to its lowest level for at least 40 years in 2019.[10] Since 2013, gross electricity production of lignite-fired power plants has fallen by around 29 percent from 161 TWh to 114 TWh. Nevertheless, lignite remains the most important energy source in power generation, with a share of around 19 percent, followed by onshore wind power (17 percent), natural gas (15 percent), nuclear power (12 percent) and hard coal (nine percent).[11] The economic efficiency of lignite-fired power plants also deteriorated overall last year due to higher $CO_2$ prices. In recent years, some older lignite-fired units were transferred to security reserve. The two remaining units of the Frimmersdorf power plant (a total of 635 MW gross electrical output) were moved to reserve for four years in October 2017.[12] Two units of the Niederaussem power plant (a total of 632 MW) and the relatively modern unit of the Jänschwalde power plant (500 MW) followed in October 2018. In October 2019, one unit each of the Neurath power plant (308 MW) and the Jänschwalde power plant (500 MW) was transferred to the reserve. Figure 13 shows the capacity of the lignite units decommissioned to date and their estimated emissions. After four years in security reserve, the lignite-fired units are to be finally decommissioned.

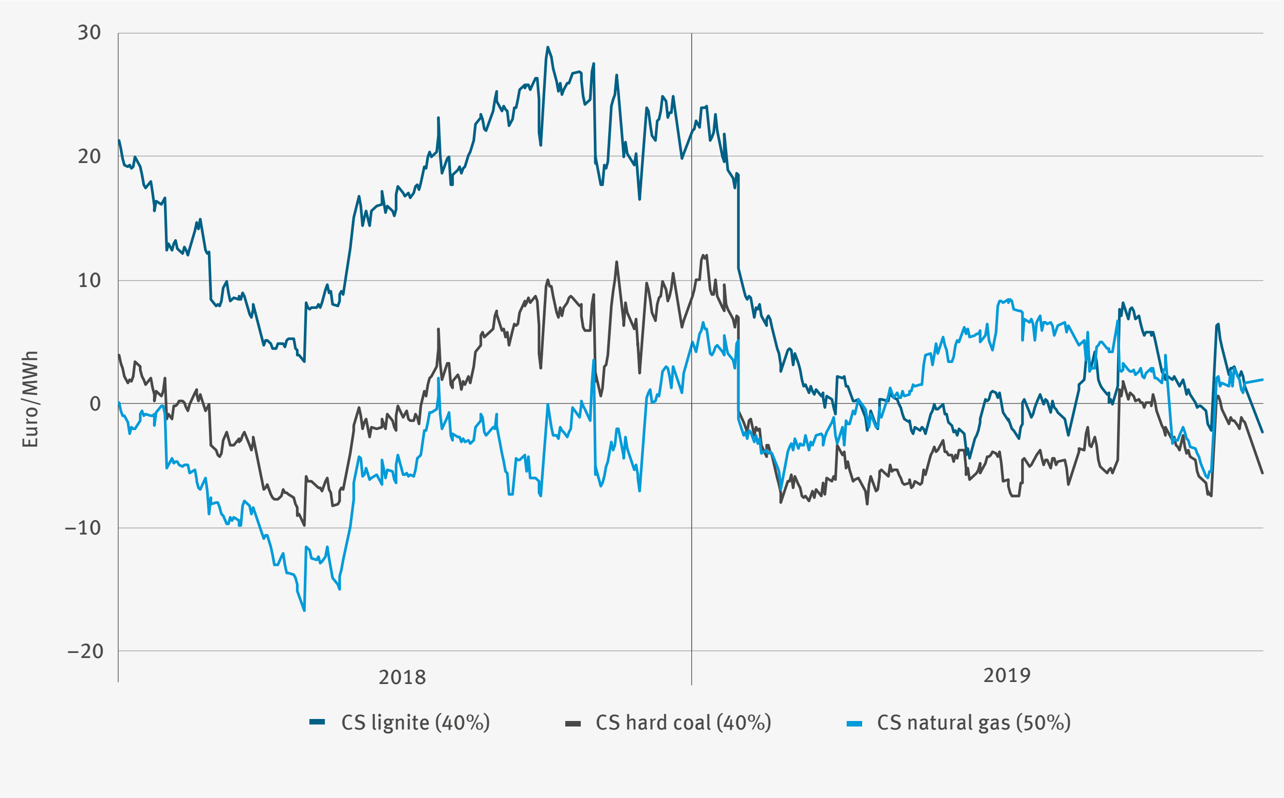
For the reasons already mentioned above, electricity production in natural gas-fired power plants reached a new high last year at the expense of coal-fired power plants and it was clearly ahead of hard coal for the first time. Since 2013, the gross power generation of natural gas power plants has risen by 35 percent from 68 TWh to 91 TWh.[13] The much stronger increase in gross power generation compared to emissions is an indication of improved average installation efficiency, also due to higher work load.

7 BDEW 2020
8 Statistics from the coal industry 2019
9 Uniper 2020
10 Statistics from the coal industry 2019
11 BDEW 2020
12 Power plants that are being transferred into security reserve will remain subject to emissions trading for the time being.
13 BDEW 2020

### Fuel Switch/Clean Spreads

The following figure shows the **calculated** contribution margins or 'clean spreads' for selected types of power plants. The clean spreads are calculated as the balance of the revenue per generated MWh and the variable costs of fuels and emission allowances plus operating costs. The actual contribution margins of the power plant operators may deviate from this and depend, among other things, on the respective hedging strategy of the energy suppliers. In particular larger electric supply companies (utilities) secure their electricity production several years in advance. Heat-controlled power plants can also have a different cost structure.

Operators of lignite power plants benefited, in particular, from the rise in electricity prices in the second half of 2018. Although lignite-fired power plants have been disproportionately affected by higher $CO_2$ prices in this period, increasing input costs have been excessively compensated by the upward trend in electricity prices. This business pattern changed fundamentally last year. In the first quarter of 2019, the calculated contribution margins for lignite decreased strongly and were in part negative in the summer months. The main causes were another rise in the $CO_2$ price combined with virtually constant fuel costs for domestic lignite and lower electricity prices. Calculated clean dark spreads (hard coal) were also largely negative last year. By contrast, average natural gas-fired power plants (50 percent efficiency) were able to achieve, at least arithmetically, higher profit margins during the summer months of 2019 than some hard coal/lignite power plants (40 percent efficiency). The profitability of natural gas installations compared to coal-fired power plants was consistently higher in this period and within the scope of the assumptions made, also due to relatively low natural gas prices.

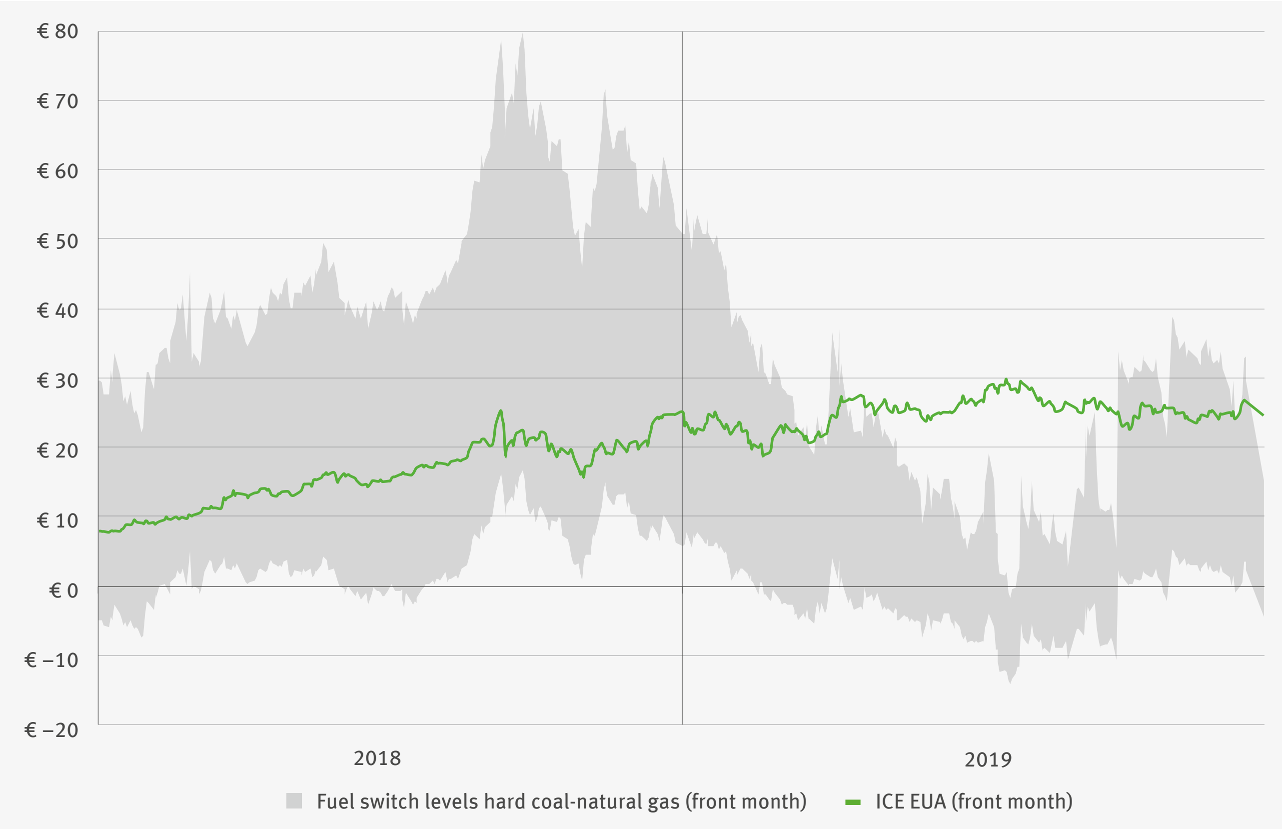



As of 07/05/2020
Source: Refinitiv Eikon, ICIS, DEHSt

Figure 9: Lignite, hard coal and natural gas clean spreads in 2018 and 2019 (all front month contracts)

In addition to the EUA price, the following figures also show a range of calculated 'fuel switch levels' for various power plant set-ups (hard coal/lignite to natural gas). The fuel switch level indicates the calculated price level for EUA above which the clean spread for natural gas exceeds that for hard coal/lignite. The fuel switch level can thus be used as an indicator of the $CO_2$ price level above which the burning of natural gas becomes more profitable than the use of hard coal/lignite.

The fall in natural gas prices relative to hard coal led to lower fuel switch levels overall last year. Figure 10 shows that with EUA prices of 20 to 30 euros and the resulting change in economic cost factors, at least in mathematical terms, many hard coal-fired power plants were displaced from the mid-load by efficient natural gas-fired power plants. The calculated fuel switch range was partially negative in the summer months, which means that under the given conditions a fuel switch would have been possible even without an additional $CO_2$ price.

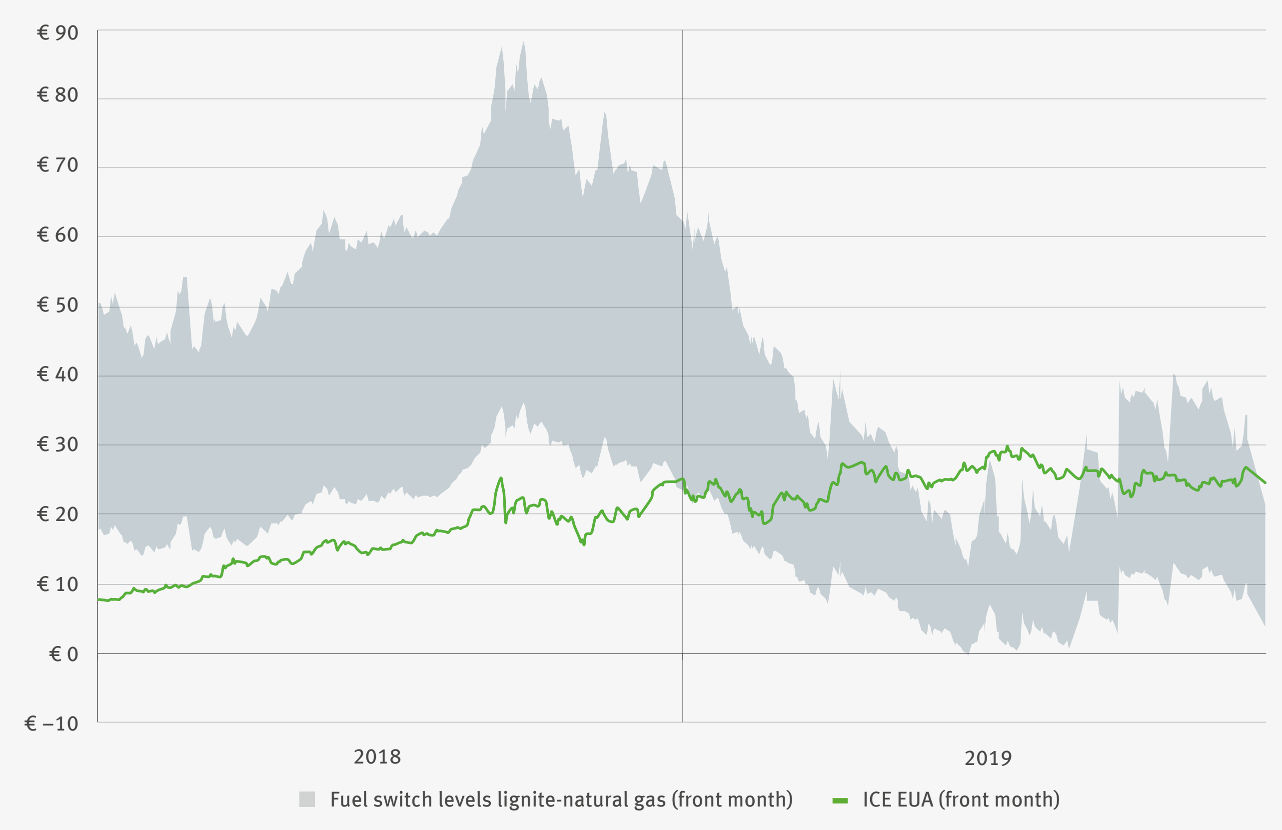



As of 07/05/2020
Source: Refinitiv Eikon, ICIS, DEHSt
* Range HC35%-NG60% to HC45%-NG50%; no amount-weighted representation of the actual available capacities.

Figure 10: Fuel switch levels from hard coal to natural gas* and EUA-price 2018 and 2019[14]

Falling natural gas prices with relatively constant production costs for lignite also led to a lower fuel switch level between lignite and natural gas compared to the previous year. Thus, at an EUA price level of 20 to 30 euros, especially during the summer months, some lignite-fired power installations could theoretically be replaced by natural gas installations.

14 In addition to fuel prices, the fuel switch level also depends on the efficiency of the power plants concerned. The range here is between hard coal-fired power plants with an efficiency of 35 percent compared to natural gas-fired power plants with an efficiency of 60 percent and hard coal-fired power plants with an efficiency of 45 percent compared to natural gas-fired power plants with an efficiency of 50 percent. The comparatively volatile front month contracts (hard coal, natural gas) were used as the basis for the calculation.



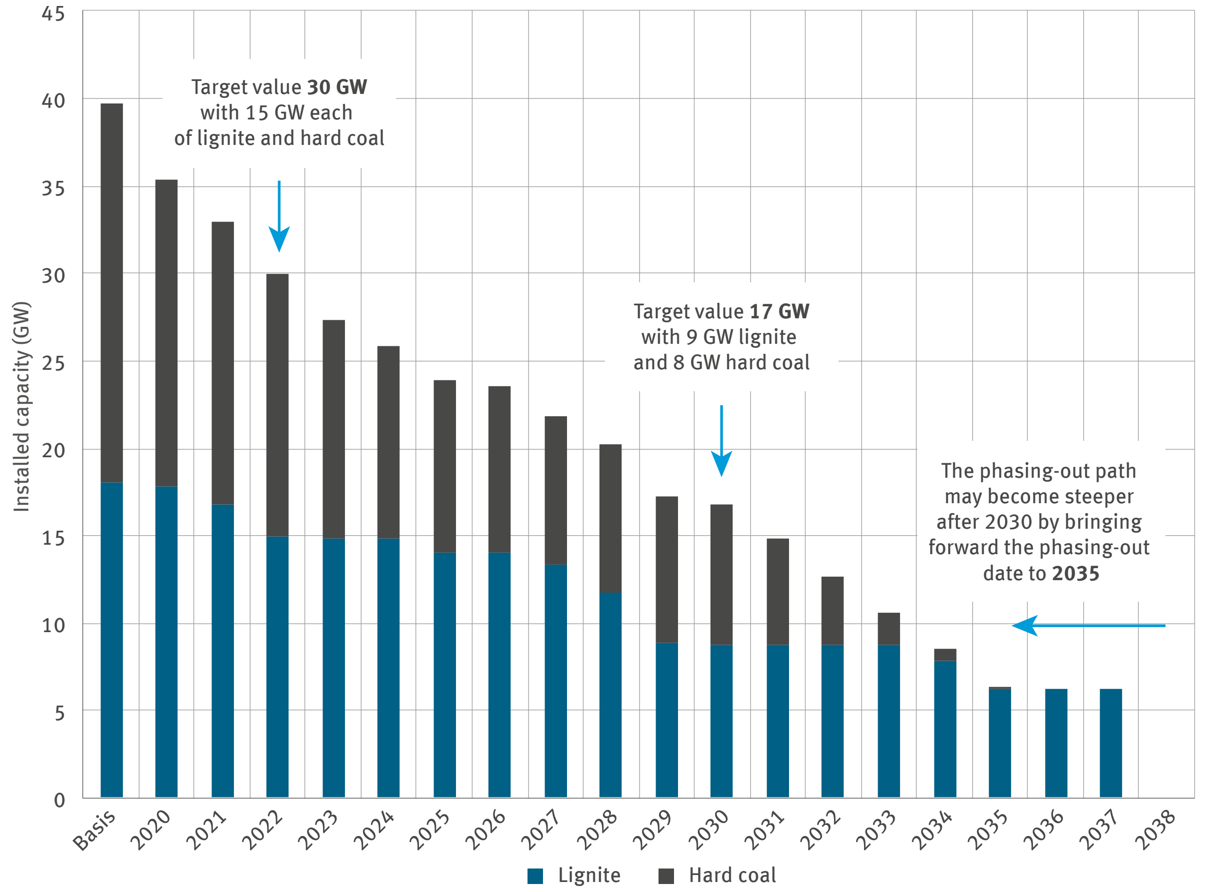

As of 07/05/2020
Source: Refinitiv Eikon, ICIS, DEHSt
* Range LG32%-NG60% to LG43%-NG50%; no amount weighted representation of the actual available capacities.

Figure 11: Fuel switch levels from lignite to natural gas* and EUA-Price 2018 and 2019

## Infobox: Phasing out of coal in Germany

On 29 January 2020, the German government adopted a draft law on 'Reduction and termination of coal-fired power generation' (KohleausstiegsG). At the time of going to press, the law was in the parliamentary process and has therefore not yet come into force. The cabinet resolution provides for a gradual reduction in installed electricity generation capacity for lignite and hard coal by 2038, combined with the possibility of bringing forward the phasing-out of coal to 2035. The decommissioning path is based on the targets for 2022, 2030 and 2038 recommended by the Commission on 'Growth, Structural Change and Employment' (WSB Commission).[15] The lignite capacities are to be decommissioned or transferred to the safety reserve according to a non-linear schedule negotiated between the German Government, the States (Länder) and power plant operators and laid down in the Act. In contrast, the Act provides for several rounds of tendering for the decommissioning of hard coal capacities until 2026. In other words, on the basis of the procedure selected, it is not yet possible to predict in detail which hard coal units will be withdrawn from the market and at what time. If insufficient bids are received for the tenders, decommissioning is to be flanked by regulatory measures from 2024 onwards. From 2027, there will only be regulatory closures, taking into account the age sequence. The maximum remaining hard coal capacity is calculated between 2022 and 2030 and between 2030 and 2038 as the difference between the overall target level and the remaining lignite capacity, so that the decommissioning path for coal-fired power generation is largely linear (see Figure 12). As compensation for the commissioning of Datteln IV, which was not foreseen by the WSB Commission, special tenders for the early decommissioning of hard coal-fired capacity will be launched. In the years 2026, 2029 and 2032, reviews will take place as to whether the power plant shutdowns after 2030 can be brought forward by three years in each case. The phasing-out of coal would then be completed by 2035.

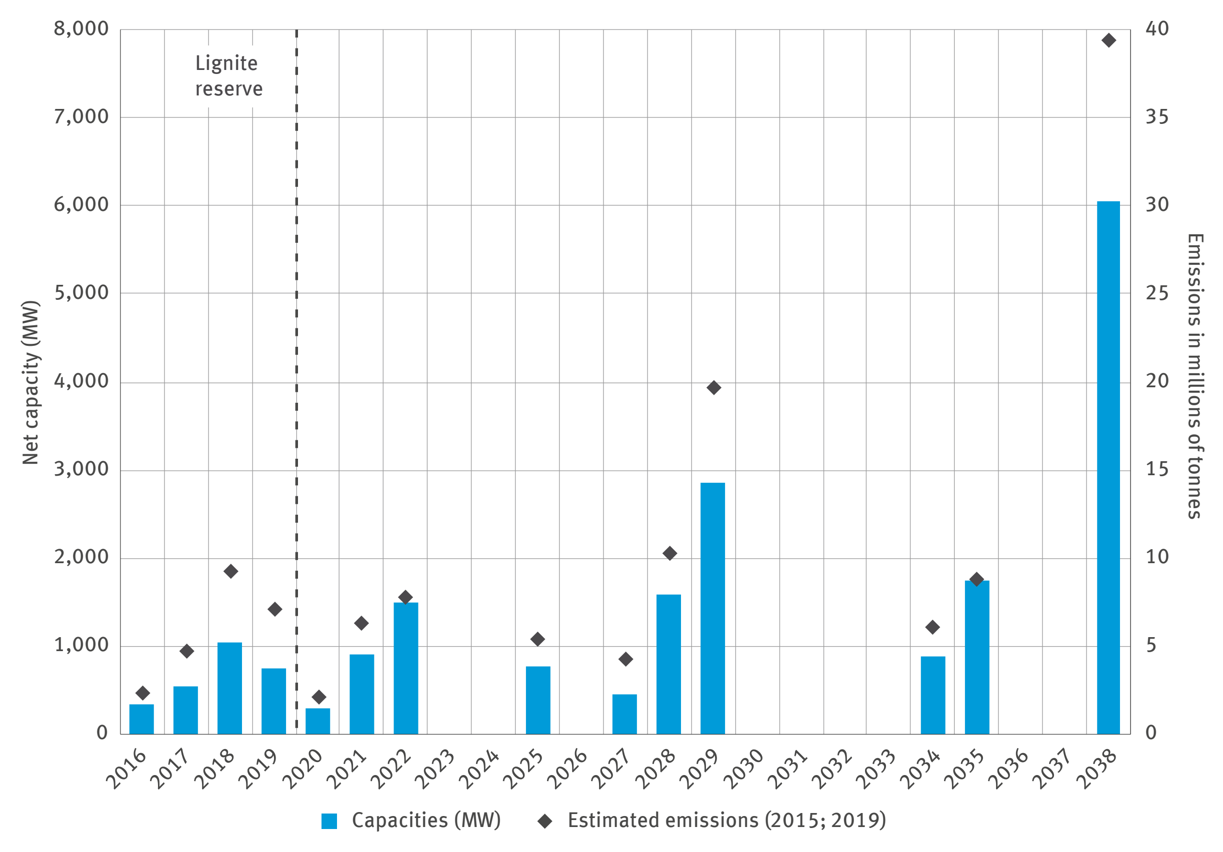
15 WSB 2019




As of 04/05/2020
Source: BMU
Capacity figures refer to the respective year end.

Figure 12: Reduction of electricity generation capacities of lignite and hard coal according to the proposal of the Coal Phasing-out Act of 29/01/2020

The closure of coal-fired power plants in Germany will lead to further emission reductions in the EU-ETS and thus to a reduced demand for emission allowances. This could have a price-reducing effect and lead to higher emissions in other ETS installations ('waterbed effect'). The resulting net reduction effect could be lower than the historical emissions of the decommissioned power plants for another reason: part of the electricity generated in the decommissioned power plants is likely to be replaced by a higher utilisation of other fossil power plants at home or abroad. This means that the resulting net reduction effect of decommissioned lignite capacities will probably be greater than that of hard coal capacities. However, lignite will be decommissioned later than hard coal (more than 80 percent of lignite capacities are not to be shut down until after 2025), which is why a substantial decline in demand in the EU ETS is not expected until the second half of the 2020s. Already in the years 2016 to 2019, around 2.7 GW of lignite capacities have been transferred to the security reserve. A similar scale is planned for the years 2020 to 2022 (see Figure 13).




As of 04/05/2020
Source: EEX, ICIS, DEHSt
Capacity figures refer to the respective year end.

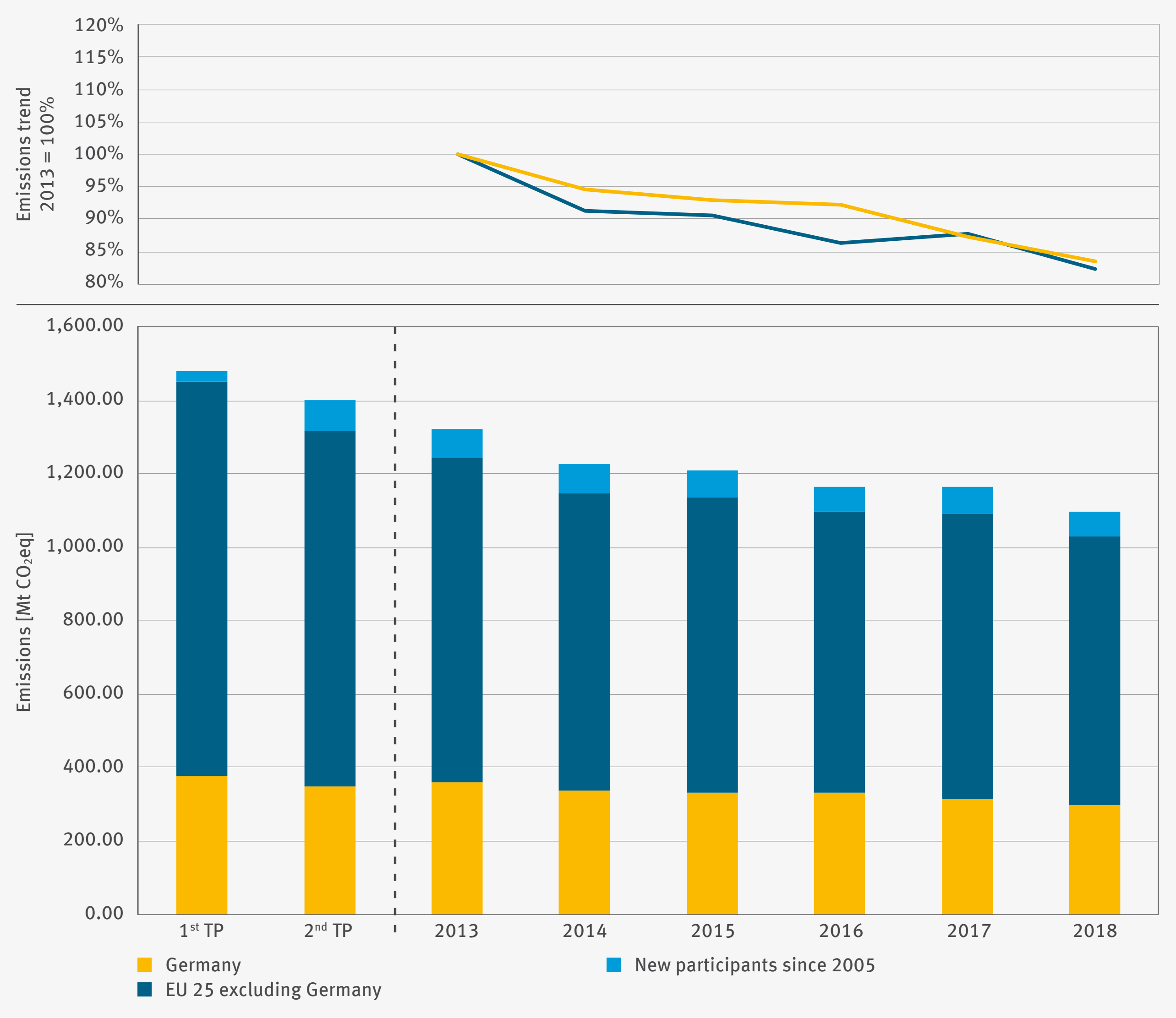
Figure 13: Decommissioning of lignite capacity and estimated historical emissions in 2019[16]

The waterbed effect due to the phasing-out of coal is mitigated by two different measures: since 2019, the Market Stability Reserve (MSR) in the EU ETS has compensated for decline in demand proportionately and with a time lag by reducing EU-wide auction amounts. In addition, to a limited extent Member States will be able to compensate for a drop in demand in the carbon market due to the closure of power plants by voluntarily waiving the auctioning of emission allowances and their subsequent cancellation. In accordance with the provisions of the Coal Phasing-out Act, Germany will make use of the option to compensate for the remaining drop in demand by additional cancellation of emission allowances. This will ensure that the national phasing-out of coal cannot lead to the 'waterbed effect' in EU emissions trading described above.

16 DEHSt has no information about power plant emissions that are specific to a particular unit. Unit-specific power generation data from the EEX were used as the basis for the estimated emission values reported. For the lignite reserve (2016 to 2019), values from the year 2015 were used. With the help of the respective efficiencies (gross), the respective thermal output was first calculated for the individual units and then the shares of the individual units in the total thermal output of the power installations. For the next step, calculated shares were multiplied by the total emissions of the respective installation (in 2015 or 2019) in order to derive an approximate value for the emissions per unit.

### The 'Combustion' activity in the EU

The following figure gives an overview of the EU-wide emissions trend within the combustion activity[17] since the beginning of emissions trading. It differentiates between the emissions trend of German installations, the other Member States that have been participating in emissions trading since 2005 and those that only joined emissions trading after 2005.




As of 04/05/2020

Figure 14: Combustion and energy emissions trends (Registry Activity 20) in Germany and in the EU up to 2018[18]

In the period 2013 to 2016, emissions due to combustion activity from installations in the EU initially fell more sharply than in Germany. In 2017, however, emissions from other Member States increased, while emissions from German installations decreased significantly. In the following year, the emissions trend levelled off. Total emissions in emissions trading in 2019 also moved in the same direction in Germany and throughout the EU (see Chapter 3.1). However, the decline in emissions in Germany, particularly in the energy sector, was greater than in the other Member States.

17 In contrast to the German scope of application of emissions trading, which for the activities in Annex 1 TEHG differentiates between six 'Combustion activities', only the activity 'Combustion' is used at EU level. It combines all energy installations and all other combustion activities according to Annex 1 EHRL.

18 Data source: EEA 2019; the evaluation is based on a combination of installations by activity in the EU Union Registry (see Table 37, Chapter 7), which may lead to differences in the emissions amount per sector for Germany. New participants in the EU ETS after 2005 are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

Compared to the first year of the third trading period, in 2018 German installations running combustion activities still accounted for 83 percent of the emissions in 2013. The emissions level of installations from the other Member States was 82 percent of the emissions in 2013. In 2018, the share of German installations in the Combustion Activity corresponds to around 27 percent of the EU-wide total emissions from this activity.

## 2.2 Other combustion

Approximately 70 installations with a rated thermal input of at least 20 MW have been subject to emissions trading since 2013 due to the broader definition of 'combustion' and are included in Activity 1. This section deals only with those 37 installations in Activity 1 that are not assigned to other industrial sectors in this report. This group of installations mainly includes test benches for turbines or engines but also process heaters and asphalt mixing plants.

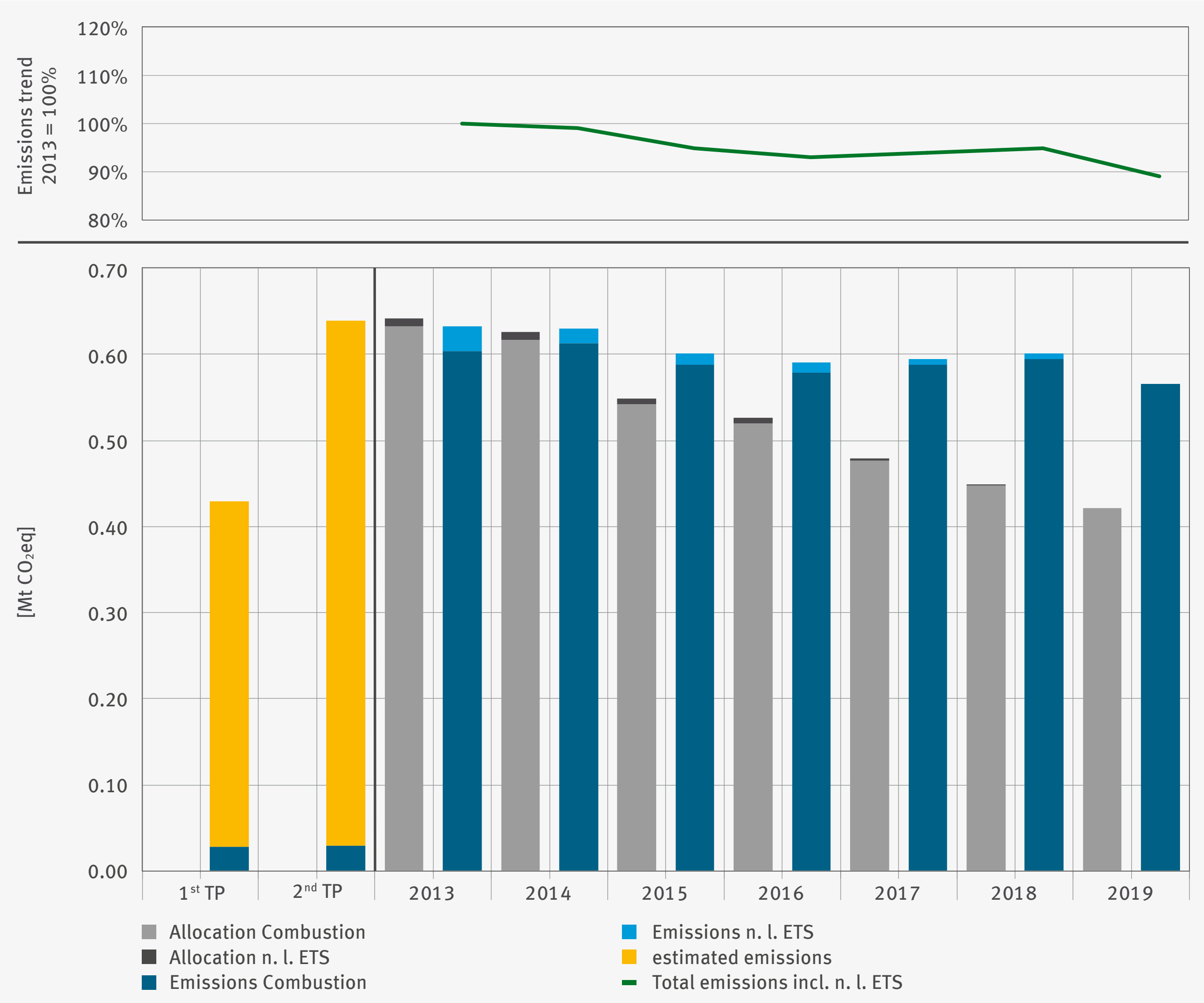
The following table summarises allocation and emissions data for these installations. In total, they emitted around 0.6 million tonnes of carbon dioxide in 2019. The allocation coverage is 74.5 percent of their emissions.

Table 7: Other combustion plants (Activity 1), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries, allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 1 | Combustion | 37 | 594 | 566 | 421 | 74.5 % |
| | N. l. ETS | *1** | 7 | – | – | – |
| **Total** | | **37** | **601** | **566** | **421** | **74.5 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

The following figure shows the emissions trend since the start of emissions trading. As the installations have only been participating in emissions trading since 2013, the figures for 2005 to 2010 are those reported by the operators in the allocation process. No emissions data is available for 2011 and 2012. Overall, emissions have fallen by around eleven percent since the start of the third trading period in 2013. As the composition of this group of installations is very heterogeneous, it is not possible to derive any overall conclusions from the emissions trends.




As of 04/05/2020

Figure 15: Other combustion plants (Activity 1), emissions trend and free allocation 2005 to 2019 in Germany[19]

## 2.3 Refineries

In the 2019 reporting year, 24 installations subject to emissions trading were refineries (Activity 7 according to Annex 1 TEHG).

In this report, power plants are considered together with refineries provided that the refinery is either licensed together with the power plant as one single installation according to the Federal Immission Control Act (BImSchG), or that DEHSt has determined that it is an ‘amalgamated installation’ from the allocation procedure. If a refinery at the same site is operated by the same operator in a technical alliance with one or more power plants, but has separate operating licences for the individual installations, they are then deemed to be an ‘amalgamated installation’ pursuant to Section 28(1)(4c) of the TEHG and Section 29(3) of the ZuV 2020. A total of 15 of the refineries include power plants. Of these, nine refineries are licensed together with one or more power plants and another six installations are covered by the above-mentioned regulation to form an ‘amalgamated installation’.

19 N. l. ETS: installations no longer subject to emissions trading. In the figure, installations that are no longer subject to emissions trading are taken into account retrospectively in order to show the actual emissions trend of European emissions trading in Germany since 2005 and not only the emissions trend of the installations subject to emissions trading in the respective reporting year (see also Chapter 1 Introduction).

Total emissions from the refineries in 2019 were 23.2 million tonnes of carbon dioxide. Compared with 2018, when carbon dioxide emissions totalled 23.9 million tonnes, emissions decreased by around 3.1 percent or 733,000 tonnes of carbon dioxide (see Table 8).

Table 8: Refineries (Activity 7), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries, allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 7 | Refineries | 24 | 23,941 | 23,208 | 17,860 | 77.0 % |
| | N. l. ETS | | 0 | – | – | – |
| **Total** | | **24** | **23,941** | **23,208** | **17,860** | **77.0 %** |

As of 04/05/2020

In 2019, the refineries sector had a total shortfall of around 5.4 million emission allowances at a 77 percent allocation coverage. In the previous year, the shortfall was 5.3 million emission allowances with an allocation coverage of around 78 percent.

### Trends in the third trading period

The upper section of Figure 16 shows the emissions history of the refineries for the third trading period. The emissions and allocation amounts are shown in the lower section. For the first and second trading periods, the data are presented as average values for each trading period and from 2013 up to and including 2019 as annual values. The figure is supplemented by the presentation of installations that are currently no longer subject to emissions trading (n. l. ETS)[20] and the estimated emissions from installations for the period 2005 to 2012, which are only subject to emissions trading from 2013 onwards[21].

20 See explanation: 'Taking into account installations no longer subject to emissions trading (n. l. ETS)' in Chapter 1, Introduction.

21 Emissions for the period of 2005 to 2010 use data from the allocation procedure. For the years 2011 and 2012 where there are no historical emissions, the values for both years were estimated by linear interpolation.

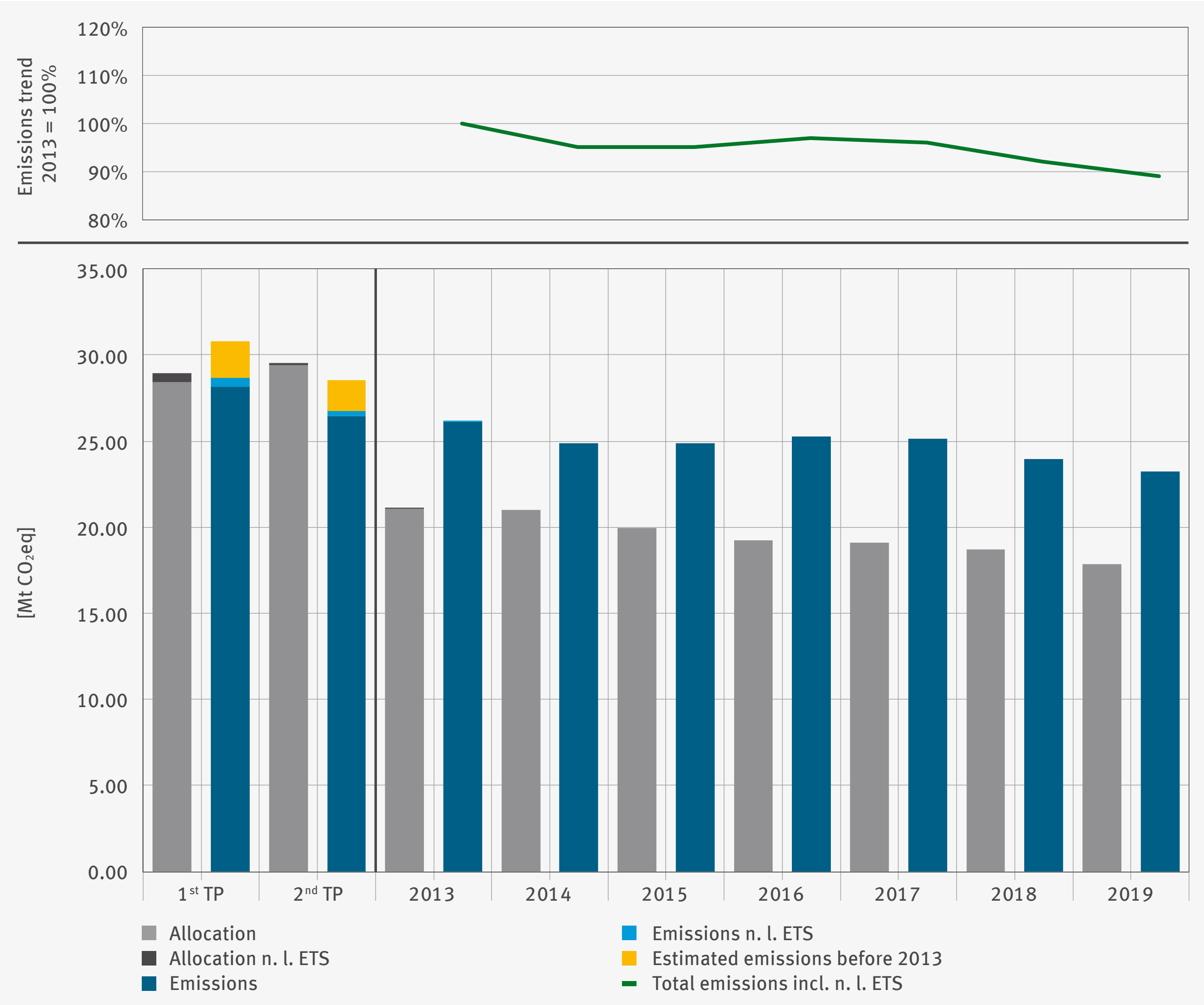



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Figure 16: Refineries (Activity 7), emissions and free allocation trends up to 2019 in Germany

At the beginning of the third trading period, emissions amounted to around 26 million tonnes of carbon dioxide and from 2014 up to and including 2017 they will be around 25 million tonnes of carbon dioxide. In 2018 and 2019, emissions decreased to about 23 million tonnes of carbon dioxide. Possible reasons for this are a number of extraordinary events in the last two reporting years. At the Vohburg refinery, there was a serious explosion followed by a major fire at the beginning of September 2018. The installation was subsequently shut down and only restarted in mid-2019. Another unusual situation was the low water levels of some watercourses in 2018 due to the dry summer, which led to difficulties in the delivery of raw materials and supplies and also meant that products could not be transported via the waterways, or at least only partially. As a result some refineries, especially along the Rhine, had to adjust their production. In 2019, oil imports from Russia to Germany were also stopped on a number of occasions. This was due to contamination in the crude oil transported via the 'Druzhba' east-west oil pipeline which could have caused considerable damage to the refinery facilities during processing. The refineries in Schwedt and Leuna, which are among the five largest refinery sites in Germany, were particularly affected by the supply bottleneck associated with this[22].

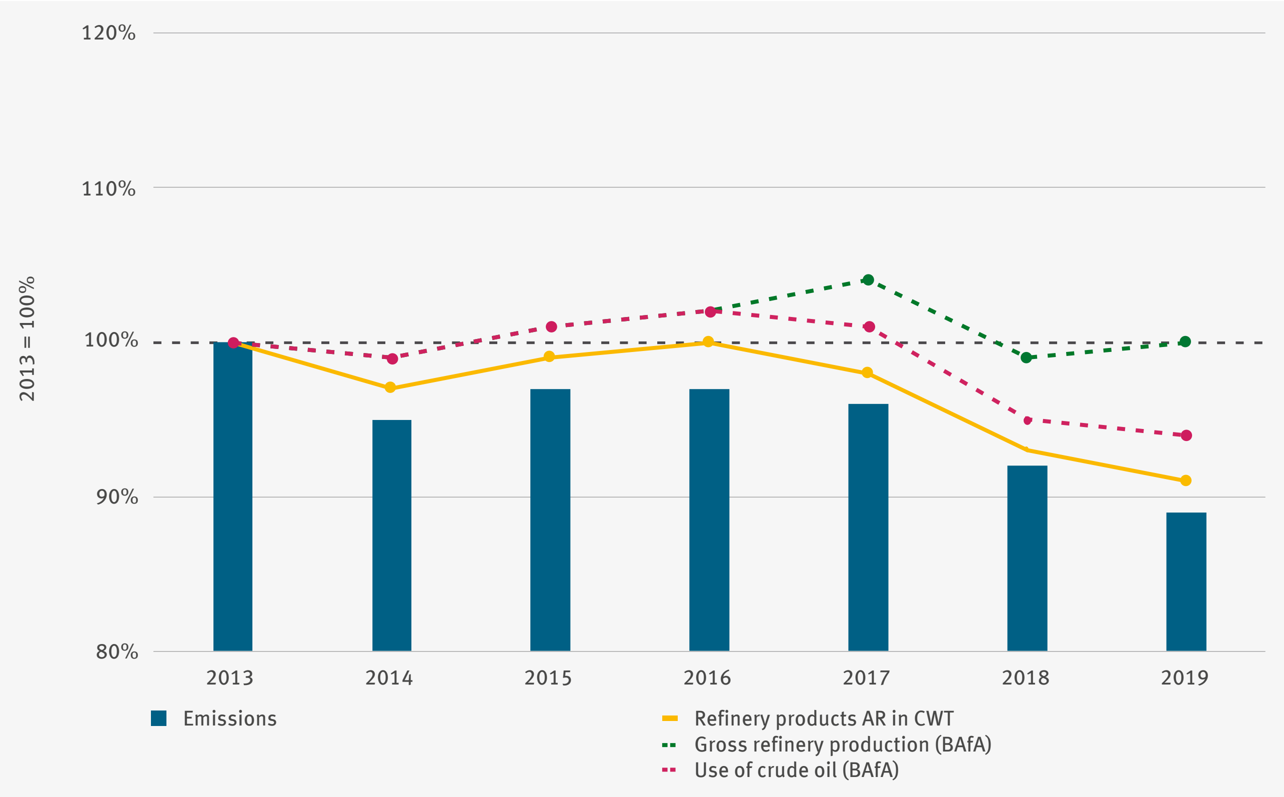
Periodic maintenance of the installations can also have an impact on emissions from the refining industry. In 2018 and 2019, several larger refineries underwent overhauls with production being halted for several weeks.

Overall, emissions decreased by about eleven percent between 2013, i.e. the start of the third trading period, and 2019.

22 Compare Reuters 2019

The free allocation (cf. Figure 16) was on average higher than the sector's emissions in both first and second trading periods, which changed in the third trading period. Due to their power plants, refineries have been affected by the discontinuation of free allocation for electricity generation in the third trading period. This has caused a considerable allowance shortage for refineries and, compared to other industrial sectors, a significantly higher shortfall from 2013 onwards.

Also due to the cross-sectoral correction factor, the annual free allocation to refineries – as in all other industrial sectors – has decreased continuously in the third trading period. In 2019, the free allocation for the sector was around 15 percent less than at the beginning of the third trading period.




As of 04/05/2020

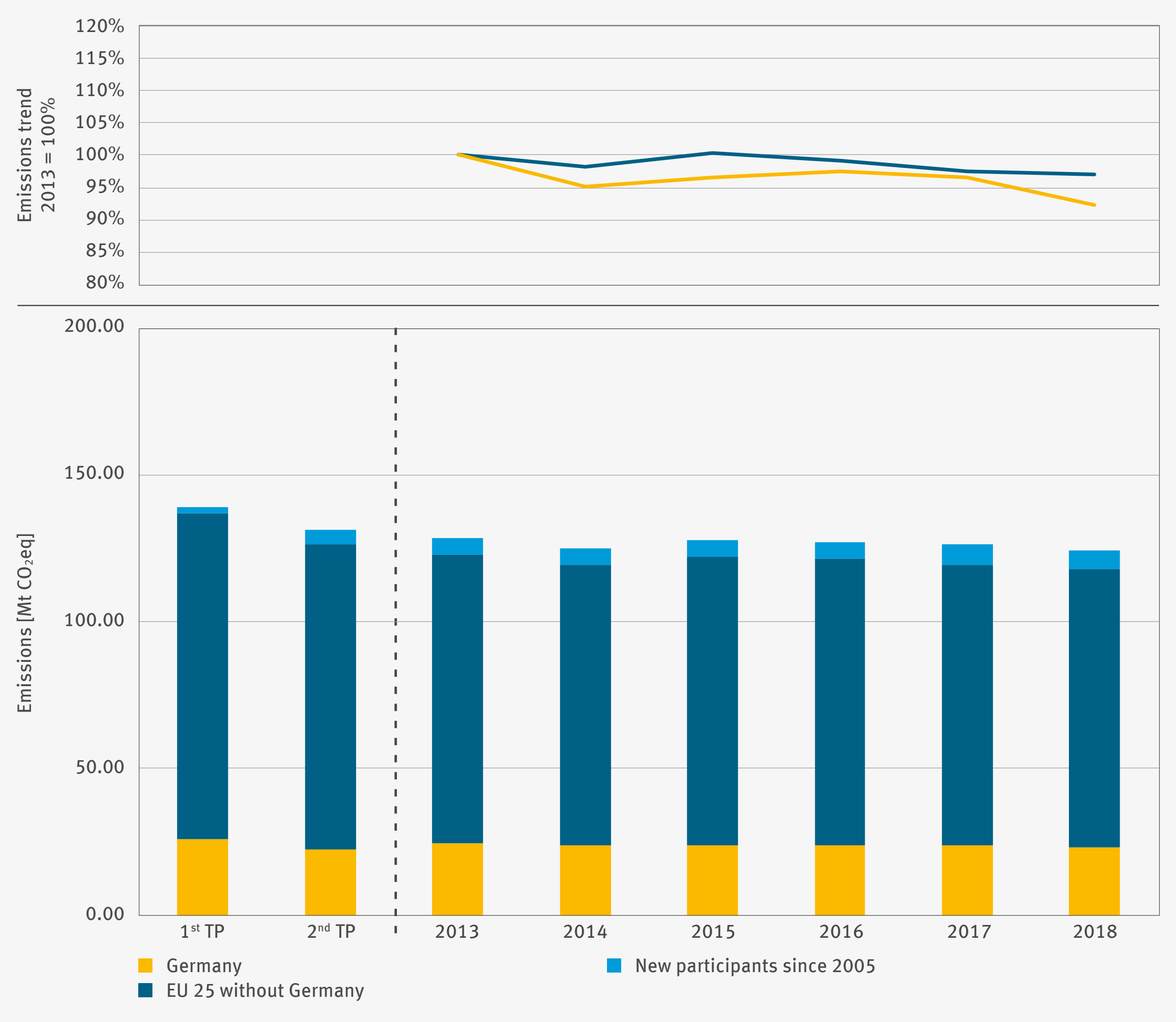
Figure 17: Refineries (Activity 7), 2013 to 2019 emissions and production trends in Germany, each in relation to 2013

Figure 17 compares the emissions trend of refineries with the trend in activity rate for the 'CWT' product benchmark ($CO_2$ weighted tonne), the German gross refinery production and the crude oil use in German refineries. A refinery's CWT value is derived from the sum of the annual input quantities of its individual processes, each weighted with the typical process $CO_2$ emission intensity. If the time profile of the CWT activity rate differs significantly from that of gross refinery production, this may indicate a change in the range of refinery products which is reflected in the CWT value. The CWT activity rate does not include the quantities for other benchmark products such as those of steam crackers, nor the product quantities of atypical refineries which predominantly produce lubricants or bitumen for example. In contrast, official statistics[23] on gross refinery production take these quantities into account.

23 See BAfA 2020a

Figure 17 shows that emissions, crude oil use and CWT activity rate are largely parallel. Until 2016, gross refinery production profile was identical to crude oil input and analogous to the CWT activity rate. Subsequently, a divergent trend emerged in gross refinery production: gross refinery production in 2017 rose by around two percent compared to 2016, while the other three parameters each decreased by at least one percent. While emissions, CWT activity rate and crude oil input decreased, gross refinery production remained unchanged in 2019 (plus 0.6 percent) compared to 2018.[24] In addition to the reasons already mentioned, methodological changes in the acquisition of official mineral oil statistics may be other potential reasons for this divergent trend in gross refinery production compared to other variables.[25]

Overall, the CWT activity rate and the amount of crude oil used reflect the trend of emissions fairly well. The decrease in emissions is likely to be mainly due to the decrease in the use of crude oil.




As of 04/05/2020

Figure 18: Emissions trend of refineries (Registry Activity 21) in Germany and in the EU until 2018[26]

24 See BAfA 2020a (preliminary values for 2019)

25 These were applied to 2017 data for the first time and may lead to breaks in the timelines of the data. See BAfA 2020b.

26 Data source: EEA 2019; the evaluation is based on a summary of the installations by the activities in the EU Union Registry (cf. Table 37, Chapter 7). This can lead to differences in the emission amount per sector in Germany. Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania have been new participants in the EU ETS since 2005.

Figure 18 shows the carbon dioxide emissions trend from refineries (Register Activity 21) in Germany and in the EU. In particular, the mandatory rule for German refineries from the third trading period onwards to form an 'amalgamated installation' pursuant to Section 28(1)(4c) of TEHG and Section 29(3) of 2020 ZuV only enables a comparison across trading periods to a limited extent.

Although emissions at the EU level increased by 1.9 percent in 2015 compared to 2014, it can be seen that the trend towards a further decline in emissions established at the beginning of the EU ETS continued after 2016. A similar picture emerges for the emissions trend of German refineries.

Overall, emissions from installations at the EU level decreased by around three percent compared to 2013. According to EEA data (see Figure 18), the decline in emissions from refineries in Germany was around eight percent since the introduction of the EU ETS. Based on the adjusted data (see Figure 16), the eleven percent decrease since the beginning of the third trading period is much more pronounced and thus higher than that at the EU level.

## 2.4 Iron and steel industry including coking plants

The iron and steel industry includes Activities 8 to 11 and one Activity 1 installation as per TEHG[27], which means a total of 125 installations that are subject to emissions trading in Germany. The assessment of the iron and steel industry summarises Activities 8 (coke production), 9 (roasting and sintering of metal ores) and 10 (pig iron and steel production). The reason for this is that the installations are strongly interlinked and connected in terms of approval regulation, especially in the blast furnace route (production of oxygen steel). Thus, the installations partially include both the production of pig iron and steel as well as the coking plants and sinter plants, which means that the emission data is not available in activity-specific form. This is predominantly due to the establishment of 'amalgamated installations' according to Section 24 of TEHG in conjunction with Section 29(2) of the 2020 Allocation Ordinance (ZuV). In other cases, coking plants and sinter plants are recorded as separate installations in the EU ETS. A differentiated view according to Activities would therefore result in a distorted picture due to the different system boundaries.[28]

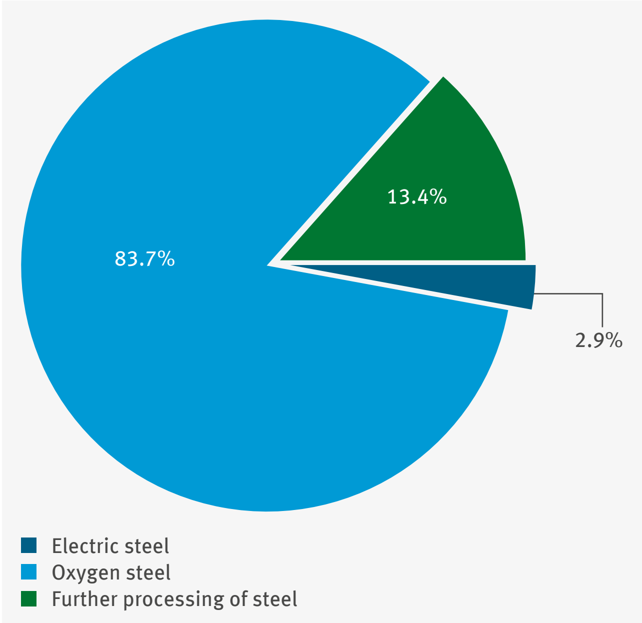
27 This is an independently approved coal grinding and drying installation, which is part of the pig iron production process.

28 In addition, a small number of Activity 10 installations contain process steps for the further processing of crude steel, which would be assigned to Activity 11 'Ferrous metals processing' if they were operated as independent installations.

Figure 19 shows that steel production installations using the blast furnace route (oxygen steel) with a share of almost 84 percent dominate the emissions of the iron and steel industry in emissions trading in Germany.

The blast furnace route accounts for about 70 percent of crude steel production.[29] In contrast, emissions from electric steel production, which accounts for 30 percent of total crude steel production in Germany, are comparatively low at just under three percent.[30] Emissions from steel processing (Activity 11) account for about 13 percent.

Table 9 shows the emissions for 2018 and 2019, broken down by Activities 8 to 10, 11 and 1 as explained above. In 2019, emissions from activities 8 to 10 were 30.7 million tonnes of carbon dioxide i.e. 5.6 percent below the previous year's figure of 32.5 million tonnes, while at the same time, crude steel production fell by around seven percent to 39.7 million tonnes.[31]




As of 04/05/2020

Figure 19: 2019 emissions distribution in the iron and steel industry (Activities 8 to 11 and 1)

Emissions from the blast furnace route (including Activities 8 and 9) amounted to around 29.7 million tonnes of carbon dioxide in 2019, some 1.7 million tonnes (5.5 percent) less than in the previous year with 31.4 million tonnes. Emissions from the electric steel route decreased by around 130,000 tonnes (eleven percent) from around 1.2 million tonnes of carbon dioxide to just over 1.0 million tonnes. Emissions from ferrous metals processing (Activity 11) fell by around 557,000 tonnes (ten percent) to 4.8 million tonnes.

Table 9: Iron and steel industry (Activities 8 to 11 and 1), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries, allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 8, 9, 10 | Pig iron and crude steel production* | 35 | 32,551 | 30,735 | 41,911 | 136.4 % |
| 11 | Ferrous metal processing | 89 | 5,294 | 4,769 | 4,312 | 90.4 % |
| 1 | Combustion | 1 | 76 | 73 | 0 | 0.0 % |
| | N. l. ETS | | 0 | – | – | – |
| **Total** | | **125** | **37,921** | **35,577** | **46,223** | **129.9 %** |

As of 04/05/2020
* Coking plants, metal ore processing, pig iron and steel production

29 See WV Stahl 2020
30 Indirect emissions resulting from electricity consumption are added to both types of crude steel production. While these are higher for electric steel production, the blast furnace route would clearly dominate emissions even if these indirect emissions are included.
31 See WV Stahl 2020

### Transfer of waste gases from iron, steel and coke production

A characteristic feature of the iron and steel industry is the transfer of waste gases from iron, steel and coke production (blast furnace gas, converter gas and coke oven gas) for energy recovery. In 2019, the total emissions from transferred and energy-intensive used waste gases from iron, steel and coke production amounted to around 24.5 million tonnes of carbon dioxide (see Table 10), about 1.2 million tonnes less than in 2018.

Table 10: Transfer of waste gases from iron, steel and coke production in 2019 – produced within Activities 8 and 10

| Transfer to [kt $CO_2$eq/a] | | | | | |
|---|---|---|---|---|---|
| Iron and steel production installations (Activities 8-10)* | Ferrous metal processing and combustion installations (Activities 11 and 1) | Energy installations | Refineries | Installations outside ETS** | Total [kt $CO_2$eq/a] |
| 3,702 | 1,027 | 19,506 | 86 | 133 | 24,455 |

As of 03/04/2020
* Emission volumes leaving installation boundaries but remaining within Activities 8 to 10
** The total amount actually transferred is 167,713 tonnes of carbon dioxide equivalents, of which 34,234 tonnes are inherently carbon dioxide

Transfers within and between Activities 8 to 10 amounted to about 3.7 million tonnes of carbon dioxide (emissions leaving the boundaries of installations but remaining within Activities 8 to 10[32]), i. e. 0.2 million tonnes less than in 2018, and transfers from these installations to installations for further processing (Activity 11) amounted to about 1.0 million tonnes of carbon dioxide (135,000 tonnes less than in 2018). Of the remaining transfers, the majority went to energy installations (around 19.5 million tonnes of carbon dioxide, compared with 20.4 million tonnes in the previous year).[33]

### Allocation status

Table 9 above not only shows the emissions but also the ratio of emissions to the allocation of the respective year – i. e. 'Allocation coverage' (last column). This was 136 percent in nominal terms for Activities 8 to 10 and 90.4 percent for Activity 11 in 2019.

However, it can be assumed for Activities 8 to 10 that, following the transfer of waste gases from iron, steel and coke production, waste gas-producing installations of the iron and steel industry will transfer emission allowances to waste gas-utilising energy installations. The producers receive an allocation for the emissions from the energy utilisation of waste gases generated in comparison to natural gas which is the baseline fuel. The benchmark also includes an 'inefficiency surcharge', which reflects the lower efficiency of energy use of waste gases in the case of blast furnace gas compared to natural gas used for electricity or heat generation. The number of emission allowances transferred can be estimated based on the waste gas volumes actually transferred. The volume of waste gases transferred to energy installations in 2019 corresponded to emissions of 19.5 million tonnes of carbon dioxide (see Section 'Transfer of waste gases from iron, steel and coke production' above).

32 For a comparison of the different installation limits, see the explanations on amalgamated installations at the beginning of this chapter.

33 When waste gases are transferred to installations not subject to emissions trading, the waste gas-producing installations must surrender emission allowances for the inherent carbon dioxide proportion of the waste gases, i. e. the volume of carbon dioxide that can no longer be used for energy purposes. This volume has already been subtracted from the total volume transferred (see Table 13) and is already included in the emissions of the waste gas-producing installation. In the case of transfers to installations subject to emissions trading, the waste gas-using installations must surrender emission allowances corresponding to the total volume of carbon dioxide contained in the transferred waste gas.

The estimate of the amount of transferred emission allowances corresponds to the emission volume from the transferred waste gases from iron, steel and coke production produced in comparison to natural gas, plus the 'inefficiency surcharge'.[34] Thus, the 2019 amount of emission allowances transferred to energy installations can be estimated at around 13.4 million emission allowances. This results in an adjusted allocation amount of about 32.9 million emission allowances and an adjusted allocation coverage of 92.4 percent (see Table 11). This means that the iron and steel industry will have to purchase almost eight percent of its need or cover it from any surpluses from the second trading period.

Table 11: Iron and steel industry (Activities 8 to 11 and 1), number of installations, allocation amounts, 2019 VET entries and adjusted allocation coverage

| Sector/ Activity | No. of installations | 2019 adjusted allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | Adjusted allocation coverage |
|---|---|---|---|---|---|
| Iron and steel | 125 | 32,867 | 35,577 | −2,710 | 92.4 % |

As of 04/05/2020

When assessing this allocation coverage in the iron and steel industry, it should also be borne in mind that a large proportion of waste gases from iron, steel and coke production is used to generate electricity. In accordance with the basic principle of allocation in the third trading period, no free allocation is granted for electricity generation. This means that a part of the deficit is the result of this principle: free allocation for electricity generation from waste gases from iron, steel and coke production is only given to an extent that corresponds to the additional emissions that occur in excess to electricity generation from natural gas (for which there is no free allocation).[35] If the electricity generated is in turn used in iron and steel production, the operator can also apply for compensation for the additional costs arising from the assumed transfer of $CO_2$ costs in addition to the electricity price.[36]

In the case of heat generation, natural gas-based subtraction is also made in the allocation for iron and steel production, but – in contrast to electricity generation – the waste gas user or heat user also receives a direct allocation for the heat generated according to heat benchmark.

## Trends in the third Trading Period

Figure 20 shows the trend of the entire sector since the beginning of the EU ETS in 2005. The green line in the top part of the figure shows the emissions trend of all installations subject to emissions trading in the respective year (including installations no longer subject to emissions trading in 2019, 'n.l. ETS').

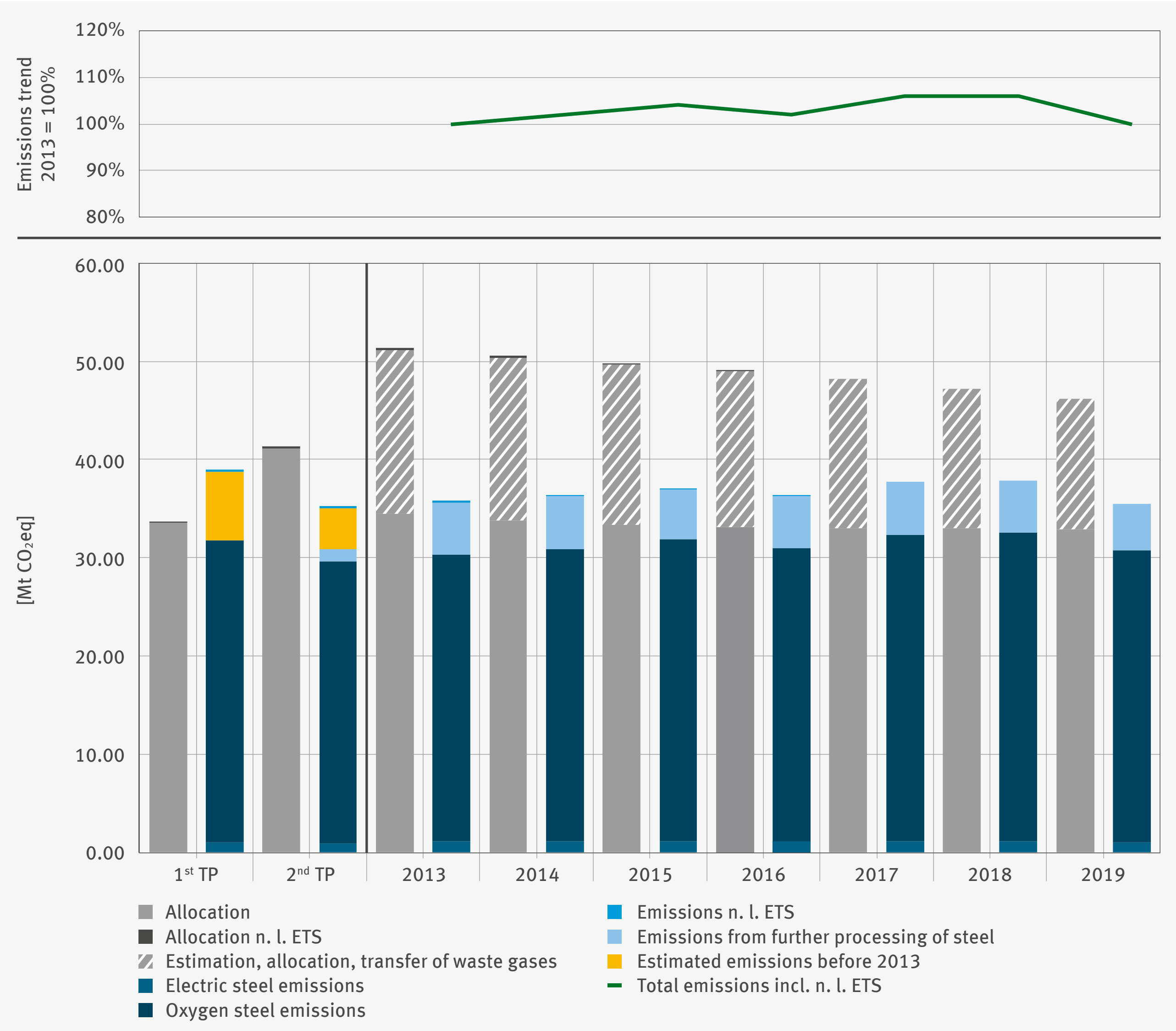
The bottom part of the figure shows both emissions and allocation amounts: the averages of the first and second trading periods and the annual values from 2013 onwards. In each case, the columns separately show the installations currently subject to emissions trading and those no longer subject to emissions trading in 2019 (n.l. ETS). The estimated shares for the transfer of waste gases from iron, steel and coke production to energy installations contained in the allocation amounts are shown in hatched form (cf. detailed explanations in the sections above). These shares are included in the allocation benchmarks and are thus allocated to steel producers. However, it is assumed that producers will pass on the proper amount of emission allowances to the operators of energy installations that are using waste gases from iron, steel and coke production.

34 See DEHSt 2014a, Chapter 'Iron and steel industry'.

35 See DEHSt 2014a, Chapter 'Iron and steel industry': There is a special feature of free allocation for waste gases, which results from Emissions Trading Directive provisions: if electricity is generated using residual gases, allowances should in exception be allocated free of charge – in contrast to electricity generation from other fuels. These regulations are intended to ensure that the utilisation of the residual gases, which are often rich in emissions and are less efficiently than conventional fuels, is not handicapped or prevented by emissions trading. This ensures that the only disadvantage of the inefficient use of residual gases compared to electricity or heat generation from natural gas is compensated for, but no further betterment in the use of residual gases occurs.

36 See DEHSt 2020

Emissions from the iron and steel industry have increased slightly from 2013 to 2018, with the exception of 2016, but, at 35.5 million tonnes in the reporting year 2019, they are again slightly below the 2013 figure (35.9 million tonnes). Emissions from oxygen steel production are around two percent higher than in 2013, while electrical steel production and processing show decreases of eleven and ten percent, respectively. Compared to 2005, total emissions in 2019 are down by nine percent.




As of 04/05/2020

Figure 20: Iron and steel industry (Activities 8 to 11 and 1), 2005 to 2019 emissions and free allocation trends in Germany[37]

37 As in the VET reports of the second trading period, the allocation amounts of this trading period are offset by taking into account the provisions of Section 11 of the 2012 Allocation Act. According to this regulation, producers of waste gases from iron, steel and coke production were in the second trading period legally obligated to transfer emission allowances in the amount of their annual waste gas transfers to the utilising installations. This waste gas transfer has already been subtracted in the illustrated allocation amounts. Since the annually transferred waste gas amounts have been different, fluctuating allocation amounts apply in these years.

While it must be assumed that there are similar contractual agreements between producers and users in the third trading period, the allocation rules for the third trading period do not contain any obligation comparable to Section 11 of the 2012 Allocation Act.

Figure 21 and Figure 22 show the emission and production volume trend for oxygen steel and electric steel each in relation to 2013. The activity rates of coke and iron ore sinter are also shown separately for oxygen steel. Their emissions are also included in the emission timelines. The figures show the activity rates of the products[38] supplemented by information from the German Steel Federation (WV Stahl 2019, 2020).[39]

Compared with 2013, emissions from oxygen steel production by 2018 had increased more than crude steel production. In 2019 they were again slightly higher than 2013, while production was lower than in 2013. At the same time, according to the activity rate of coke production, which is also shown in the figure, about 460,000 tonnes more coke was produced in 2019 than in 2013 (in 2018 it was 820,000 more). Net imports of coke by the entire German iron and steel industry dropped by around 1.34 million tonnes between 2013 and 2019 (by 1.02 million tonnes in 2018 compared with 2013).[40]

These figures indicate that the increased in-house coke production between 2013 and 2016 as described above has increasingly replaced coke previously purchased from abroad. By 2019 this proportion seemed to have decreased somewhat, but still exceeded that of 2013.This trend means that direct emissions from coke production, which were previously outside the system boundaries considered here, are now within these boundaries, leading to a relative increase in total direct emissions (of the activities considered) in German installations.

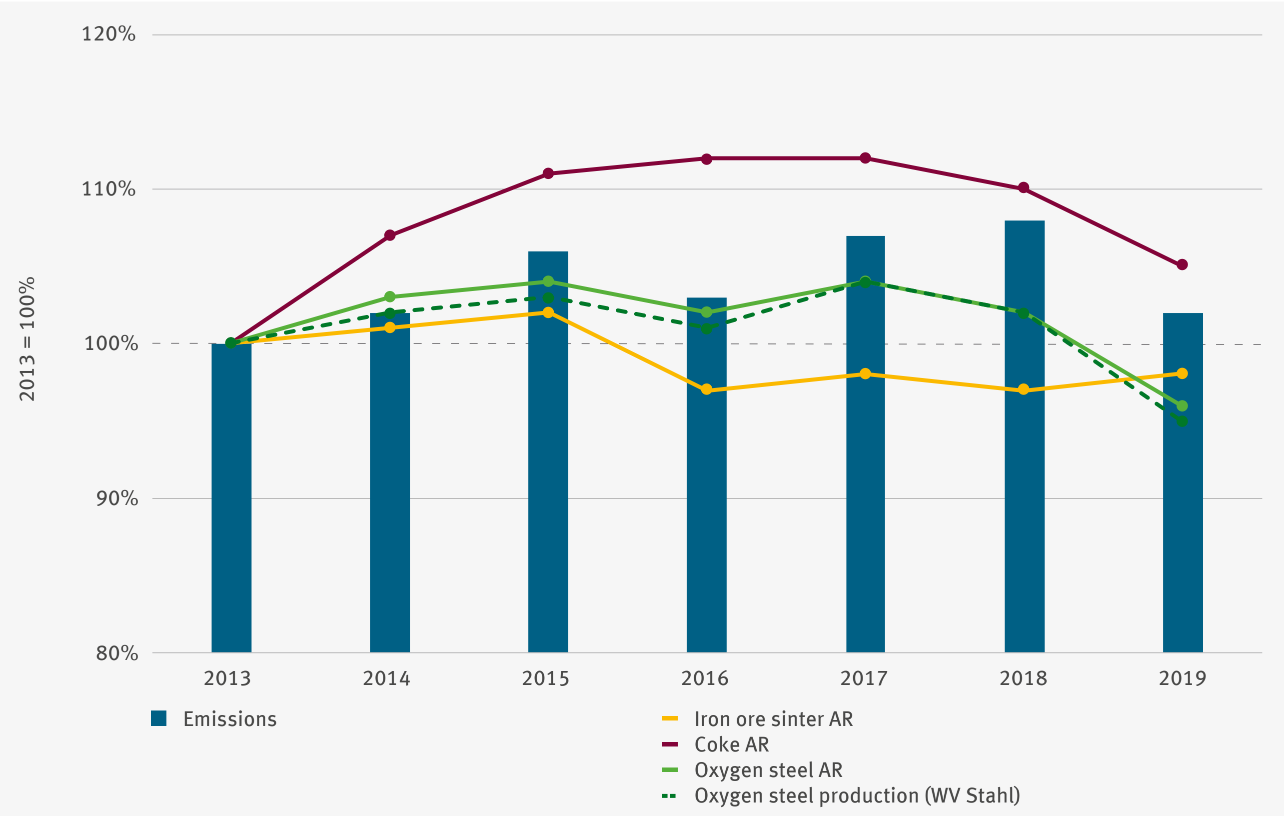
Other factors influencing emission fluctuations in the iron and steel industry may be other changes in the fuel mix, for example, the mutual substitution of natural gas and hard coal causing more emission. Another reason may lie in changed raw material qualities (ores).[41]

38 Activity rates for the 'carbon steel' and 'high-alloy steel' product benchmarks are summarised for electric steel. It should be noted in connection with the activity rate for oxygen steel ('liquid pig iron' product benchmark) that due to the allocation rules, the data refers to the amount of pig iron produced, that is, prior to processing into steel in the steel converter. The crude steel amount is generally higher by about 10% (predominantly due to the addition of steel scrap in the converter). Since the figure shows the relative trend and since the amount of steel scrap added to the converter is approximately constant, there are no significant deviations.

39 WV Stahl (2017) for 2013 to 2017; WV Stahl (2020) for 2014 to 2019. Data from both sources for 2014 to 2017 are checked for consistency.

40 They even decreased by 1.7 million tonnes from 2012 to 2016. See Federal Statistical Office: Foreign trade statistics list of goods (8-digit), for link see bibliography.

41 Other reasons for the observed changes may be uncertainties in the determination of emissions. These may superimpose potential correlations (e. g. production changes) that unfortunately cannot be verified using the available data (e. g. production shifts, changes in the emissions determining methodology).

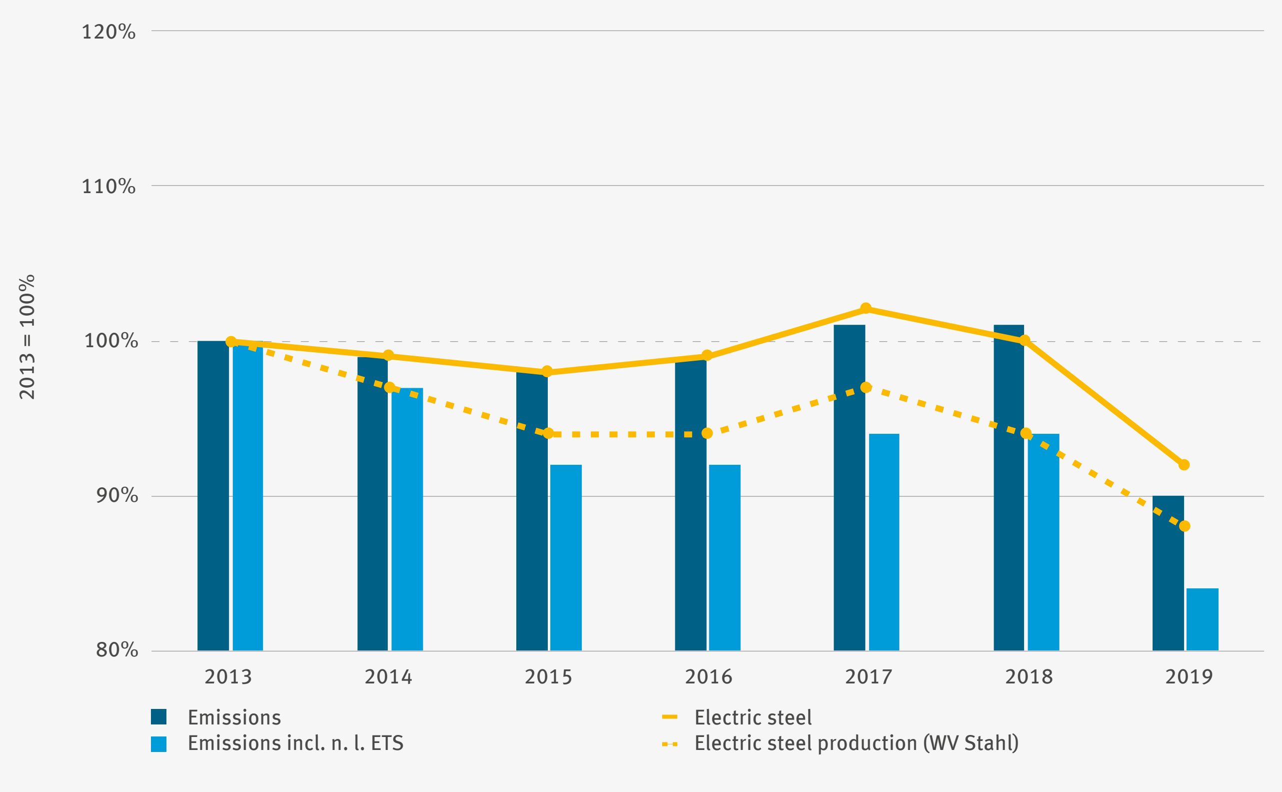



As of 04/05/2020

Figure 21: Oxygen steel production, 2013 to 2019 emissions and production trends in Germany, each in relation to 2013

The following Figure 22 for electric steel shows both the emissions from installations currently subject to emissions trading (dark blue columns) as well as the emissions from those installations subject to emissions trading in the respective year (light blue columns, 'emissions including n. l. ETS') in relation to 2013. It can be seen that emissions decreased until 2015, increased slightly from 2015 to 2018 and decreased again in 2019. This general trend is consistent with the production trend, with the exception of the 2018 when emissions did not decrease despite a decline in production. The relative annual figures of the emission timelines including n. l. ETS and production (WV Stahl) are lower compared to 2013 than the corresponding timelines in relation to the installations currently subject to emissions trading. The background is that three electric steel installations were decommissioned between 2012 and 2014 but they are included in both timelines.[42]

42 Considering these three installations, the production trend based on the activity rates ('Electric steel AR') and the information provided by WV Stahl since 2013 are almost identical. The activity rates trend and association data in the figure only differ because these three installations are not included in the activity rate and emissions that only relate to installations currently subject to emissions trading.

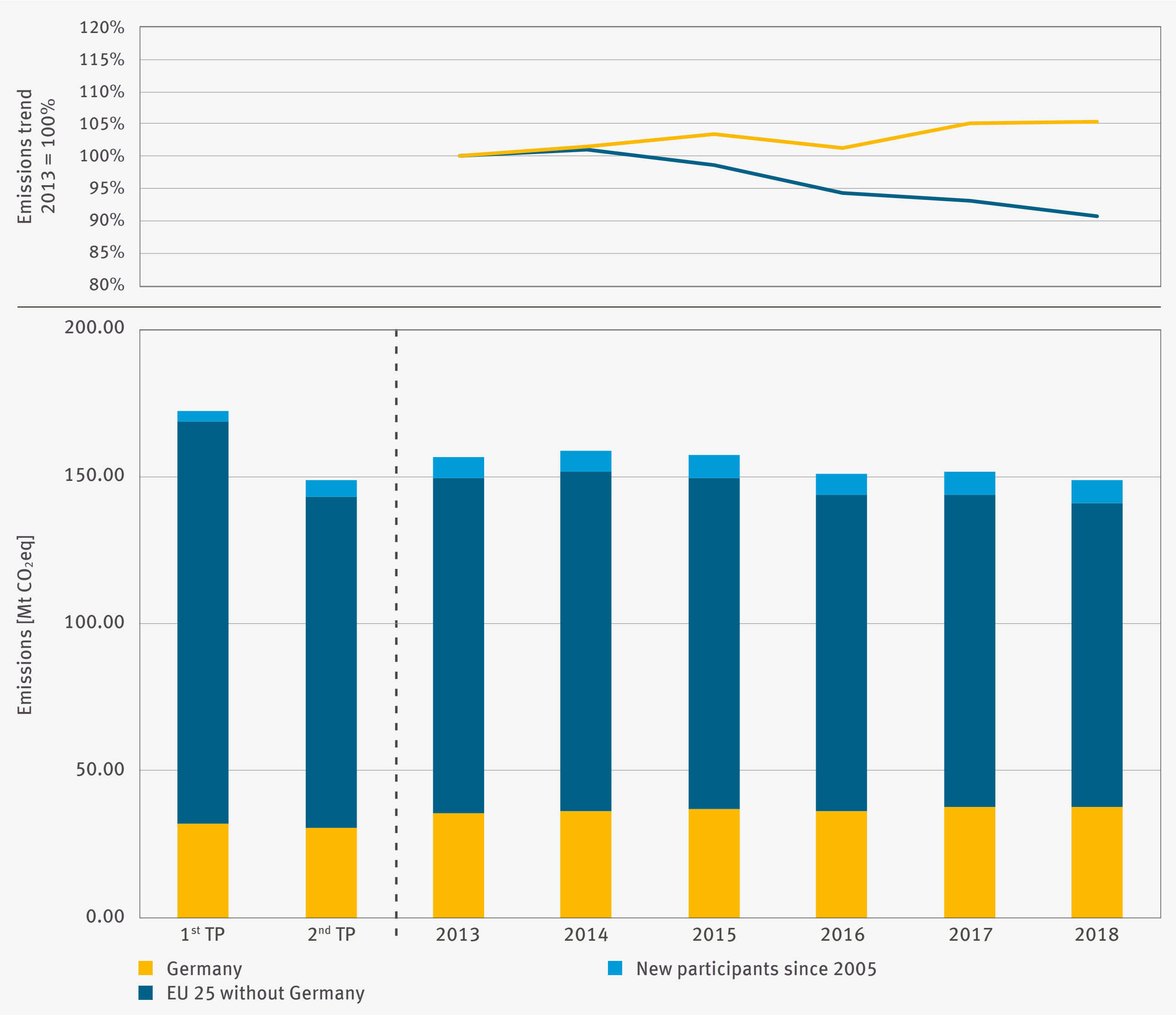



As of 04/05/2020

Figure 22: Electric steel production, 2013-2019 emission and production trends in Germany, each in relation to 2013

Figure 23 shows the emissions trend in the iron and steel industry both for the EU as a whole and for Germany. It can be seen that EU-wide emissions have decreased since 2013. By contrast, the emissions trend for German installations showed an increase up to 2018: emissions in each year of the third trading period up to 2018 being higher than in the baseline year 2013. The production trend does not provide a plausible explanation for this. Crude steel production at EU level, for example, has remained roughly the same at 166 million tonnes in 2013 and 168 million tonnes in 2018. Production in Germany also remained roughly the same over the same period at 42.6 million tonnes (2013) and 42.4 million tonnes (2018).[43] The slight relative increase in the electric steel production with less emissions in the EU cannot explain the emissions that are almost ten percent below the 2013 level.

43 See WSA 2019




As of 04/05/2020

Figure 23: Emissions trend of the iron and steel industry (Registry Activities 23 to 25) in Germany and in the EU until 2018[44]

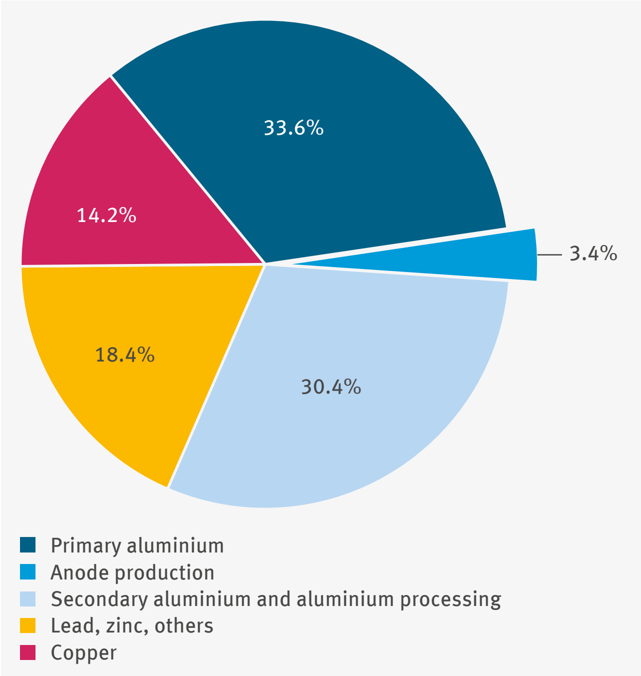
44 Data source: EEA 2019; the evaluation is based on grouping the installations according to the Activities in the EU Union Registry (see Table 37, Chapter 7). This can lead to differences in the emission amount per sector in Germany. Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania have been new participants in the EU ETS since 2005.

## 2.5 Non-ferrous metal industry

The non-ferrous metals industry (Activities 12 and 13 according to Appendix 1 TEHG) included a total of 39 installations in the 2019 reporting year and therefore did not change compared to the previous year. In 2019, installations subject to emissions trading in the non-ferrous metals industry emitted around 2.6 million tonnes of carbon dioxide equivalents. Thus 2019 emissions were about three percent below the level of the previous year. Overall, the non-ferrous metals industry had a deficit of about 280,000 emission allowances in 2019 which corresponds to eleven percent of their surrender obligation.

Figure 24 shows the shares of emissions from the non-ferrous metals industry for 2019, broken down into the products primary aluminium and anode production (Activity 12), secondary aluminium and aluminium processing, and installations for the production or processing of lead, zinc or other non-ferrous metals (Activity 13).

The electrolysis installations for primary aluminium production account for the largest share of emissions from the non-ferrous metals industry at about 34 percent. At around 30 percent, the installations for secondary aluminium production and aluminium processing are responsible for the second largest share of the sector's total emissions. Installations for the production or processing of lead, zinc or other non-ferrous metals account for 18 percent of the non-ferrous metal industry's emissions. The share of the installations for copper production and processing in the sector's emissions is somewhat smaller at around 14 percent. Emissions from anode production (Activity 12) only account for three percent.




As of 04/05/2020

Figure 24: 2019 emission shares from non-ferrous metals industry (Activities 12 and 13)

Table 12 provides an overview of emissions and allocations for the non-ferrous metals industry in 2019.

Table 12: Non-ferrous metals industry (Activities 12 and 13), number of installations, 2018 emissions, 2019 free allowances, 2019 VET entries and 2019 allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 12 | Primary aluminium production | 7 | 1,029 | 955 | 838 | 87.7 % |
| 13 | Non-ferrous metal processing | 32 | 1,633 | 1,625 | 1,462 | 90.0 % |
| | N. l. ETS | | 0 | – | – | – |
| **Total** | | **39** | **2,662** | **2,580** | **2,300** | **89.1 %** |

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The seven installations in Activity 12 (primary aluminium and anode production) emitted just under 1 million tonnes of carbon dioxide equivalents. They include three installations for anode production, which are consumed in primary aluminium production. The four electrolysis installations for primary aluminium production emit carbon dioxide and PFC (perfluorocarbons). In 2019, these PFC emissions correspond to almost 91,000 tonnes of carbon dioxide equivalents and their average share in the total emissions of the four electrolysis installations has thus fallen to about nine percent. In 2018, this share was just under 14 percent, which means that emissions in 2019 fell by around 28 percent compared to the previous year. Overall, the level of emissions from the electrolysis installations subject to emissions trading was 7.1 percent below the previous year's level.

The 32 installations in Activity 13 (production and processing of other non-ferrous metals such as copper, zinc or lead and secondary aluminium) emitted somewhat more than 1.6 million tonnes of carbon dioxide equivalents in 2019, 0.5 percent less than in 2018, so the level of emissions remained more or less unchanged.

The installations for the production of primary aluminium and anode production receive a free allocation according to the product benchmarks 'aluminium' or 'prebaked anodes'. The free allocation for these installations for 2019 corresponded on average to about 88 percent of their annual emissions compared to 83 percent in 2018.[45] However, until 2014, these operators did not theoretically have to purchase any emission allowances in order to meet their surrender obligations.[46] The increased allocation coverage compared to the previous year is due to the lower emissions compared to the previous year, which exceed the annually decreasing free allocation due to the cross-sectoral correction factor. Activity 13 installations have been slightly better supplied on average across all installations in recent years partly due to the fallback allocation. By 2016, their allocation coverage was 96 percent or more.[47] The 2019 allocation coverage was only ninety percent due to the increase in emissions since the beginning of the third trading period and the regular reduction in allocation due to the cross-sectoral correction factor.

45 See DEHSt 2019
46 See DEHSt 2015
47 See DEHSt 2017

## Trends in the third trading period

Figure 25 shows the emissions of the non-ferrous metals industry subdivided according to the material or product predominantly produced or processed both as absolute emissions and as a percentage emission trend in relation to 2013. The average emissions are indicated as absolute values for the first and second trading periods.[48]

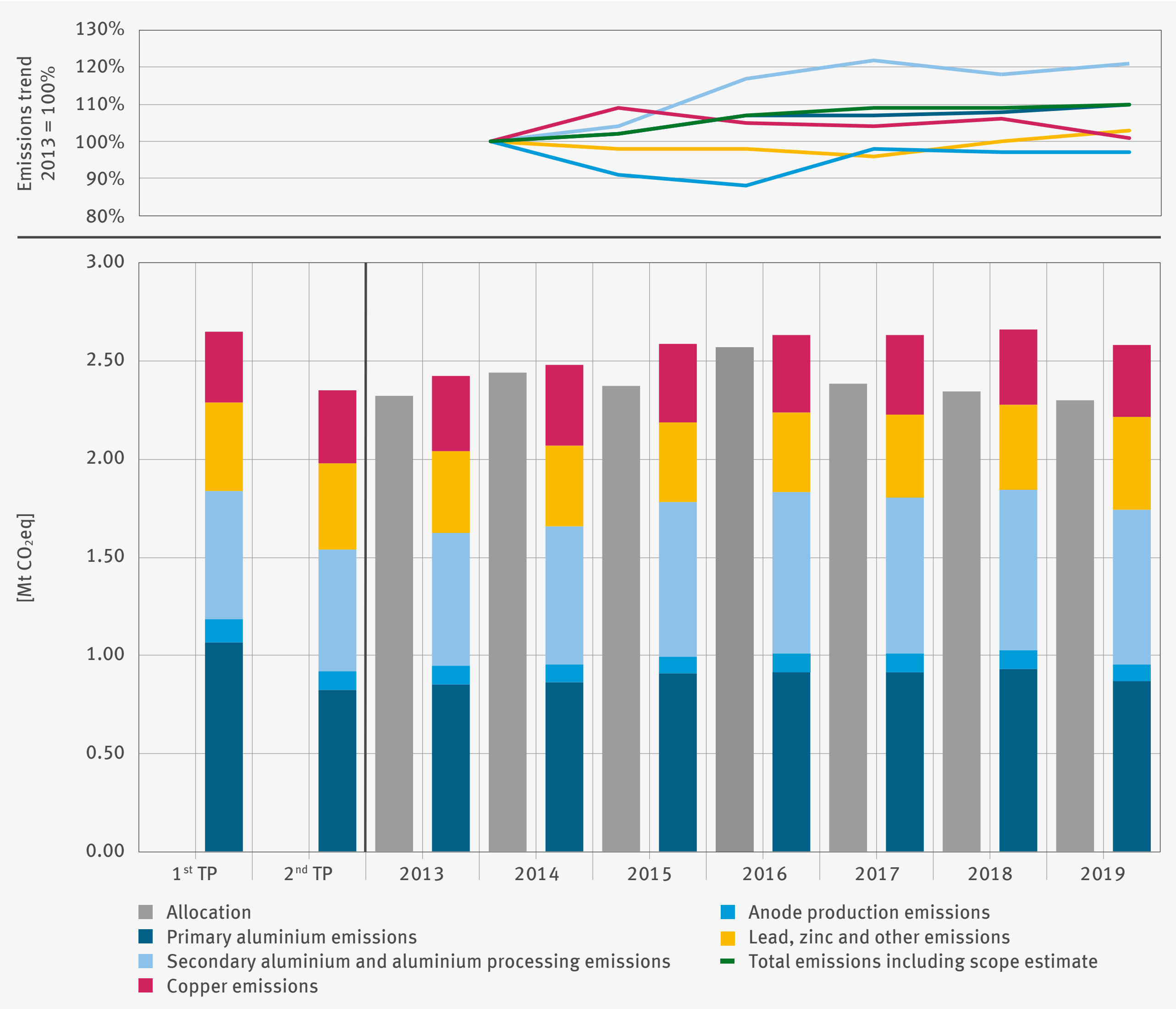


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Figure 25: Non-ferrous metals industry (Activities 12 and 13). 2005-2019 emissions and free allocation trends in Germany[49]

48 Emissions data for the years before 2013 cannot be considered based on emissions reports because installations in the non-ferrous metals industry only became subject to emissions trading at the beginning of the third trading period. Instead, a comparable overview of the sector's emissions trend can be established using 2005 – 2010 emissions data from the third trading period allocation procedure.46 For five installations, 2009 and 2010 emissions were estimated (linear interpolation of the data between 2008 and 2013). This included, among others, the three anode production installations. No emissions data were available for the non-ferrous metals industry for 2011 and 2012.

49 Two energy installations have been subject to emissions trading since 2005, which are operated at production sites for non-ferrous metals. Since the beginning of the third trading period, these installations are recorded together with the installation section that produces or processes non-ferrous metals. The figure does not show the free allocation and emissions from these energy installations during the first and second trading periods.

By 2018, emissions from electrolysis installations (primary aluminium) had increased by almost ten percent from the start of the emissions trading obligation in 2013, then decreased in 2019 and are now only two percent above the 2013 level. Emissions from anode production fell by ten percent from the start of the emissions trading obligation in 2013 by 2019. Compared to 2013, emissions from the installations for secondary aluminium production and aluminium processing rose by over 21 percent by 2018 and only fell slightly in 2019. Their emissions are currently about 17 percent above the 2013 level, roughly in line with the production trend. In addition, the number of installations has increased by two new installations compared to 2013.

Emissions from the copper production and processing installations have declined significantly after an interim sharp increase in 2018 and 2019 and are now four percent below the 2013 level. This is also roughly reflected by the production data.

Emissions from installations for the production or processing of lead, zinc or other non-ferrous metals initially decreased since 2013 and increased from 2016. They are now 13 percent above the 2013 level. While the aluminium and copper production figures decreased compared to 2018, the production of lead, zinc, tin and their alloys increased over the same period.[50]

### Emissions and production trend

Figure 25 compares the emissions trend with the production data trend for the electrolysis installations for primary aluminium production. These are based on the activity rates (AR) of the product benchmark 'primary aluminium' and the primary aluminium production data by the Metal Industry Association (WVMetalle). The trend of the activity rate is in good agreement with the trend of the WVMetalle data.

50 See WVMetalle 2020: Production figures for the production of tin, lead, zinc and their alloys

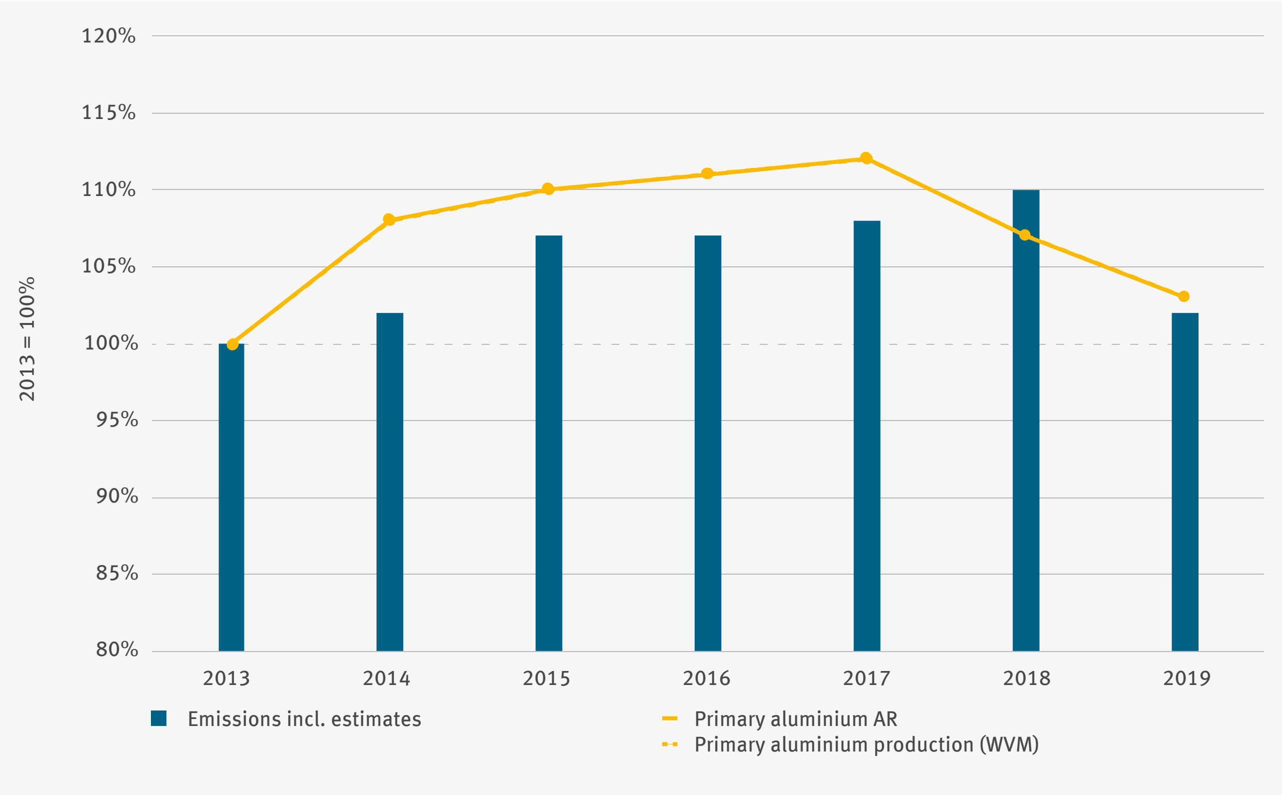


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Figure 26: Electrolysis installations, 2013–2019 emissions and production trends in Germany, each in relation to 2013[51]

Figure 26 shows that the emissions trend from the electrolysis installations was relatively well in line with the trend of the activity rate of primary aluminium production in the period from 2013 to 2017. The production of primary aluminium increased by twelve percent. At the same time, emissions from the electrolysis installations rose by eight percent.

In 2018, however, a contrary development was observed. Primary aluminium production fell by four percent to its lowest level since 2013. In contrast, emissions increased by about two percent. The installations had a lower workload in 2018 due to the decline in production, which may have been the reason for the higher specific emissions.

In 2019, relative emission trends and production trends were again in good agreement compared to 2013 and were two and three percent above the 2013 level, respectively.

51 Primary aluminium (WVMetalle): see WVMetalle 2020; Production figures for the production of aluminium from ore.

### Non-ferrous metals industry in the EU

Figure 27 compares the emissions trend of the non-ferrous metals industry in Germany with the trend in other countries participating in the EU ETS. Activities 12 (Primary aluminium production) and 13 (Non-ferrous metals processing) as per Annex 1 TEHG correspond to activities 26 to 28 in the Union Registry. Registry Activity 26 corresponds to TEHG activity 12: Primary aluminium production. TEHG activity 13 (Non-ferrous metal processing) comprises Registry Activities 27 (Secondary aluminium production) and 28 (Non-ferrous metal production and processing).

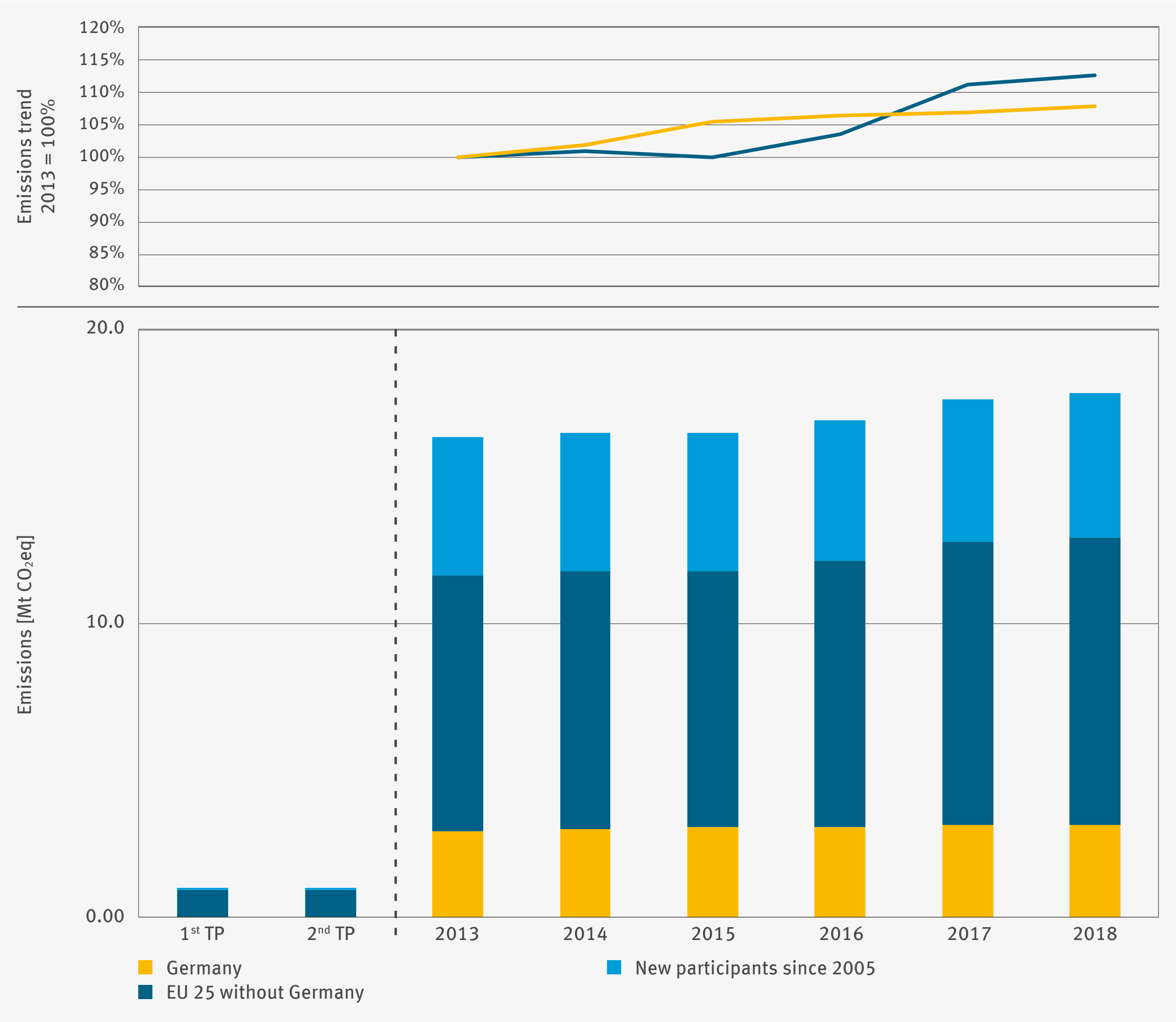


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Figure 27: Emissions trend in the non-ferrous metals industry (Registry Activities 26 to 28) in Germany and in the EU until 2018[52]

52 Data source: EEA 2019. The evaluation is based on a grouping of the installations by activities in the Union Registry (see Table 37, Chapter 7), thereby differences can occur in the emission amounts per sector for Germany. New post-2005 entrants in the EU ETS are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

Figure 27 shows increasing emissions from the non-ferrous metals industry both for Germany and the rest of the EU since the start of emissions trading in 2013. The sharp rise in emissions between 2016 and 2017 in the EU is due, among other things, to the commissioning of an installation expansion in Poland. At the end of 2016, a new and expanded electric arc furnace for copper production was commissioned at the Glogow site of the KGHM mining group. This increased the emissions from this installation by 50 percent and the emissions from the Polish non-ferrous metal industry, which is subject to emissions trading, rose by almost 400,000 tonnes of carbon dioxide equivalents. This is even more than the increase in EU-wide emissions from the non-ferrous metals industry, which amounted to around 300,000 tonnes of carbon dioxide equivalents between 2016 and 2017. The emissions of the non-ferrous metals industry in the EU in 2017 and 2018 were thus eleven and 13 percent, respectively, in excess of the 2013 emissions. In Germany, the increase in emissions in 2018 was less significant at eight percent compared to 2013.

## 2.6 Mineral processing industry

Within the mineral processing industry, more than half (57 percent) of the total 35 million tonnes of carbon dioxide equivalents emitted in 2019 is attributable to the production of cement clinker. The production of lime, gypsum and sugar, which, in addition to industrial and building lime installations, also includes the sugar industry and gypsum processing plants (for example power plant flue gas desulphurisation installations), accounts for a further 25.8 percent of emissions. Glass and mineral fibre production accounts for another 11.6 percent and ceramics installations for around 5.7 percent of emissions.

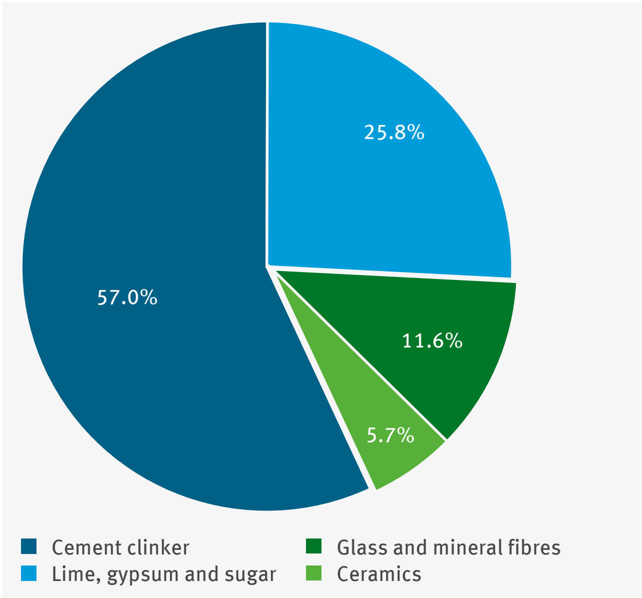


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Figure 28: The mineral processing industry’s shares in the 2019 emissions

### 2.6.1 Cement clinker production

The 35 installations that produce cement clinker and one installation for the manufacture of products from burnt oil shale are hereinafter referred to under the term ‘cement industry’. The installations cover the entire cement clinker production in Germany since the threshold in the scope of the EU ETS is 500 tonnes of cement clinker per day (Activity 14(2), Annex 1 of TEHG). In Germany, it is far exceeded by all installations throughout the industry.

In 2019, emissions remained at almost the same level as in 2018, after a steady increase in emissions in the years up to 2017. The first decrease of 468,000 tonnes of carbon dioxide equivalents occurred in 2018.

Table 13: Cement clinker production (Activity 14), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries and 2019 allocation coverage

| Nr. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 14 | Cement clinker production | 36 | 19,998 | 19,990 | 16,828 | 84.2 % |
| | N. l. ETS | | 0 | – | – | – |
| **Total** | | **36** | **19,998** | **19,990** | **16,828** | **84.2 %** |

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The free allocation for cement clinker installations in 2019 of around 3.2 million emission allowances (approximately 84 percent) was below the obligation to surrender requirement (see also Table 18). This means that the purchase requirement has increased by around 340,000 emission allowances compared with the previous year. This is due to the reduced allocation as a result of the decreasing EU ETS cap.

#### Trends in the third trading period

Figure 29 shows the emissions and free allocation trend of the cement clinker installations in the 2013 – 2019 period and additionally the averages of the first two trading periods (see columns ‘1st TP’ and ‘2nd TP’ in the bottom part of the figure).[53]

The green line in the top part of the figure shows the emissions trend compared to the starting year of the third trading period 2013, i. e. all installations subject to emissions trading in the respective year.

In the bottom part of the figure (columns), in addition to the installations currently participating (dark blue for their emissions, light grey for their allocation), the emissions (light blue) and allocations (dark grey) for installations that will no longer be subject to emissions trading in 2019 (e. g. due to closures) are also included for the first two trading periods.

Emissions from German clinker production have not changed significantly since the beginning of emissions trading in 2005. A slight decrease in emissions was only recorded in a few years, particularly during the economic and financial crisis (2009 and 2010) – but this is not visible on average in the second trading period. Between 2015 and 2017, emissions increased significantly, reaching their highest level in 2017 since 2008 and they have been back at roughly the same level as in 2005 since 2018.

53 It should be noted that fixed emission factors have been applied to the process-related emissions in the timelines of the first and second trading periods in Germany (first trading period – 0.53 tonnes $CO_2$/tonne of cement clinker; second trading period – 0.525 tonnes $CO_2$/tonne of cement clinker). Since the beginning of the third trading period, operators must analyse their process-related emissions. It has been found that most installations (even the most efficient ones) have higher specific process-related emissions. The reported emissions have thus been slightly higher since 2013 than they would have been if the fixed emission factors had been updated.

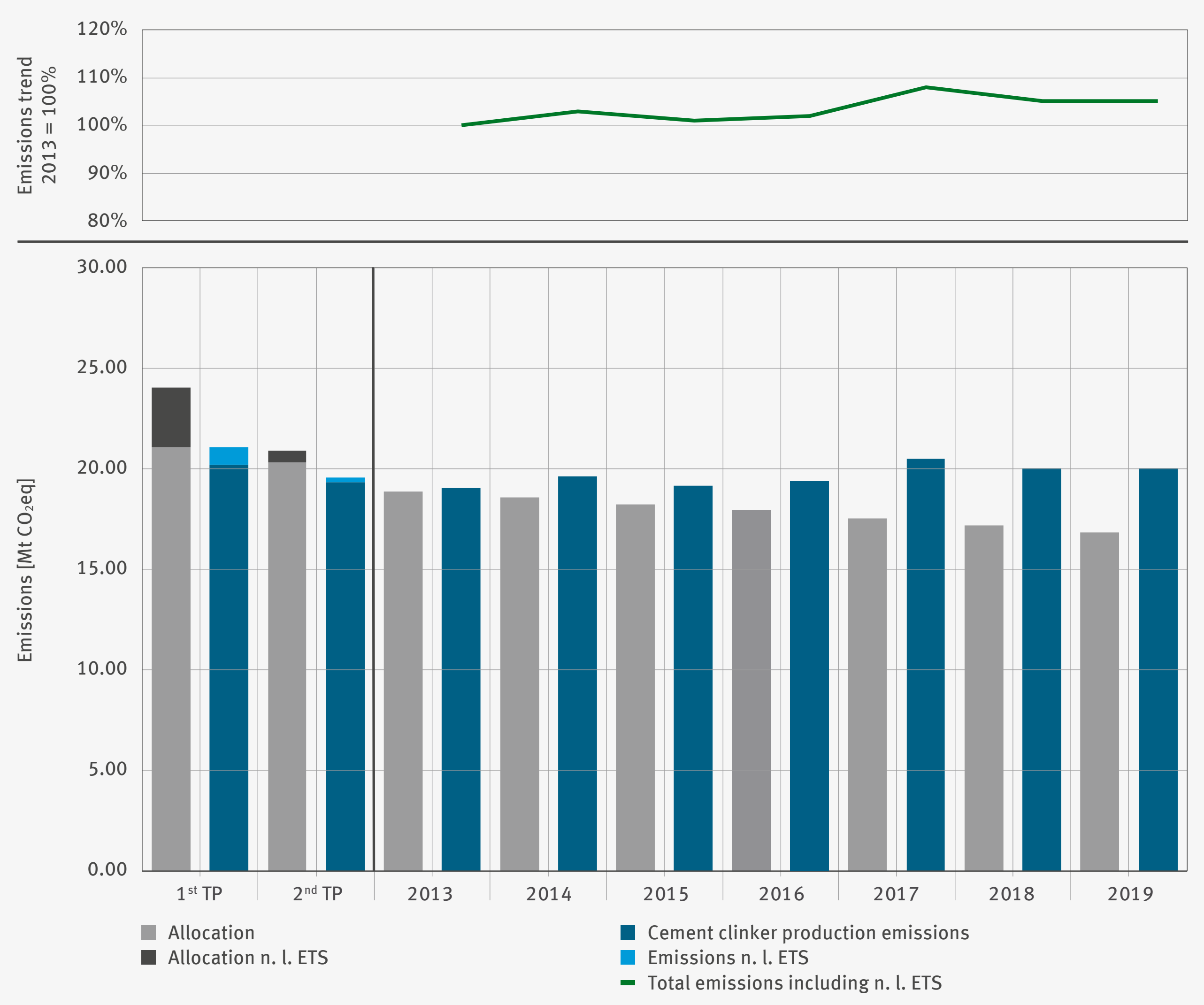


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Figure 29: Cement clinker production (Activity 14), emissions trends, 2005–2019 free allocation in Germany

It is clear that the allocation exceeded the emissions in the first and second trading periods, which was no longer the case since the beginning of the third trading period. In the last three years in particular, emissions were significantly higher than the allocation amounts, which fell steadily due to the cross-sectoral correction factor.

Emissions from cement clinker production are primarily determined by production trends. Figure 30 shows emissions and production (amount of clinker produced as reported in the emissions report and production data of the German Cement Works Association) in relation to 2013.[54] Emissions and production trend have shown an almost identical tendency since 2013. This means that the specific emissions from clinker production have not changed significantly since the beginning of the third trading period. Among other things, this can also be attributed to the high proportion of process-related emissions (about two-thirds) from the deacidification of limestone. Common measures for $CO_2$ reduction (e. g. increasing energy efficiency, use of alternative fuels) have been in use for years but have a limited reduction potential as they usually only affect energy-related emissions.

The specific emission figure of the 34 grey cement clinker installations amounted to 0.791 tonnes of carbon dioxide per tonne of cement clinker in 2019, roughly the same as in the previous year.

54 The production data were evaluated based on of the reported material flows from the emission reports. The cement clinker production quantities also contain amounts of dusts converted to cement clinker equivalents. The oil shale installation is not included in this evaluation. All installations subject to emissions trading in the respective year are indicated. VDZ data from: VDZ 2020.

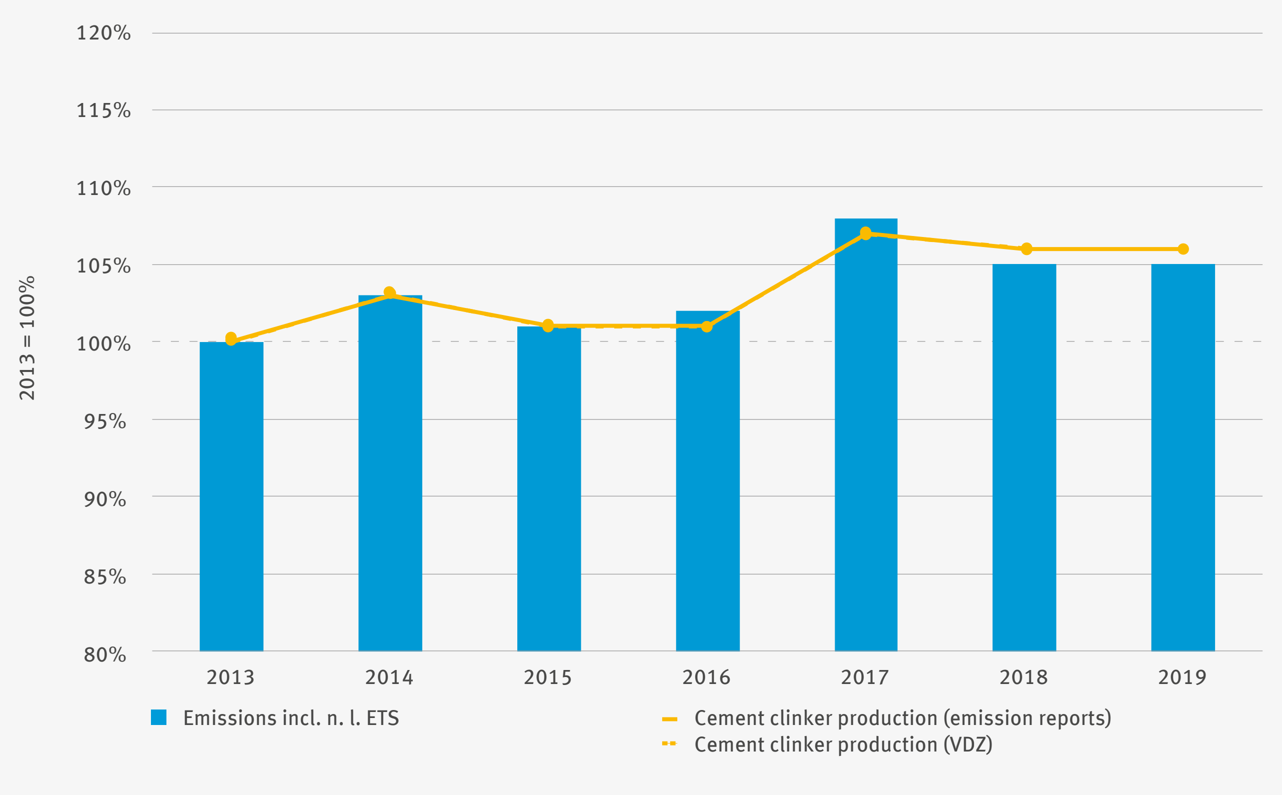


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Figure 30: Cement clinker production (Activity 14), emissions trend and production[55] in Germany in relation to 2013

The trend in the rest of Europe does not differ significantly from that in Germany (see Figure 31). Since 2013 there has been a continuous overall increase in emissions in the EU25 excluding Germany, especially in the years 2014 and 2018 (see upper sub-graph). In 2018, emissions in the rest of the EU were 7 percent above the value in 2013, while emissions from German cement clinker production increased by 5 percent in the same period.

55 Source for production data: VDZ

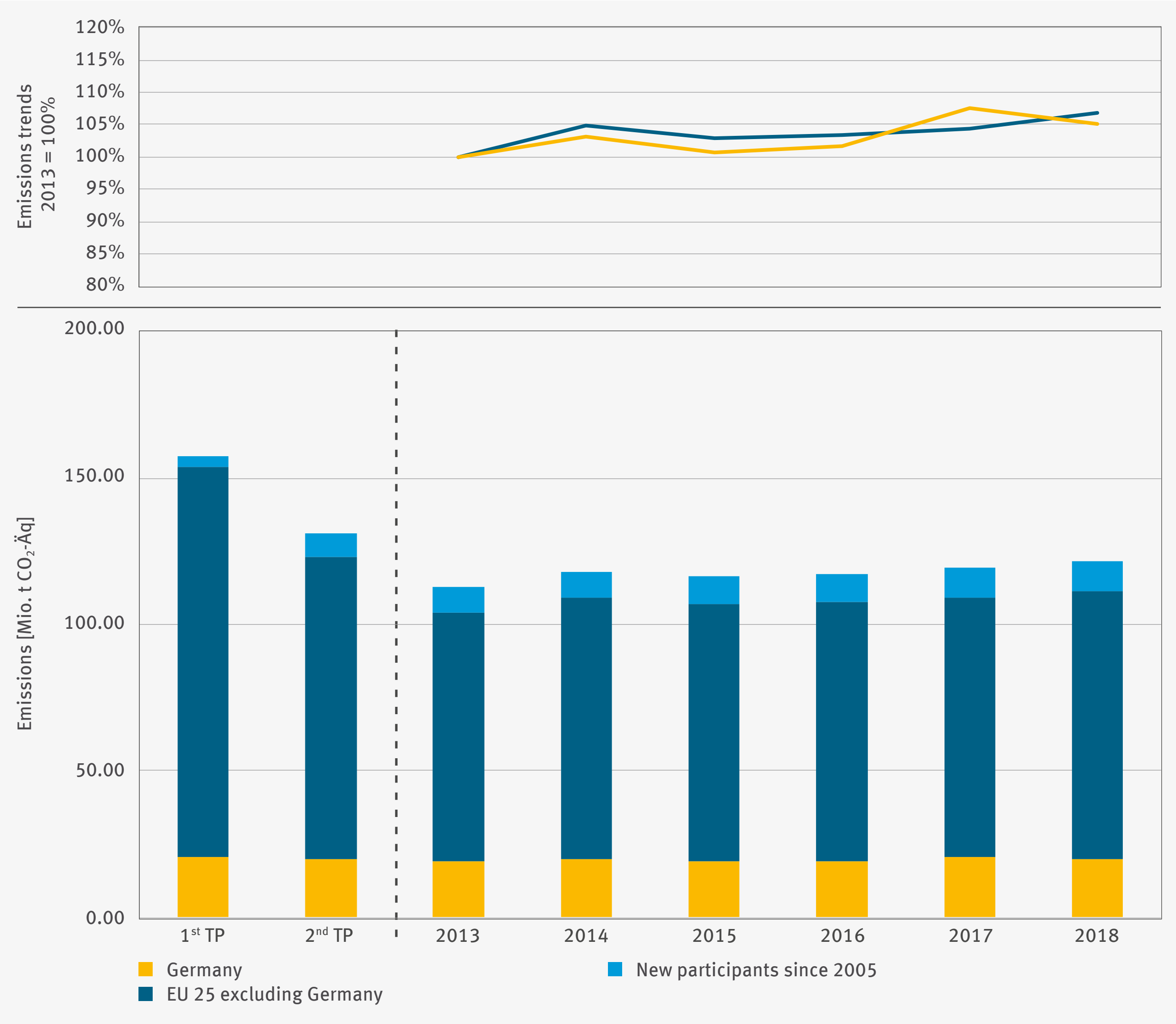


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Figure 31: Emissions trend from cement clinker production (Registry Activity 29) in Germany and in the EU until 2018[56]

56 Data source: EEA 2019; the evaluation is based on a summary of installations according to activities in the EU Union Registry (see Table 37, Chapter 7), which may lead to differences in the emission volume per sector for Germany. New participants in the EU ETS after 2005 are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

### 2.6.2 Lime, gypsum and sugar production

This section includes emissions from Activities 15 'Production of lime' and 19 'Manufacture of plaster' from Annex 1, Part 2 TEHG. Together, these installations are responsible for 25.8 percent of emissions in the mineral processing industry (see Figure 28).

Activity 15 includes two different industrial sectors: industrial and building lime and the sugar industry. 39 of these installations, one less than in the previous year, produce lime or dolomitic lime for construction, paper, chemical, iron and steel industry and environmental technology and are referred to within the section as the 'industrial and building lime' category. A limestone drying plant (combustion plant, Activity 1) is also included in this category. Within the mineral processing industry, 19.6 percent of emissions are attributable to the production of industrial and building lime (see Figure 32).

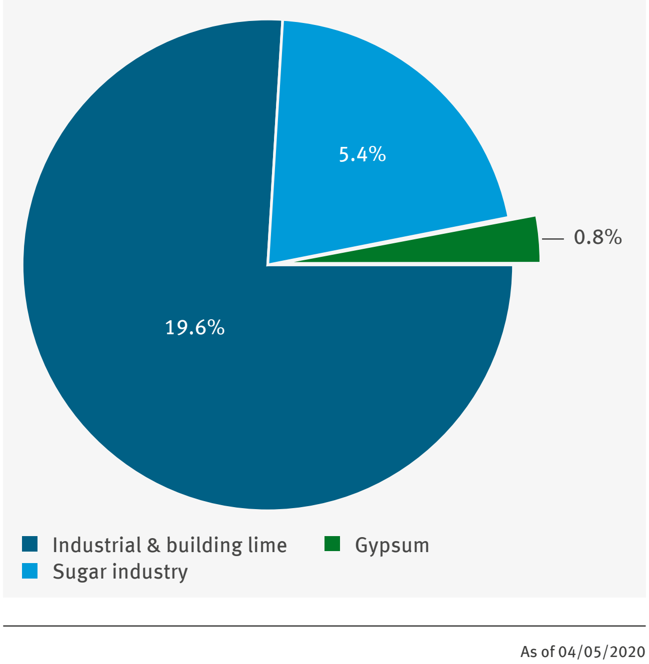


Figure 32: Proportions of the production of lime, gypsum and sugar in the 2019 emissions (Activities 1, 15 and 19) in the mineral processing industry

Activity 15 also includes 20 installations that use lime for sugar production and use heat and electricity.[57] The sugar industry also includes other sub-activities, such as beet slice drying and caramelisation installation. In 2019, sugar industry installations accounted for about 5.4 percent of emissions within the mineral processing industry.

Activity 19 'Gypsum production' covers nine installations, which mainly purchase and process FGD gypsum from large power plants with flue gas desulphurisation (FGD) facilities. Emissions from this activity account for less than one percent of the emissions from the mineral processing industry and are explained in the sections on 'Industrial and building lime production'.

57 Since 2013, the sugar industry energy installations have also been included in the lime production activity, whereas in the second trading period the energy and lime installations were considered separately. In this section, the energy installations are retrospectively assigned to the lime production activity.

Table 14: Lime, gypsum and sugar production (Activities 1, 15 and 19), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries, allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 15 | Lime production | 39 | 7,357 | 6,874 | 6,064 | 88.2 % |
| | Sugar production | 20 | 2,081 | 1,902 | 1,145 | 60.2 % |
| | | **59** | **9,437** | **8,776** | **7,209** | **82.1 %** |
| 19 | Gypsum production | 9 | 271 | 273 | 282 | 103.2 % |
| | | **9** | **271** | **273** | **282** | **103.2 %** |
| 1 | Combustion | 1 | 20 | 15 | 4 | 30.2 % |
| | | **1** | **20** | **15** | **4** | **30.2 %** |
| | N. l. ETS | *1** | 0 | – | – | – |
| **Total** | | **69** | **9,729** | **9,063** | **7,495** | **82.7 %** |

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*N. l. ETS not included in total number of installations.

Emissions from the production of industrial and building lime in 2019 amounted to around 6.9 million tonnes of carbon dioxide, which is around 6.6 percent below the previous year's figure. The number of emission allowances allocated free of charge was around 88 percent, i. e. operators had to purchase around 810,000 emission allowances or 12 percent of the necessary emission allowances to meet their surrender obligation in 2019 (see Table 14).

Sugar plant emissions were also significantly down on the previous year (minus 8.6 percent) and amounted to about 1.9 million tonnes of carbon dioxide. In 2019, operators had to purchase about 757,000 emission allowances, which corresponds to 40 percent of their emissions this year.

Emissions from gypsum plants remain almost unchanged at around 273,000 tonnes of carbon dioxide. In 2019, the gypsum plants were again allocated more emission allowances than they needed, free of charge, to cover their surrender obligation for the year. The level of allocation was around 103 percent.

The combustion plant (limestone drying) received an allocation for 2019 corresponding to around 30 percent of its emissions.

### Trends in the third trading period – Industrial and building lime and gypsum

Figure 33 shows the emissions trend and free allocation for the production of industrial and building lime (dark blue) and gypsum (ochre yellow) since the start of emissions trading in 2005. The lines in the upper part of the figure show the emissions trend for all installations in both sectors that are subject to emissions trading in the respective year compared to 2013. The lower part of the figure contains not only the installations currently subject to emissions trading (dark blue and light grey) but also the emissions and allocations of installations that will no longer be subject to emissions trading in 2019 (n. l. ETS) (marked light blue and dark grey). Estimated emissions for the period 2005 to 2012 from installations that will only be subject to emissions trading from 2013 onwards are shown in yellow[58]. For the first and second trading period, emissions and free allocation are each shown as an average.

58 The emissions resulting from the extended scope of the third trading period were estimated for the period 2005 to 2012 using data from the allocation process.

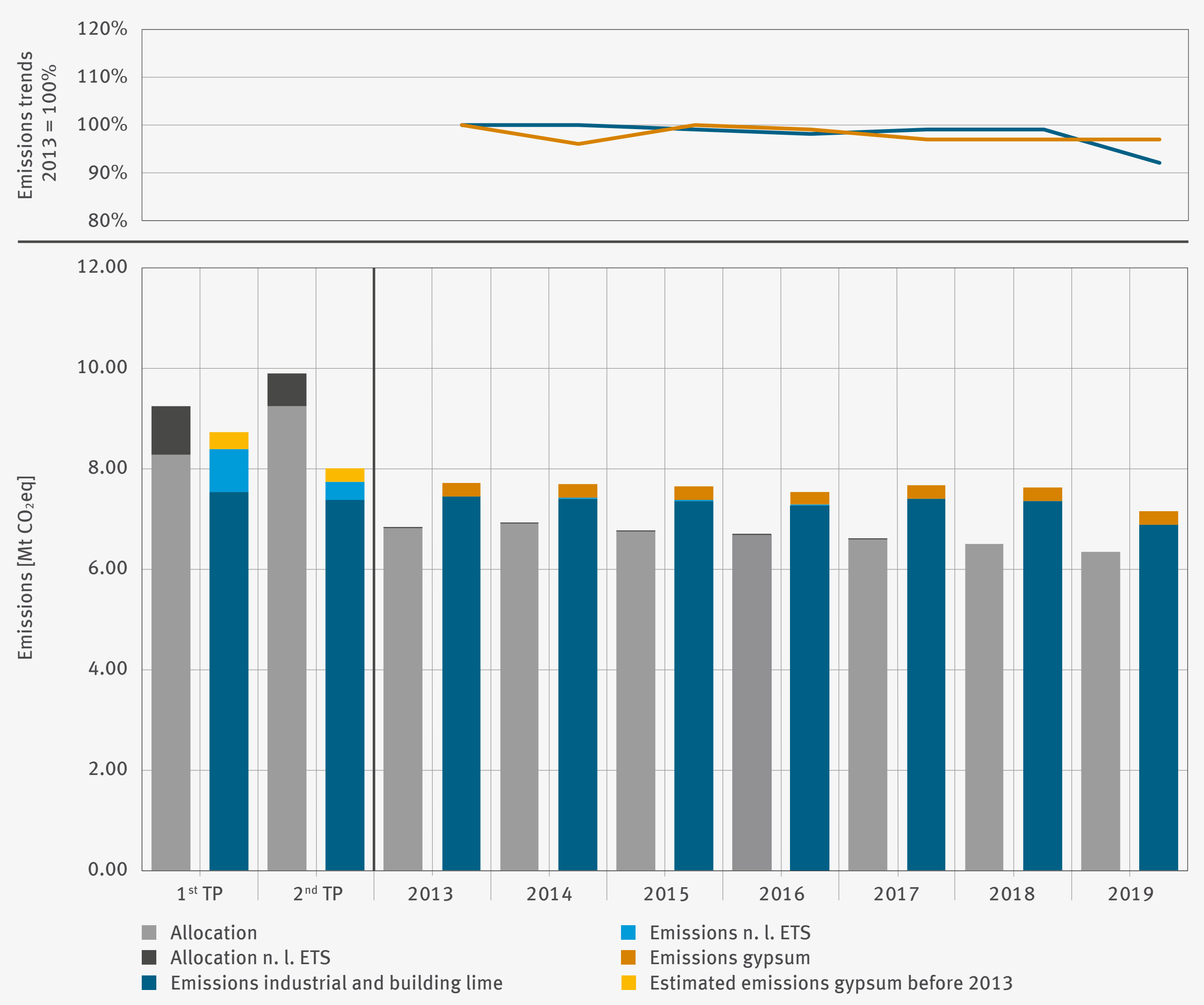


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Figure 33: Industrial and building lime production (Activity 15) and gypsum production (Activity 19) in Germany, emission trends and free allocation 2005 to 2019

The production and emissions of industrial and building lime installations are mainly determined by the economic situation of the steel and construction industries. After emissions fell by 7.9 percent from the first to the second trading period due to the economic situation, they rose again slightly at the beginning of the third trading period. Since then, emissions have remained largely constant at the 2013 level. However, emissions after 2013 are comparable with those from the second trading period only to a limited extent. This is because fixed emission factors were used in the first and second trading period, while the emission factors since 2013 have to be determined on a plant-specific basis, which – in contrast to the case of cement clinker manufacturers (see Footnote 54) – led to lower emissions on average. In addition, the emissions from 2013 onwards were corrected retrospectively for one installation after implementation of the ruling of the European Court of Justice in Case C-460/15-Schaefer Kalk and are therefore somewhat lower than in the previous trading periods.[59]

In the 2019 reporting year, emissions fell by almost seven percent compared to the previous year. This is primarily due to the decline in production in the iron and steel industry.

59 The lower emissions do not represent a reduction in emissions compared to the past, but take into account the fact that the $CO_2$ stored (chemically bound) in the end product PCC (precipitated calcium carbonate) and thus not released into the atmosphere, is not considered an emission within the meaning of the ET Directive and therefore there is no surrender obligation in emissions trading. Due to the retrospective correction for the years 2013 to 2016, there are also minor deviations from the previous years' reports.

Figure 33 also clearly shows that free allocation was higher than emissions in both the first and second trading periods. The allocation status changed significantly with the start of the third trading period. Primarily due to the cross-sectoral correction factor, the annual free allocation of the industrial sectors industrial and building lime, sugar and gypsum – as in all other industrial sectors – decreases continuously in the third trading period. After 2013, the free allocation was lower than the emissions in all years and amounted to less than 90 percent of the emissions of the respective year.

The nine gypsum producing installations have only been in emissions trading since the beginning of the third trading period. These installations did not receive a free allocation before 2013 and only estimates based on data from the allocation procedure are available for the emissions. The emissions of the gypsum producing installations averaged around 27,000 tonnes of carbon dioxide and have remained largely unchanged since the installations were included in emissions trading.

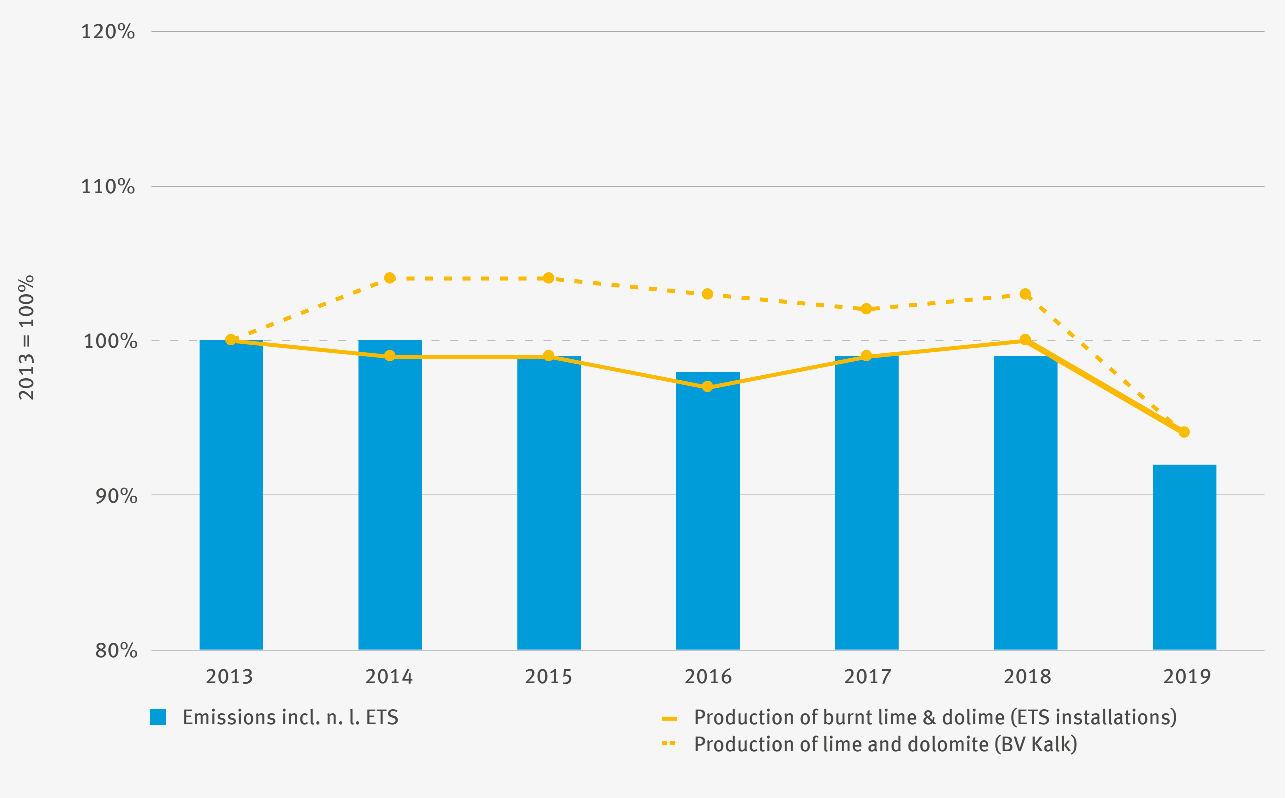


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Figure 34: Industrial and building lime production (Activity 15), emissions and production trends[60] in Germany in relation to 2013

Figure 34 shows the emissions and production trends in relation to 2013. The solid line shows the trend for all installations subject to emissions trading in the respective year (production of quicklime and dolomite lime). In contrast, the data from the Association of the German Lime Industry (dashed line) only covers the lime and dolomite installations organised within the association. The emissions trend in the period 2013 to 2019 basically reflects the trend of lime production. Despite the use of more efficient kilns, the specific emissions have remained largely unchanged in recent years because more pulverised lignite was used as a fuel. In 2019, the specific emissions from lime installations amounted to 1.1 tonnes of carbon dioxide per tonne of burnt lime or dolime and is thus roughly at the level of previous years.

60 Sources for production data: Association of the German Lime Industry (BV Kalk)

## Trends in the third trading period – sugar industry

The upper section of Figure 35 shows the emissions trend of the sugar industry for the third trading period. The lower section shows the emissions and free allocation of the sugar industry, including the associated energy installations. Data for the first and second trading periods are shown as average values for each trading period and from 2013 up to and including 2019 as annual values.[61] The figure is supplemented by the inclusion of installations that are currently no longer subject to emissions trading (n. l. ETS) and the estimated emissions from installations that are only subject to emissions trading from 2013 for the period 2005 to 2012.

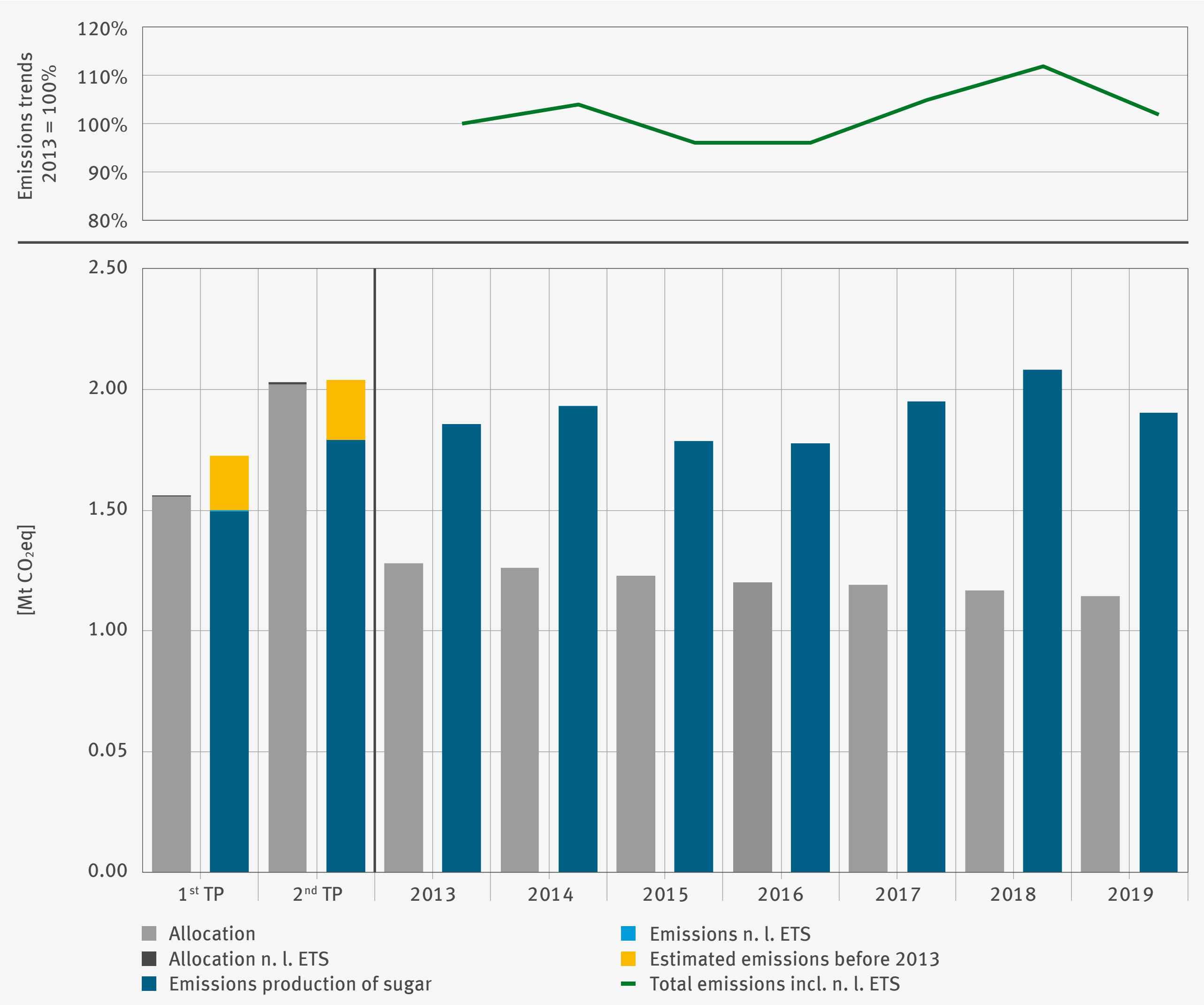


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Figure 35: Emissions and free allocation trends in the sugar industry in 2005 to 2019 (Activity 15)

In addition to fuel input, emissions from sugar installations are primarily influenced by the quality and quantity of the sugar beet harvest and are therefore subject to annual fluctuations due to weather conditions. No clear trend can be discerned when looking at the emissions trend in the sugar industry since 2013. Only in 2017 and 2018 did emissions increase significantly over two years and were 12 percent higher than in 2013. In 2019, emissions fell again by 8.6 percent compared to the previous year.

61 Emissions resulting from the extended scope of the third trading period were estimated for the period 2005 to 2012 using data from the allocation process.

For a comparison of emissions and free allocation, the emissions within the scope of the respective trading period must be considered, i. e. without the emissions estimated retrospectively (without the yellow column section). It can be seen that the free allocation of sugar installations, especially in the second trading period, was significantly higher than the emissions. In particular, due to the elimination of free allocation for electricity generation, sugar installations in the third trading period receive significantly fewer emission allowances free of charge than they need to cover their emissions. While the allocation coverage was still about 70 percent of emissions in 2013, it was only 60 percent in 2019. The reason for this, apart from the annual decline in free allocation due to the cross-sectoral correction factor, is the significant increase in production compared to the base period for allocation.

### The activity 'Production of lime' in the EU

Figure 36 compares the emissions trend of lime production in Germany (with no separation of the lime and sugar industries) with the trend in the other EU ETS Member States.

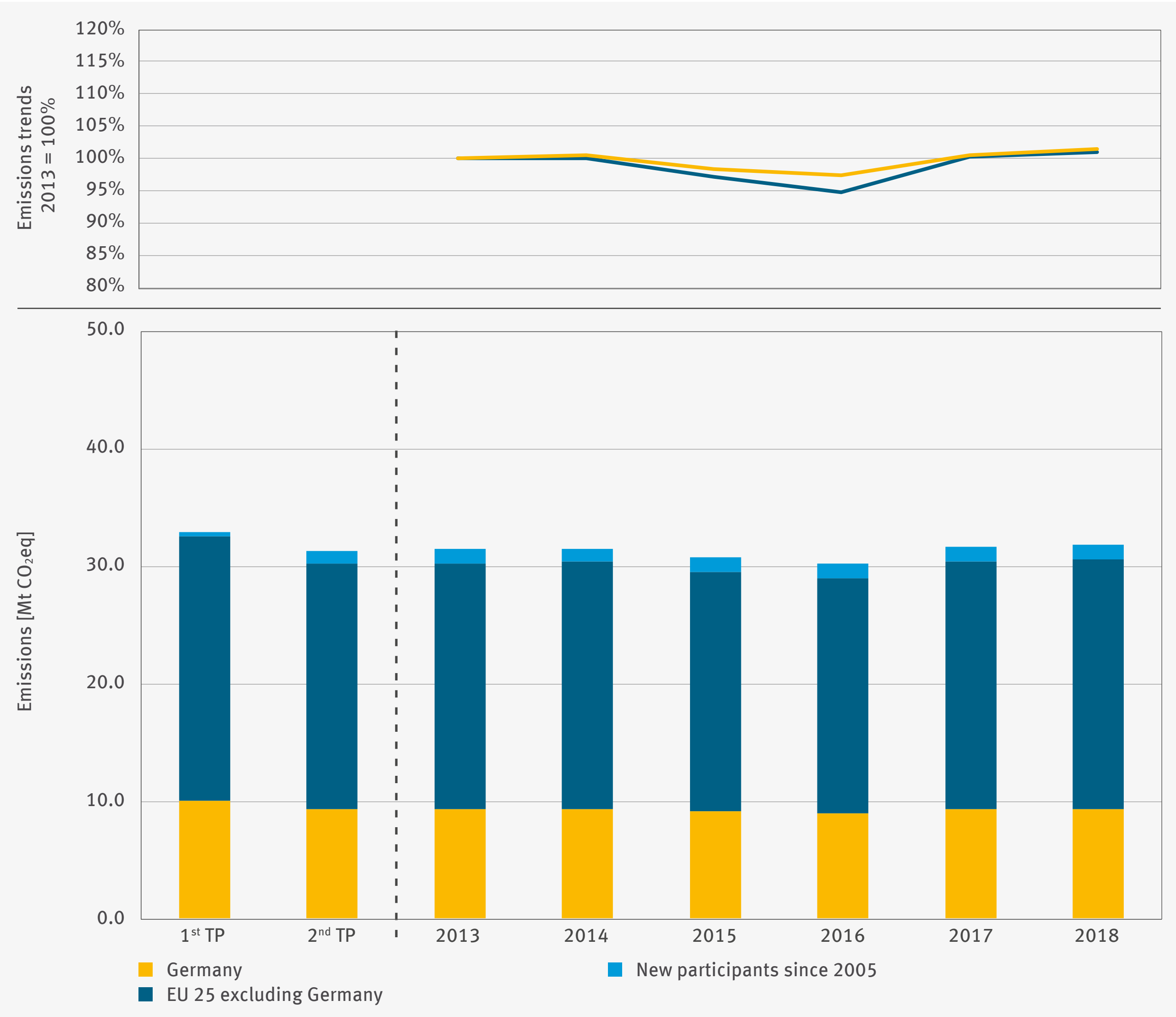


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Figure 36: Emissions trend from lime production (Registry Activity 30) in Germany and the EU until 2018[62]

62 Data source: EEA 2019; the evaluation is based on a combination of installations according to activities in the EU Union Registry (see Table 37, Chapter 7), which may lead to differences in the emission volume per sector for Germany. New participants in the EU ETS after 2005 are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

The values for Germany differ in part from the values mentioned above in this section, as the emissions reported by the EEA in the Union Registry were allocated slightly differently in some cases, particularly in the earlier trading periods[63]. Due to the changes in the scope of application or in the allocation of installations to the activity 'lime production', the values between the trading periods are also only comparable to a limited extent. For this reason, the trend in the third trading period is the primary focus of this report: since the beginning of this period, emissions have remained largely stable with the exception of a decrease in 2015 and 2016. Compared to 2014, this decrease in 2016 was around 3.1 percent for Germany and around 5.3 percent for the other ETS Member States. In 2017 and 2018, emissions from lime production in both Germany and the rest of the EU were back at the level of 2013.

### 2.6.3 Glass and mineral fibre production

This section includes Activities 16 (manufacture of glass) and 18 (manufacture of mineral fibre). These activities account for around 11.6 percent of emissions within the mineral processing industry. Emissions mainly arise in the production of flat and hollow glass (see Figure 37).

Overall emissions from installations for glass and mineral fibre production, subject to emissions trading in 2019, fell by four percent compared to the previous year to around 4.1 million tonnes of carbon dioxide. A total of 77 installations were covered, 70 of which were glass production installations and seven mineral fibre production installations.[64]

Table 15 shows the emissions in 2019 compared to the previous year, differentiated by economic sector.[65]

Emissions from the production of hollow glass have fallen by 1.8 percent compared with 2018. Emissions from the production of flat glass, which is used in the automobile and construction industries, for example, have fallen by 3.7 percent.

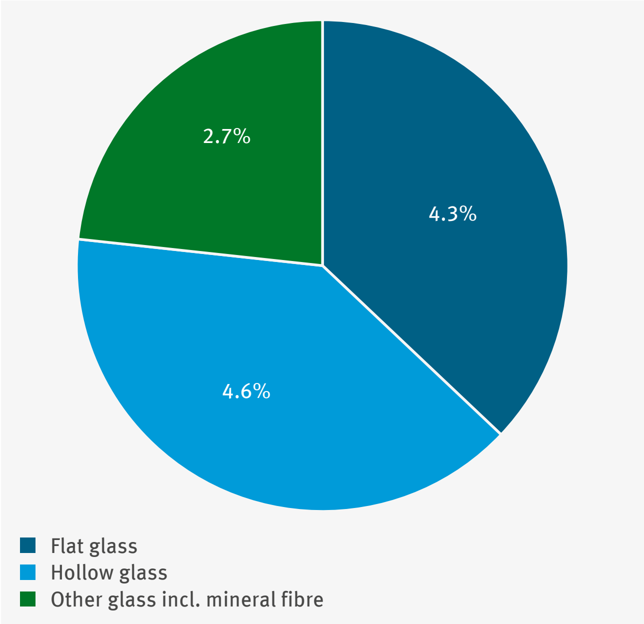


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Figure 37: Proportions of production of glass and mineral fibre emissions from the mineral processing industry in 2019 (Activity 16 and 18)

Emissions from the production of mineral fibre decreased by 10.9 percent, which is not greatly significant due to its low absolute level.

63 The energy installations of the sugar industry in Germany were allocated to the combustion plants in the second trading period.
64 Three installations of Activity 16 were closed down and two others were merged with other installations.
65 The allocation is based on information provided by the operators.

Table 15: Glass and mineral fibre production (Activities 16 and 18), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries, allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 16 | Production of hollow glass | 34 | 1,652 | 1,622 | 1,262 | 77.8 % |
| | Production of glass fibre and goods thereof | 8 | 210 | 191 | 132 | 69.1 % |
| | Production, finishing and processing of flat glass | 15 | 1,554 | 1,497 | 1,168 | 78.0 % |
| | Production, finishing and processing of other glass including technical glassware | 13 | 381 | 385 | 312 | 81.2 % |
| | | 70 | 3,797 | 3,694 | 2,874 | 77.8 % |
| 18 | Production of glass fibre and goods thereof | 2 | 55 | 53 | 27 | 50.6 % |
| | Production of other non-metallic mineral goods n. e. c. | 5 | 350 | 308 | 253 | 82.1 % |
| | | 7 | 405 | 361 | 279 | 77.5 % |
| | N. l. ETS | 5* | 21 | – | – | – |
| **Total** | | **77** | **4,223** | **4,054** | **3,154** | **77.8 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

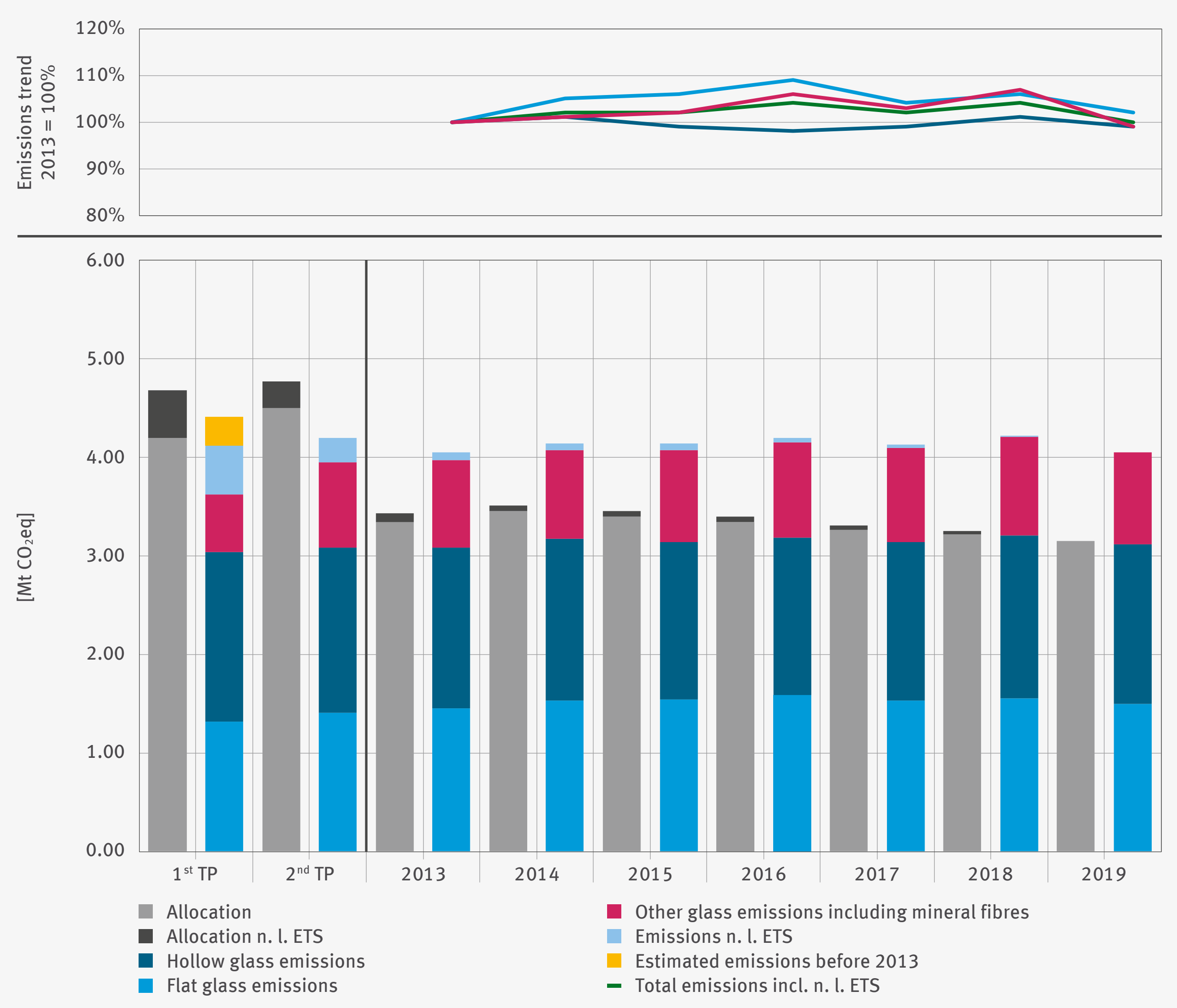
Compared to 2018, the aggregated shortfall of all installations has fallen by 82,000 emission allowances to 900,000, of which around 820,000 are attributable to glass production alone (see Table 15). In 2019, the allocation coverage was around 78 percent. This also applies to the allocation coverage of installations for mineral fibre production, flat glass and hollow glass.

## Trends in the third trading period

Figure 38 shows the emissions and free allocation trends in glass and mineral fibre production since the start of the EU ETS in 2005. The green line in the upper part of the figure shows the emissions trend since 2013 for all installations that are subject to emissions trading in the respective year (including installations that will no longer be subject to emissions trading in 2019 – n. l. ETS).[66] For the first and second trading period, emissions and free allocation are shown as average values.

In the industry as a whole, only minor and no permanent changes in emissions can be observed. After a cyclical decline in emissions in the second trading period, emissions have been above 4 million tonnes of carbon dioxide since 2013, with slight annual fluctuations.

66 For mineral fibre production, which was only included in emissions trading in the second trading period, an estimate was made based on data from the allocation procedure.




As of 04/05/2020

Figure 38: Glass and mineral fibres production (Activities 16 and 18), 2005-2019 emissions and free allocation trends in Germany

### 2.6.4 Ceramics production

The ceramics industry consists of numerous installations with a broad product range and comparatively low emissions in comparison to the other sectors subject to emissions trading. The transition between trading periods brought about changes in the scope of emissions trading that have affected the incumbent installations. 140 installations from the ceramics industry were subject to emissions trading in 2019, one less than in the previous year. These installations accounted for around 5.7 percent of the emissions from the mineral processing industry (see Figure 28).

Emissions from ceramics installations subject to emissions trading in 2019 decreased by 2.8 percent compared to the previous year.

Table 16: Ceramics production (Activity 17), number of installations, 2018 emissions, 2019 free allocations, 2019 VET entries and allocation coverage

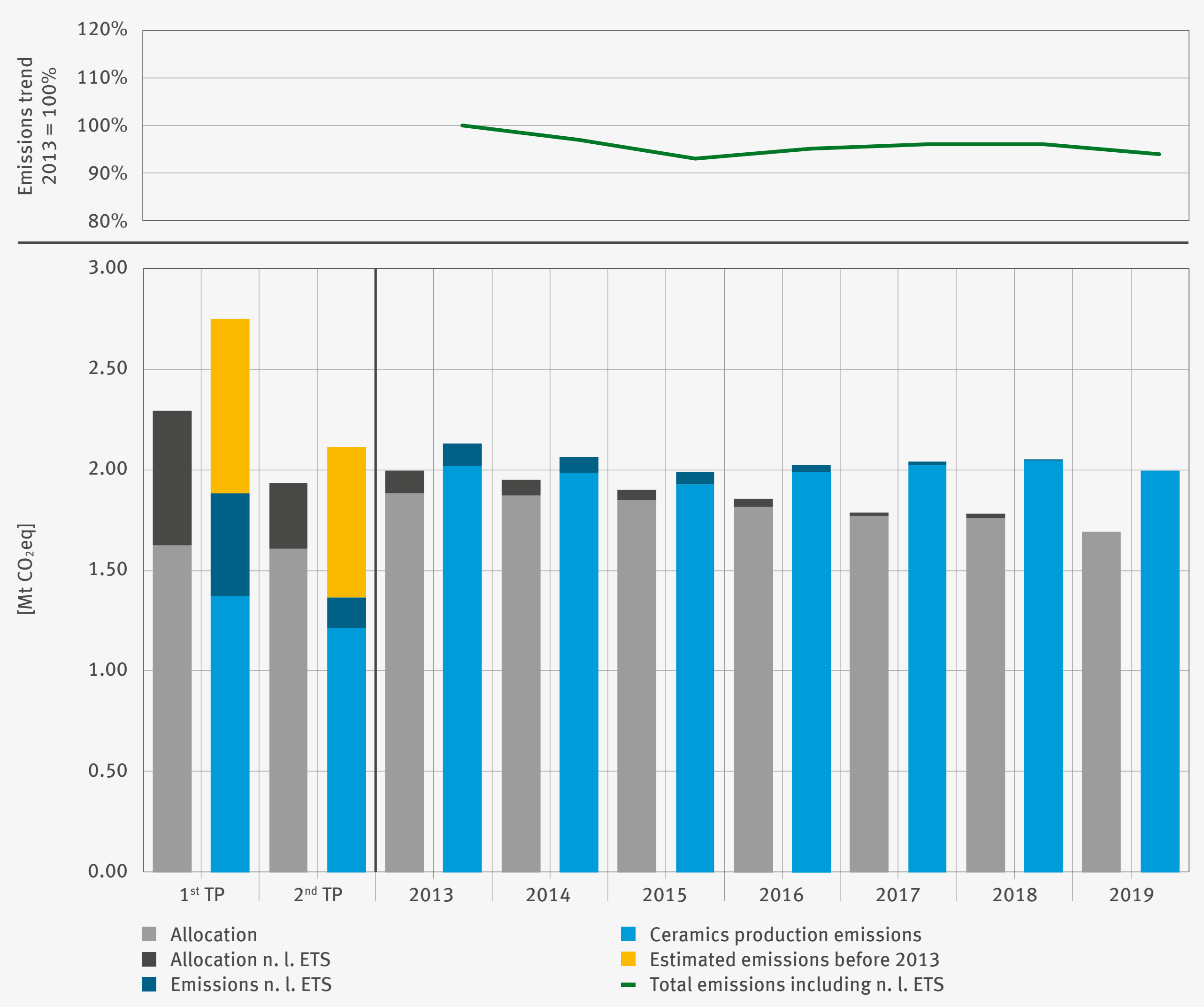
| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 17 | Ceramics production | 140 | 2,046 | 1,994 | 1,695 | 85.0 % |
| | N. l. ETS | *1** | 5 | – | – | – |
| **Total** | | **140** | **2,051** | **1,994** | **1,695** | **85.0 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

In 2019, the average allocation coverage of around 85 percent from ceramics installations decreased again compared to the previous year (86 percent). However, around 26 percent of the installations will continue to receive more free emission allowances than are required to surrender.

#### Trends in the third trading period

Figure 39 shows the emissions and free allocation trend in the ceramics industry since the start of emissions trading in 2005. The line in the top of the figure shows the emissions trend of all installations subject to emissions trading in the respective year compared to 2013. The bottom part of the figure contains not only the installations currently subject to emissions trading (dark blue and light grey) but also the emissions from and allocations to installations that were no longer subject to emissions trading in 2019 (n. l. ETS) (light blue and dark grey). The emissions from installations that have only been subject to emissions trading since the third trading period were estimated for the period 2005 to 2012 using data from the allocation process (yellow column section). For the first and second trading period, the average emissions and free allocation figures are shown.




As of 04/05/2020

Figure 39: Ceramics production (Activity 17), 2005-2019 emissions and free allocation trends in Germany

Emissions have remained relatively constant at around 2 million tonnes of carbon dioxide since the beginning of the third trading period.

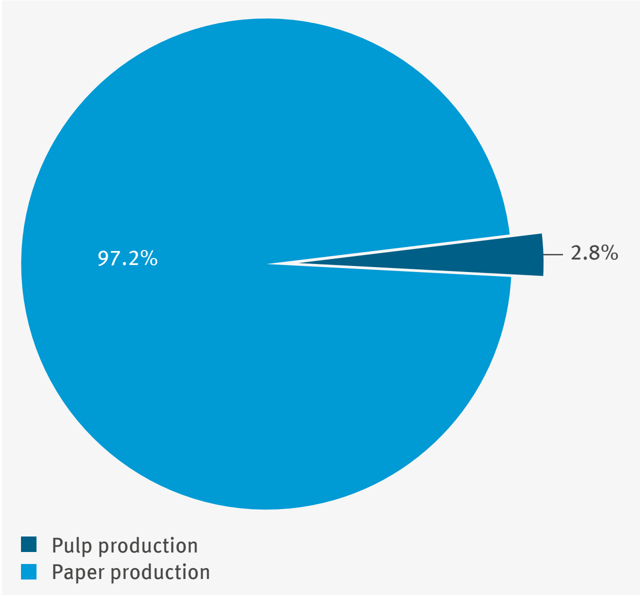
It is only the emissions in the current scope (without the yellow column sections) that may be considered as a comparison to free allocations. As in other sectors, the allocation status of the ceramics industry changed significantly in the beginning of the third trading period so that the installations have had an overall shortfall since 2013. The allocation coverage dropped from around 94 percent in 2013 to around 85 percent in 2019.

## 2.7 Paper and pulp industry

This sector includes pulp production and paper, cardboard or paperboard manufacture (Activities 20 and 21 as per Annex 1 TEHG).

The number of installations decreased from 145 in 2018 to 144 in 2019. Five installations were assigned to pulp production and 139 to paper production. The paper and pulp industry's installations emitted about 5.1 million tonnes of carbon dioxide in 2019. Thus 2019 emissions were about 6.7 percent below the previous year's level. Figure 40 shows that paper production had a share of slightly more than 97 percent. Pulp production accounts for somewhat less than three percent of emissions.

Emissions from pulp production subject to surrender requirement dropped by ten percent from 157,000 tonnes of carbon dioxide in 2018 to 141,000 tonnes of carbon dioxide in the 2019 reporting year (see Table 17). In the paper production activity, emissions fell by 353,000 tonnes of carbon dioxide or just under 6.6 percent to slightly less than 5 million tonnes of carbon dioxide. According to the Association's data, paper production decreased by 2.7 percent in the same period.[67]




As of 04/05/2020

Figure 40: Shares of the 2019 emissions from the paper and pulp industry (Activities 20 and 21)

The operators of 139 installations in the paper production activity received approx. 5.8 million emission allowances for 2019, i. e. about 825,000 more than they needed to surrender in 2019 according to the VET figures (5 million, see Table 17). By contrast, pulp industry installations have a significant overall shortfall of about 58 percent of 2019 emissions.

Table 17: Paper and pulp industry (Activities 20 and 21), number of installations, 2018 emissions, 2019 free allocation, 2019 VET entries and allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 20 | Pulp production | 5 | 157 | 141 | 82 | 58.2 % |
| 21 | Paper production | 139 | 5,322 | 4,971 | 5,796 | 116.6 % |
| | N. l. ETS | *1** | 0 | – | – | – |
| **Total** | | **144** | **5,479** | **5,112** | **5,878** | **115.0 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

67 See VDP (2020), Press release of 04/03/2020

However, if the allocation is adjusted by the estimated allocation amount for heat imports[68], the picture changes in terms of allocation coverage (Table 18). Overall, the allocation share attributable to heat imports from other installations subject to emissions trading can be estimated at around 1.6 million emission allowances (cf. Figure 41, shaded area).[69] The allocation coverage in the activities paper production (Activity 21) and pulp production (Activity 20) would fall to around 83 percent without this share (adjusted allocation coverage). This indicates an overall shortfall.

Table 18: Paper and pulp industry (Activities 20 and 21), number of installations, allocation amounts, 2019 VET entries and adjusted allocation coverage

| Sector/ activity | No. of installations | 2019 adjusted allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | Adjusted allocation coverage |
|---|---|---|---|---|---|
| Paper and pulp | 144 | 4,257 | 5,112 | – 855 | 83.3 % |

As of 04/05/2020

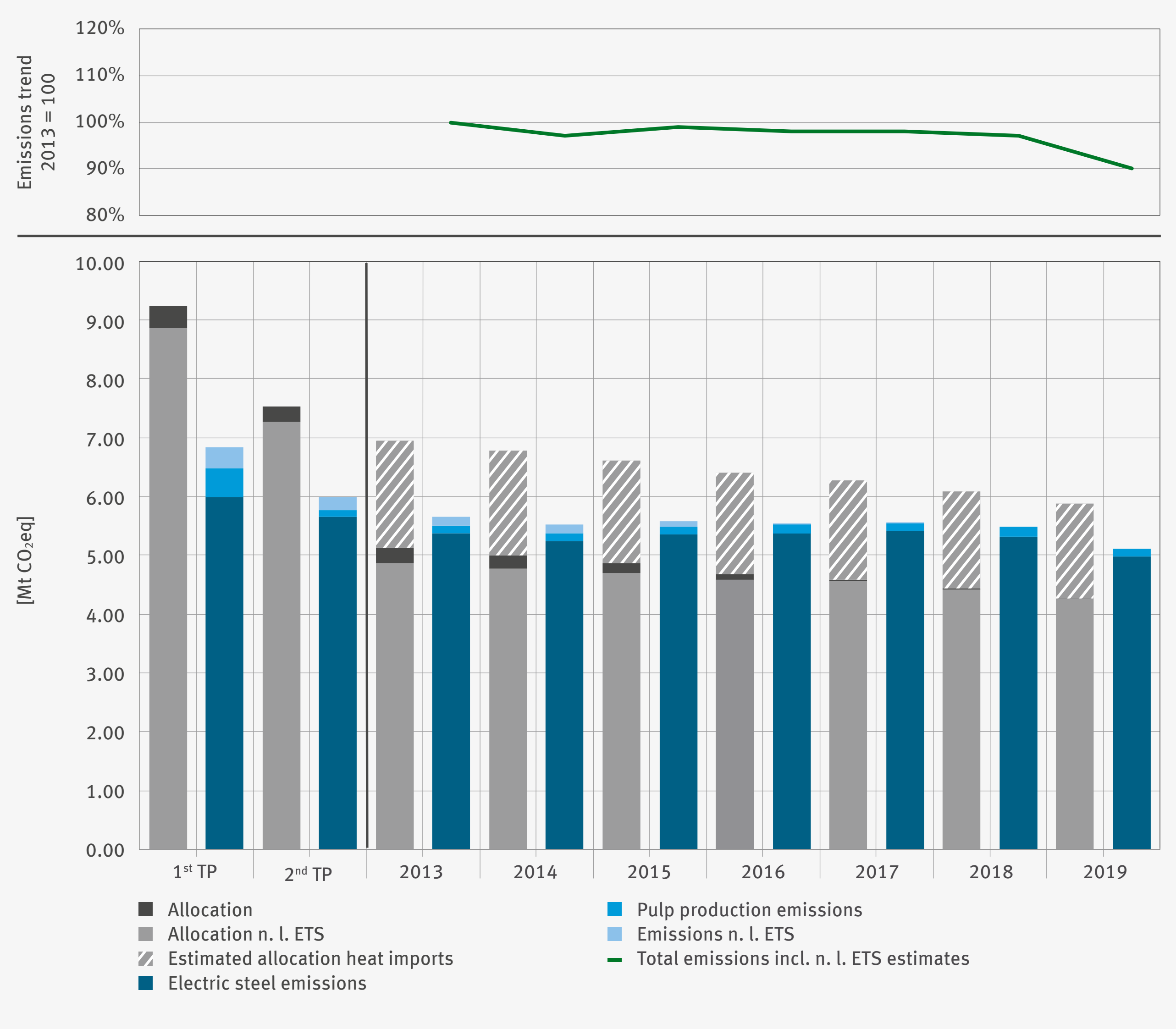
### Trends in the third trading period

Figure 41 shows the emissions and free allocation trends of cement clinker installations in the 2013 – 2019 period and, in addition, the averages of the first two trading periods (see columns ‘1st TP’ and ‘2nd TP’ in the bottom part of the figure). The green line in the top shows the emission trend compared to the starting year of the third trading period in 2013, i. e. of all installations that are subject to emissions trading in the respective year.

Overall, emissions from the paper and pulp industry have remained relatively constant since the beginning of the third trading period and have settled at a level of approx. 5.4 million tonnes by 2018. However, as mentioned above, a significant reduction in emissions by more than six percent was recorded in 2019 (see Figure 41). Compared to 2013, i. e. the first year of the third trading period, emissions fell by around ten percent overall. The reasons for the trend since 2013 are not only an improvement of energy efficiency in production but also the trend of production (see Figure 42)

68 Many installations engaged in these activities import heat from other installations subject to emissions trading and receive a free allocation in return while the emissions are generated by the heat generating installation. It can be assumed that part of this free allocation is passed on to the heat generating installation.

69 Only the information from the Allocation report (DEHSt 2014a) can be used as an estimate. This figure was derived based on data on heat imports from other EU ETS installations from the allocation procedure (cf. Chapter 7.8 of the Allocation report). This estimate cannot be adjusted to the current situation regarding heat imports in the paper industry as no current data is available.




As of 04/05/2020

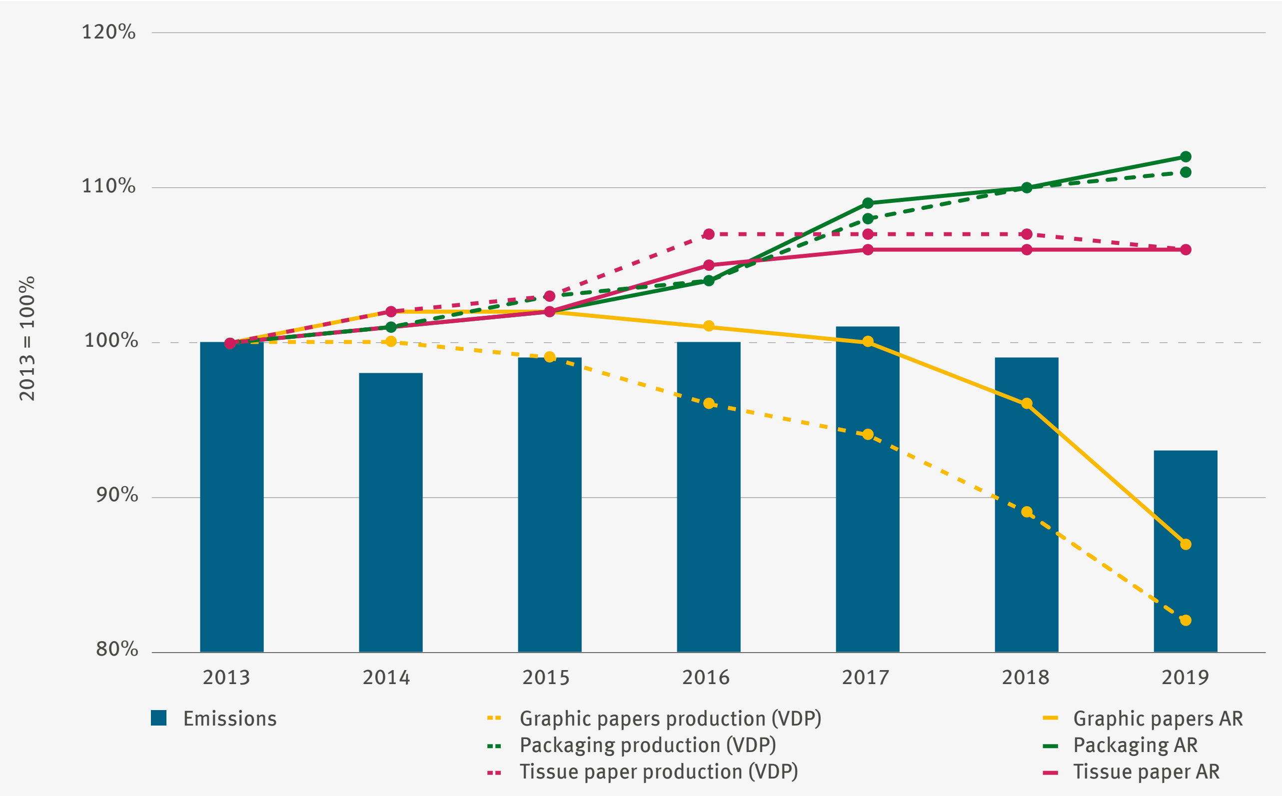
Figure 41: Paper and pulp industry (Activities 20 and 21), free allocation and emissions trend from 2005 to 2019 in Germany[70]

Figure 42 compares the emissions trend of the paper industry with the trend of the production data. For this purpose, the activity rates of the product benchmarks for 'Fine paper' and 'Newsprint' were combined to form 'Graphic papers'. The activity rates of the product benchmarks for 'Cardboard' and 'Testliner and fluting' were combined to form 'Packaging'. The activity rates of the product benchmark for 'Tissue paper' (German term: Hygienepapier) are also shown. The activity rates are compared with the relevant data of The German Pulp and Paper Association (VDP).

In the production of paper, a noticeable decline in the activity rate for graphic papers can be observed compared to the previous year, in accordance with the VDP production data. Similarly, a decline is also visible throughout the third trading period, which has intensified in recent years. Tissue papers have shown a relatively constant trend at a similar level both in production data and activity rates since 2016. Packaging products showed the strongest increase in the third trading period in a comparison among product groups.

70 N. l. ETS: Installations no longer subject to emissions trading are taken into account retroactively in the figure in order to show the actual emissions trend of the European Emissions Trading Scheme in Germany since 2005 and not only the emissions trend of installations subject to emissions trading in the respective reporting year (see also Chapter 1 Introduction).

Overall, the activity rates and VDP production data cannot be properly compared since not all installations participate in emissions trading. This may be an explanation for the discrepancy between the different levels of VDP production data and activity rates.

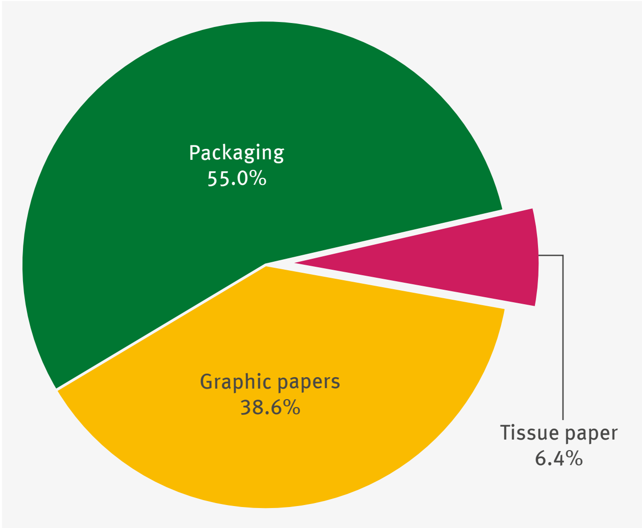



As of 04/05/2020

Figure 42: Paper production (Activity 21), emissions and production trends[71] in Germany from 2013 to 2019 compared to 2005

71 VDP data (performance reports of the respective years)

Figure 43 shows the 2019 shares of the above paper production sectors such as Packaging, Graphic papers and Tissue papers using the data from the corresponding activity rates (in tonnes). Packaging production accounts for 55 percent which is the largest share. Graphic papers have a share of just under 39 percent and tissue papers still account for slightly more than six percent.




As of 04/05/2020

Figure 43: Significance of the production of graphic papers, tissue papers and packaging papers for the paper industry subject to emissions trading with shares of each of the areas based on their activity rates[72]

72 Technical and special papers are not taken into account in Figures 42 and 43 since no comparable activity rate (production data) is available using the fallback approach in this group

Figure 44 below shows the emissions trend for both the entire EU and Germany. It can be seen that overall emissions from the paper and pulp industry (Registry activities 35 and 36) were clearly decreasing in both the EU and Germany in the third trading period. The decrease in the EU and in Germany was relatively uniform until 2017. Only in 2017 were emissions at EU level and in Germany approximately two percent above the 2016 level and a downward emissions trend appeared again in 2018 where the reduction was stronger in Germany than at EU level.

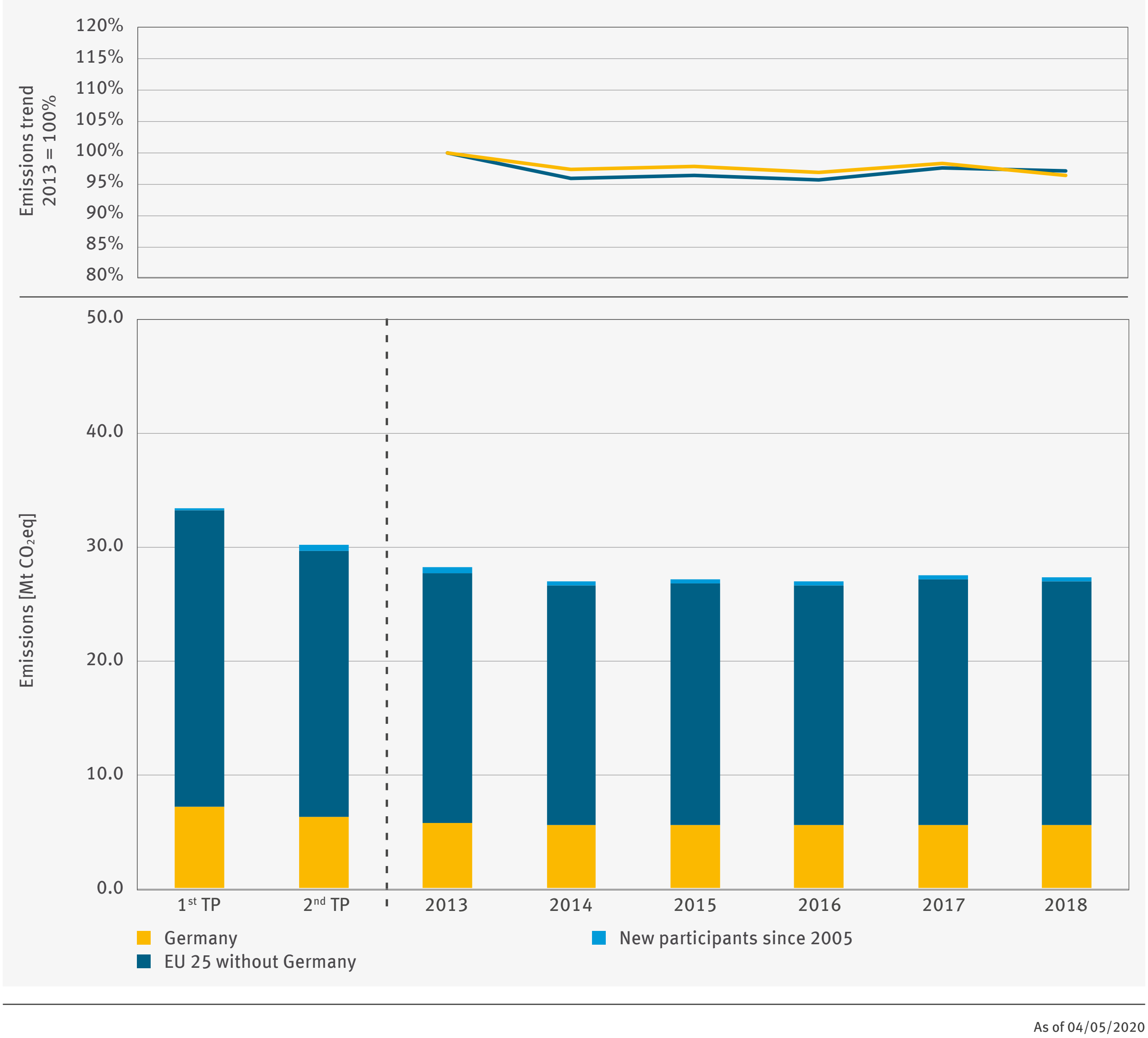



Figure 44: Emissions trend in the paper and pulp industry (Registry activities 35 and 36) in Germany and in the EU until 2018[73]

73 Data source: EEA 2019; the evaluation is based on grouping the installations by activities in the EU Union Registry (see Table 37, Chapter 7), which can cause differences in the emissions amount in Germany's sectors. New participants in the EU ETS after 2005 are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

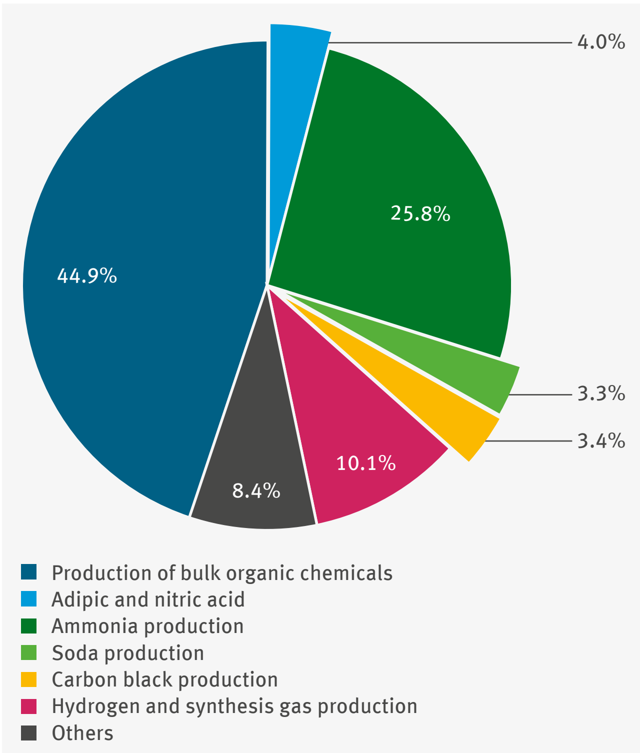
## 2.8 Chemical Industry

The chemical industry comprises Activities 22 to 29 as per Annex 1 TEHG, which for the most part were for the first time included in emissions trading at the start of the third trading period. Also assigned to the sector are some installations that do not belong to any chemical activity subject to emissions trading but which fall under Activity 1 in Annex 1 TEHG because of their rated thermal input of a minimum of 20 MW – for example, installations for the production of titanium dioxide or other inorganic chemistry products. Installations generating electricity and heat for the chemical industry, however, are assigned to energy installations, provided they are approved independently in terms of pollution control and are therefore not discussed in this sector chapter. The chemical industry comprised 227 installation in 2019. The number of incumbent installations has remained relatively constant on balance. The emissions of the chemical industry amounted to around 16.9 million tonnes of carbon dioxide equivalents in 2019, which represent a share of 4.7 percent of the total emissions from all installations subject to emissions trading.

Figure 45 shows the percentage shares of the activities covered in the emissions of the chemical industry. They are clearly dominated by the production of bulk organic chemicals (Activity 27) at 45 percent, followed by ammonia production (Activity 26) at almost 26 percent. Hydrogen and synthesis gas production (Activity 28) and 'Others' fall into the next largest categories at 10 and 8 percent, respectively. Other activities have the smallest share at less than five percent each. The category 'Others' includes installations of Activity 1 (Combustion) and Activity 25 (Glyoxal and glyoxylic acid production).

Emissions from the 227 installations amounted to 16.9 million tonnes of carbon dioxide equivalents in the reporting year. This was 922,000 tonnes of carbon dioxide equivalents or 5.5 percent less than in the previous year.

In detail, emissions decreased in almost all areas of activity. The largest changes compared to the previous year occurred within Activity 27 (Production of bulk organic chemicals) with a decrease of 429,000 tonnes of carbon dioxide (minus 5.7 percent) and Activity 26 (Ammonia production) with a decrease of 230,000 tonnes of carbon dioxide (minus 5.3 percent), followed by Activities 1 and 25 (Others) with a decrease of 120,000 tonnes of carbon dioxide (minus 7.8 percent).




As of 04/05/2020

Figure 45: Shares of 2019 emissions from the chemical industry (Activities 22 to 29 and 1)

Table 19: Chemical industry (Activities 22 to 29 and 1), number of installations, 2018 emissions, 2019 free allocations 2019 VET entries and allocation coverage

| No. | Activity | No. of installations | 2018 emissions [kt $CO_2$eq] | 2019 VET [kt $CO_2$eq] | 2019 allocation amount [1000 EUA] | 2019 allocation coverage |
|---|---|---|---|---|---|---|
| 22 | Carbon black production | 4 | 621 | 579 | 419 | 72.4 % |
| 23, 24 | Adipic and nitric acid | 11 | 773 | 672 | 1,612 | 239.7 % |
| 26 | Ammonia production | 5 | 4,593 | 4,363 | 3,559 | 81.6 % |
| 27 | Production of bulk organic chemicals | 159 | 8,021 | 7,592 | 8,751 | 115.3 % |
| 28 | Hydrogen and synthesis gas production | 15 | 1,735 | 1,715 | 1,485 | 86.6 % |
| 29 | Soda production | 6 | 540 | 557 | 1,006 | 180.4 % |
| 1, 25 | Others | 27 | 1,539 | 1,419 | 1,260 | 88.8 % |
| | N. l. ETS | *10** | 1 | – | – | – |
| **Total** | | **227** | **17,821** | **16,899** | **18,092** | **107.1 %** |

As of 04/05/2020
* N. l. ETS not included in total number of installations.

Activities 23 and 24 include eleven installations that produce adipic or nitric acid and are subject to emissions trading both in terms of their carbon dioxide and nitrous oxide (dinitrogen monoxide, $N_2O$) emissions. In 2019 the nitrous oxide emissions amounted to around 563,000 tonnes of carbon dioxide equivalents and accounted on average for 83.7 percent of the total emissions from these installations.

## Allocation status

Compared to other industrial sectors, the chemical industry's installations are, on average, adequately provided with free emission allowances (see Table 19).

In 2019, chemical industry installations were allocated around 1.2 million emission allowances. This was 7.1 percent above the number of allowances required for surrender. Compared with the previous year, this calculated surplus rose significantly by around 702,000 emission allowances or 143 percent which can be mainly explained by the sharp drop in emissions.

The largest relative surplus allocation with free emission allowances can be observed in the adipic and nitric acid production installations (239.7 percent). This can be explained by the fact that $N_2O$ emission abatement techniques have in the meantime been implemented and further developed in these installations so that their specific emissions are significantly lower than the specific product benchmarks for adipic acid and nitric acid, which are essential for allocation throughout the EU.

The bulk organic chemical production installations (115.3 percent or 940,000 emission allowances) and soda production installations (180.4 percent or 449,000 emission allowances) also have a significant surplus allocation compared to their emissions. This can be attributed in particular to the allocation rules for cross-installation heat flows: many installations involved in these activities import heat from other installations subject to emissions trading and receive a free allocation in return, while the emissions are produced by heat-generating installations. In addition, many processes producing bulk organic chemicals are exothermic. Efficient heat recovery systems allow a large proportion of the reaction heat to be used without causing additional emissions.

In contrast, the free allocation to the carbon black, ammonia and hydrogen or synthesis gas producing installations was not sufficient to fully cover these installations' emissions in 2019: the operators of ammonia installations had to purchase a total of 804,000 emission allowances (18.4 percent). Carbon black producers needed 160,000 emission allowances (27.6 percent).

The shortfall for hydrogen and synthesis gas production remained at a level similar to that of the previous year (230,000 emission allowances or 13.4 percent).

Table 20: Chemical industry (Activities 22 to 29 and 1), number of installations, allocation amounts, 2019 VET entries and adjusted allocation coverage

| Sector / activity | No. of installations | 2019 adjusted allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | Adjusted allocation coverage |
|---|---|---|---|---|---|
| Chemical industry | 227 | 16,633 | 16,899 | –266 | 98.4 % |

As of 04/05/2020

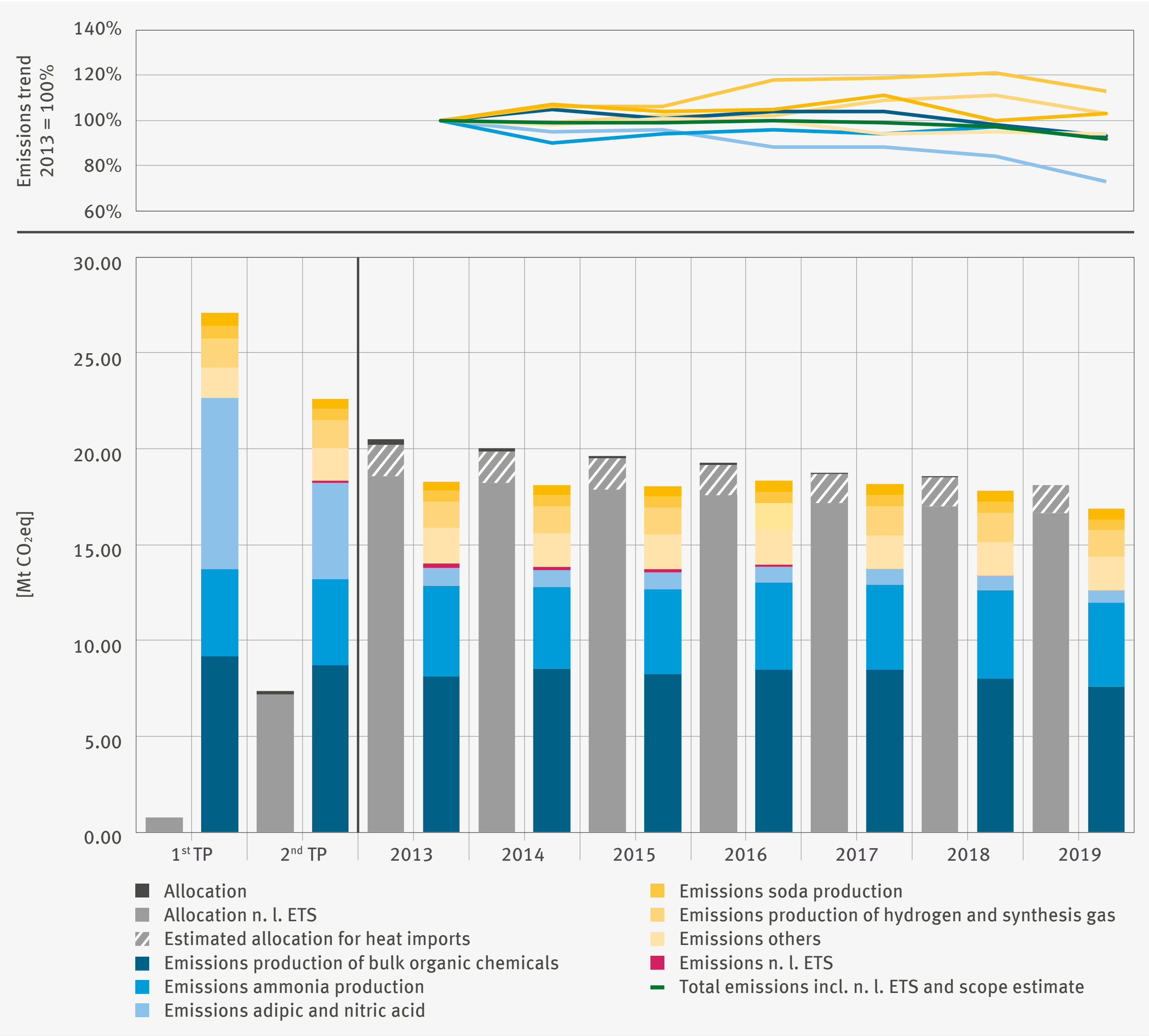
Even after adjusting the free allocation by an estimated allocation for imported heat, the chemical industry's installations are, on average, still relatively well provided with free emission allowances compared to other sectors. After subtracting the estimated allocation amount due to heat imports from other installations subject to emissions trading amounting to approx. 1.6 million emission allowances[74], the chemical industry's adjusted allocation coverage would still be 98.4 percent, which would be a minor increase over the previous year.

## Trends in the third trading period

Figure 46 shows the emissions and free allocation trend of the chemical industry in the period from 2013 to 2019 and, additionally, the averages of the first two trading periods (see columns '1st TP' and '2nd TP' in the bottom part of the figure). The lines in the top part show the emission trends of the individual activities and of the entire industry compared to the starting year 2013 of the third trading period. The majority of the installations have only reported their emissions since the third trading period so the first and second trading period figures are largely estimated.

Total emissions from the chemical industry remained at roughly the same level in the first few years of the third trading period, only decreasing visibly from 2018 onwards, and were around eight percent below the 2013 level in 2019. Emissions from the various activities fluctuated according to production.

74 Only the data from the allocation report (DEHSt 2014a) can be used as an estimate. This figure was derived based on data on heat imports from other EU ETS installations from the allocation procedure (cf. Section 7.8 of the allocation report). It is not possible to adapt this estimate to the current situation regarding heat imports in the chemical industry as no current data is available.




As of 04/05/2020

Figure 46: Estimated allocation for heat imports (Activities 22 to 29 and 1), emissions and free allocation trends in Germany from 2005 to 2019[75]

The decrease in emissions from adipic and nitric acid production in the first and second trading periods largely resulted from the implementation of abatement technologies, which enabled nitrous oxide emissions to be reduced at a relatively low cost. Substantial emission reductions were achieved even before the start of the emissions trading obligation through voluntary commitments by industry, immission control requirements and above all implementing joint implementation projects in Germany. However, replacement new buildings and further reduction measures have gained emission reductions after 2013.

75 N. l. ETS: In the figure, installations that are no longer subject to emissions trading are taken into account retroactively in order to show the actual emissions trend of the European Emissions Trading Scheme in Germany since 2005 and not only the emissions trend of installations subject to emissions trading in the respective reporting year (see also Chapter 1 Introduction).

Figure 46 shows the increase of the allocation from the first to the third trading period according to the extended scope of emissions trading for the chemical industry. Energy installations were already included in emissions trading from the first trading period. Some installations for the production of carbon black, ethylene and propylene (steam crackers) were added in the second trading period and were assigned to the chemical industry. Figure 46 also highlights the annual decrease of free allocation since the start of the third trading period due to the cross-sectoral correction factor applied while the emissions trend was approximately constant.

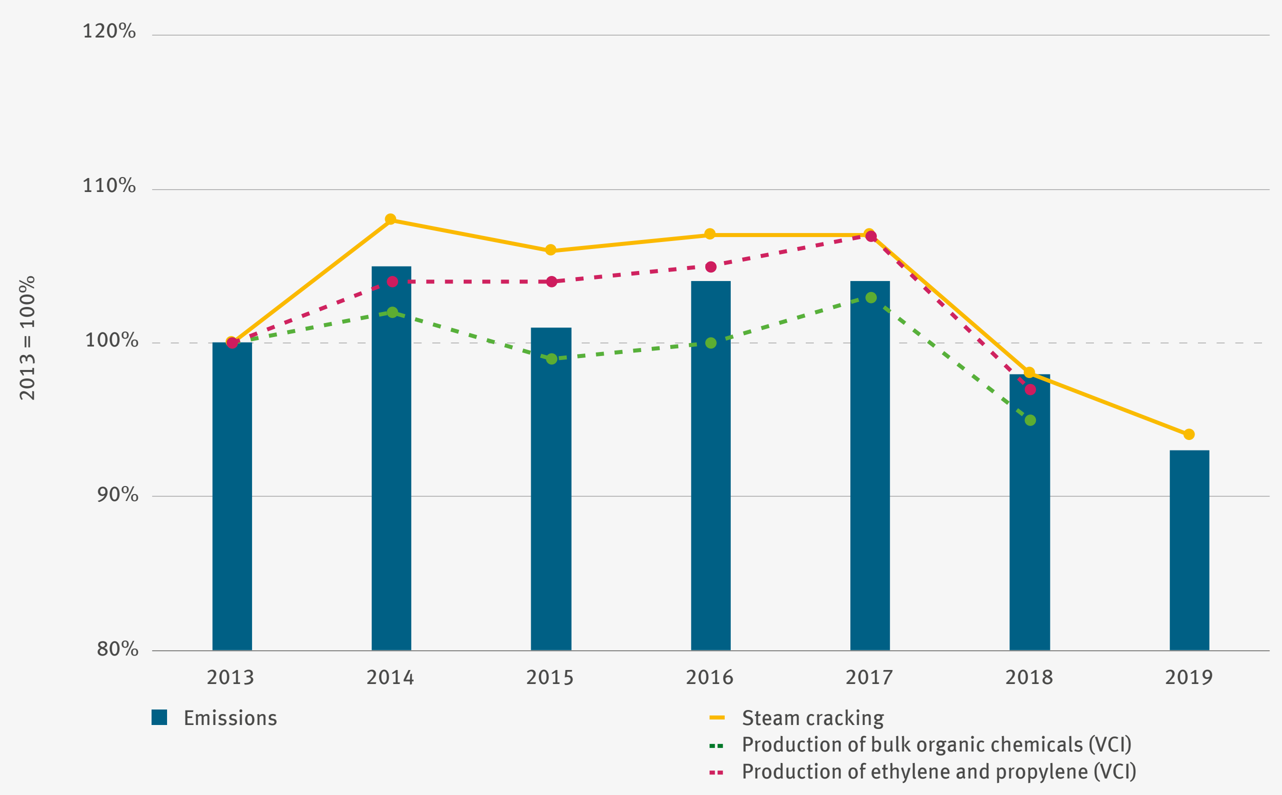
Figure 47 and Figure 48 below show the Activity 27 and 26 emissions which are the highest within the chemical industry. In addition, the corresponding activity rates from the annual operational reports and the corresponding data of the German Chemical Industry Association (VCI) are shown.

For Activity 27 in Figure 47, this is the activity rate for the 'steam cracking' product benchmark, as this product benchmark makes up a large part of the total allocation in the production of bulk organic chemicals activity. In addition to the activity rate, the VCI data was included in the illustration comprising an index for bulk organic chemicals and an index for ethylene and propylene being the key products arising from steam cracking.[76]

In principle, emissions, activity rates and production indices were within a similar corridor from 2013 to 2019. The activity rate of steam cracking increased somewhat more steeply than the production index for ethylene and propylene. Both make up only partial areas of the production of bulk organic chemicals, this is why the emission trends are similar but not identical. The differences between the emissions and the VCI production index for bulk organic chemicals can be explained by the fact that the VCI index only includes a selection of typical products but not all of them. Looking at the 2013 – 2019 tendency, a slow decrease in emissions since 2017 can be observed. Part of the decreasing emissions can be explained by a decline in demand from Germany and abroad.[77] At the same time, effects such as the overhaul of crackers have a strong influence on the emissions trend of the activity. In 2018, for example, there was a reduction in emissions of around 187,000 tonnes of carbon dioxide equivalents. In 2019, emissions decreased by as much as 372,000 tonnes due to the overhaul of the Böhlen cracker.

76 The index for bulk organic chemicals consists of all organic chemical production data published by the VCI in the publication 'Chemie in Zahlen' ('Chemistry in figures', VCI 2013, VCI 2019), while the index for ethylene and propylene comprises only these products. Data gaps for some products were interpolated. The 2018 xylene figure is missing in the VCI publication and has not been included in the index. Therefore the 2018 index is not identical to the previous year but the tendency remains the same.

77 VCI 2019a

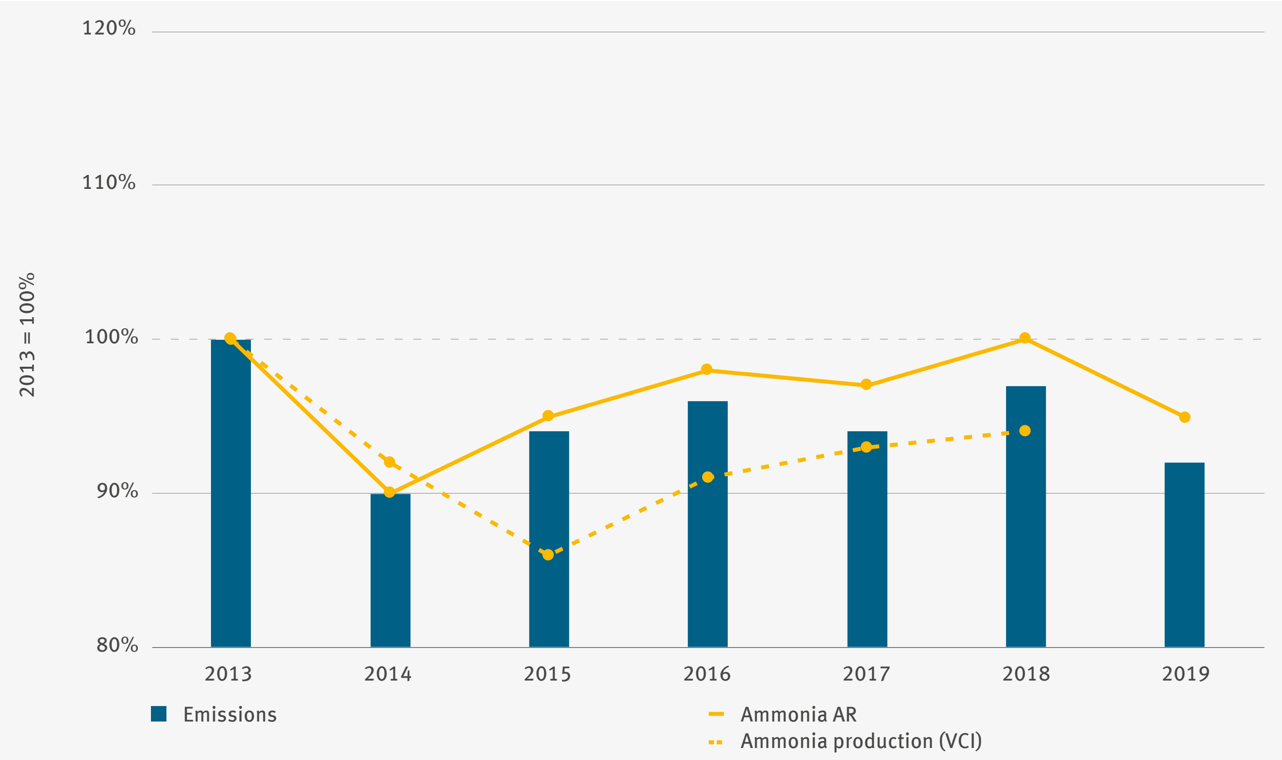



As of 04/05/2020

Figure 47: Production of bulk organic chemicals (Activity 27), 2013-2019 emissions and production trends in Germany, each in relation to 2013[78]

The emissions trend from ammonia production (see Figure 48) corresponds relatively well to the trend of activity rate and the Association's data. An inverse trend of the emissions and activity rate compared to the Association's data was only observed in 2015. One ammonia-producing installation is included in the refinery activity because it is approved as a refinery as per Section 4 TEHG. This relatively large installation showed a strong decrease in emissions in 2015 but is not included in the ammonia activity rate but is included in the VCI production figures. This can lead to a deviation from the Association's data. After this drop in 2015, however, production data is again approaching the trend of activity rate and emissions.

78 VCI 2013, VCI 2019b

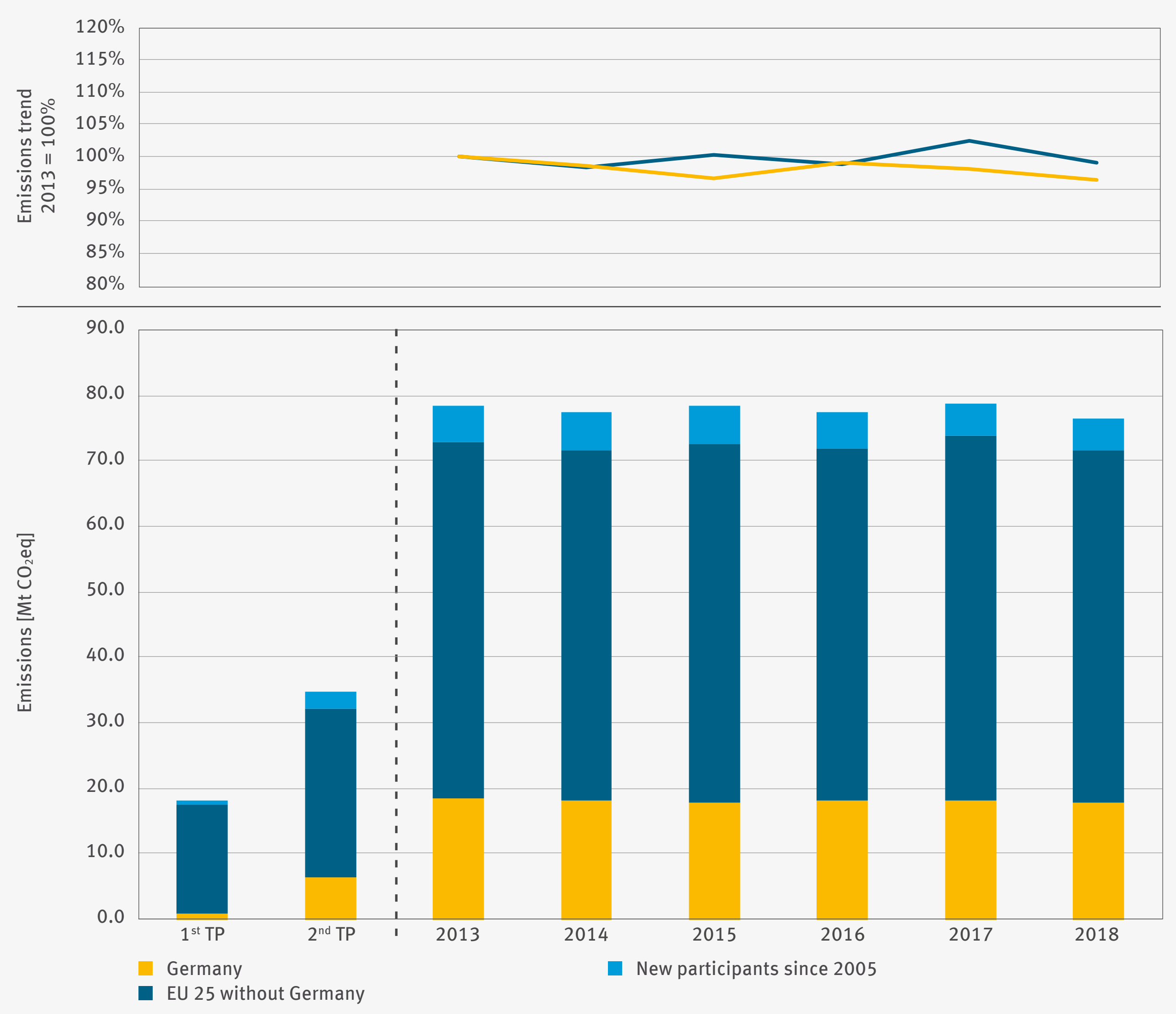



As of 04/05/2020

Figure 48: Ammonia production (Activity 26), 2013-2019 emissions and production trends in Germany, each in relation to 2013[79]

A look at the chemical industry in a European comparison provides a picture similar to that of Germany. Figure 49 shows that an increasing number of activities were included in the scope of emissions trading for the chemical industry in the first and second trading period. In the third trading period, emissions in Germany decreased by four percent within the 2013 – 2019 period and a minor change of minus two percent took place from 2018 to 2019. No clear trend is discernible in a European comparison: emissions fluctuated around their initial figure by plus or minus two percent. The relative trend shows that other Member States experienced fluctuations opposite to those in Germany, which was particularly pronounced between 2015 and 2017, however 2018 produced an emission decrease both in Europe and Germany.

79 VCI 2013, VCI 2019b




As of 04/05/2020

Figure 49: Emissions trend in the chemical industry (Registry activities 37 and up to 44) in Germany and in the EU until 2018[80]

80 Data source: EEA 2019; the evaluation is based on grouping the installations by activities in the EU Union Registry (see Table 37, Chapter 7), which can cause differences in the emissions amount in Germany's sectors. New participants in the EU ETS after 2005 are Bulgaria, Iceland, Croatia, Liechtenstein, Norway and Romania.

## 2.9 Overview of the allocation status in Germany

In the seventh and penultimate year of the current third trading period, the verified emissions of all installations subject to emissions trading in Germany, at 363 million tonnes of carbon dioxide equivalents significantly exceeded the free allocation amount for the current year.[81] In 2019, a total of around 141 million emissions allowances were allocated free of charge to operators of 1,617 of the 1,851 German installations.

The free allocation thus covered an average of 38.8 percent of the verified emissions from all installations in Germany (2018: 34.5 percent). The average allocation coverage thus was around four percent higher than in the previous year due to the decrease in emissions. Table 21 shows the allocation and emission status differentiated by activity (1 to 29).

A comparison of the individual activities clearly reflects the large differences between energy and industrial installations with regard to the third trading-period allocation rules.

Table 21: 2019 allocation status by activities (non-adjusted allocation coverage)

| Sector | No. | Activity | No. of installations | 2019 allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | 2019 allocation coverage* | 2018 allocation coverage* |
|---|---|---|---|---|---|---|---|---|
| Energy | 2 | Energy conversion >= 50 MW RTI | 478 | 17,682 | 237,387 | −219,706 | 7.4 % | 6.6 % |
| | 3 | Energy conversion 20–50 MW RTI | 387 | 2,673 | 5,113 | −2,440 | 52.3 % | 57.2 % |
| | 4 | Energy conversion 20–50 MW RTI, other fuels | 13 | 92 | 149 | −57 | 61.8 % | 71.8 % |
| | 5 | Prime movers (engines) | 3 | 8 | 38 | −30 | 21.0 % | 65.9 % |
| | 6 | Prime movers (turbines) | 52 | 439 | 1,225 | −785 | 35.9 % | 40.3 % |
| | | | **933** | **20,894** | **243,912** | **−223,018** | **8.6 %** | **7.6 %** |
| Industry | 1 | Combustion | 65 | 1,679 | 2,063 | −384 | 81.4 % | 78.1 % |
| | 7 | Refineries | 24 | 17,860 | 23,208 | −5,349 | 77.0 % | 78.1 % |
| | 8, 9, 10 | Production of pig iron and crude steel ** | 35 | 41,911 | 30,735 | 11,176 | 136.4 % | 131.4 % |
| | 8 | Coking plants | 4 | 1,604 | 3,735 | −2,130 | 43.0 % | 42.5 % |
| | 9 | Processing of metal ores | 1 | 64 | 79 | −16 | 80.4 % | 80.5 % |
| | 10 | Production of pig iron and steel | 30 | 40,243 | 26,921 | 13,322 | 149.5 % | 143.5 % |
| | 11 | Processing of ferrous metals | 89 | 4,312 | 4,769 | −457 | 90.4 % | 84.0 % |
| | 12 | Production of primary aluminium | 7 | 838 | 955 | −117 | 87.7 % | 83.2 % |

81 The number of installations of the reporting year 2019 is used throughout in Section 2.9.

| Sector | No. | Activity | No. of instal-lations | 2019 allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq] | 2019 allocation coverage* | 2018 allocation coverage* |
|---|---|---|---|---|---|---|---|---|
| Industry | 13 | Processing of non-ferrous metals | 32 | 1,462 | 1,625 | −163 | 90.0 % | 91.3 % |
| | 14 | Production of cement clinker | 36 | 16,828 | 19,990 | −3,162 | 84.2 % | 85.9 % |
| | 15 | Lime production | 59 | 7,209 | 8,776 | −1,567 | 82.1 % | 78.3 % |
| | 16 | Glass production | 70 | 2,874 | 3,694 | −820 | 77.8 % | 77.2 % |
| | 17 | Ceramics production | 140 | 1,695 | 1,994 | −299 | 85.0 % | 86.1 % |
| | 18 | Production of mineral fibres | 7 | 279 | 361 | −81 | 77.5 % | 70.4 % |
| | 19 | Gypsum production | 9 | 282 | 273 | 9 | 103.2 % | 106.1 % |
| | 20 | Pulp production | 5 | 82 | 141 | −59 | 58.2 % | 55.4 % |
| | 21 | Paper production | 139 | 5,796 | 4,971 | 825 | 116.6 % | 112.6 % |
| | 22 | Carbon black production | 4 | 419 | 579 | −160 | 72.4 % | 69.3 % |
| | 23 | Production of nitric acid | 8 | 641 | 558 | 82 | 114.7 % | 98.9 % |
| | 24 | Production of adipic acid | 3 | 971 | 114 | 857 | 852.3 % | 887.7 % |
| | 25 | Production of glyoxal and glyoxylic acid | 1 | 8 | 10 | −3 | 74.9 % | 71.3 % |
| | 26 | Ammonia production | 5 | 3,559 | 4,363 | −805 | 81.6 % | 79.1 % |
| | 27 | Production of bulk organic chemicals | 159 | 8,751 | 7,592 | 1,159 | 115.3 % | 111.9 % |
| | 28 | Production of hydrogen and synthesis gas | 15 | 1,485 | 1,715 | −230 | 86.6 % | 87.4 % |
| | 29 | Soda production | 6 | 1,006 | 557 | 448 | 180.4 % | 190.1 % |
| | | | 918 | 119,946 | 119,043 | 902 | 100.8 % | 99.0 % |
| **Total** | | | **1,851** | **140,840** | **362,955** | **−222,116** | **38.8 %** | **34.5 %** |

As of 04/05/2020
* Without considering possible adjustments for the transfer of waste gases and for heat imports
** Coking plants, metal ores processing, production of pig iron and steel

The operators of the 918 installations with industrial activities received a total allocation of 119.9 million emission allowances for the 2019 reporting year. This compares with the total verified emissions of 119 million tonnes of carbon dioxide equivalents. The allocation corresponded to 100.8 percent of the surrender obligations of these installations (99 percent in 2018) and again exceeded the 100 percent mark.

However, at 87 percent (2018: 85 percent) the adjusted allocation coverage[82] remains considerably below the 100 percent mark (cf. the following sections with Table 22 and Table 23).

The situation is different for the 933 energy installations (Activities 2 to 6). Due to the discontinuation of the free allocation for power generation in the third trading period, the 2019 ratio of allocation to verified emissions was only 8.6 percent on average, thus slightly higher than in the previous year (2018: 7.6 percent). Overall, in 2019 the energy installations received an allocation of 20.9 million emission allowances for heat generation, while the verified emissions amounted to 243.9 million tonnes of carbon dioxide equivalents. The emissions of these installations at 18 percent clearly decreased more acutely than the allocation, which however was also about eight percent lower than in the previous year. The noticeable decrease in allocation can be attributed to the fact that no carbon leakage risk applies to a significant part of the allocation to energy installations (see Section 2.1).

In addition to the energy sector, power generation in industry also no longer receives free allocations. This applies, for example, to refineries and to the paper industry since (heat and) power stations are usually in operation in both sectors. Thus in 2019, refineries received an allocation that corresponded to only 77 percent of their verified emissions (2018: 78.1 percent). The allocation in the paper industry, however, does not indicate that part of the emissions is attributable to power generation. These installations even showed a surplus allocation of free emission allowances due to the allocation rules for cross-boundary heat flows (see Section 2.7). The installations from the paper industry exhibited a ratio of allocation to verified emissions of 115 percent (112.6 percent in 2018).

Pig iron and steel production installations nominally received a clearly higher allocation (129.9 percent, 2018: 143.5 percent) compared to the emissions. This is substantiated by the allocation rules for the high-emission waste gases from iron, steel and coke production but some of them are transferred to energy installations. The overall allocation coverage of the entire iron and steel industry adjusted by the allocation amount for the transfer of waste gases from iron, steel and coke production is around 92 percent (see Section 2.4).

### Allocation status taking into account waste gases from iron, steel and coke production and heat imports

The allocation that can be traced back to transferred waste gases from iron, steel and coke production and heat imports from other installations subject to emissions trading has a significant impact on the allocation coverage for the sectors concerned. In 2019, an estimated 13.4 million emission allowances were assigned to waste gas transfer from industrial installations to energy installations and around 3.1 million emission allowances to heat imports from industrial installations to energy installations.[83]

Assuming that these allocation amounts were settled between industry and energy sector operators, the industry sector exhibited a deficit of around 15.5 million emission allowances in 2019. Thus, the allocation coverage for the industrial sector would be 87 percent instead of the aforementioned 100.8 percent corresponding to a significant deficit.

The sectors affected here are iron and steel, paper and pulp and the chemical industry (see Table 22). Conversely, under the assumptions made for the energy sector, the allocation coverage as a ratio of adjusted allocation to verified emissions for 2019 increases from 8.6 to 15.3 percent. Table 22 summarises the allocation status adjusted by transferred waste gases from iron, steel and coke production and imported heat for 2019 at the sector level.

82 See explanations to the adjusted allocation coverage in the Glossary (Chapter 8).

83 See explanations on the allocation estimate in Sections 2.1 'Energy installations', 2.4 'Iron and steel industry including coking plants', 2.7 'Paper and pulp' and 2.8 'Chemical industry'

Table 22: Adjusted allocation coverage (taking into account waste gases from iron, steel and coke production and heat imports)

| Industry | Sector 3rd TP | No. of installations | 2019 allocation amount [1000 EUA] | 2019 VET [kt $CO_2$eq] | 2019 allocation deviation from 2019 VET [kt $CO_2$eq | 2019 allocation coverage* | 2019 adjusted allocation amount** [1000 EUA] | 2019 allocation coverage** |
|---|---|---|---|---|---|---|---|---|
| Energy | Energy installations | 933 | 20,894 | 243,912 | −223,018 | 8.6 % | 37,331 | 15.3 % |
| | | **933** | **20,894** | **243,912** | **−223,018** | **8.6 %** | **37,331** | **15.3 %** |
| Industry | Refineries | 24 | 17,860 | 23,208 | −5,349 | 77.0 % | 17,860 | 77.0 % |
| | Iron and steel | 125 | 46,223 | 35,577 | 10,646 | 129.9 % | 32,867 | 92.4 % |
| | Non-ferrous metals | 39 | 2,300 | 2,580 | −280 | 89.1 % | 2,300 | 89.1 % |
| | Industrial and building lime | 39 | 6,064 | 6,874 | −810 | 88.2 % | 6,064 | 88.2 % |
| | Cement clinker | 36 | 16,828 | 19,990 | −3,162 | 84.2 % | 16,828 | 84.2 % |
| | Other mineral processing industry | 247 | 6,279 | 8,238 | −1,958 | 76.2 % | 6,279 | 76.2 % |
| | Paper and pulp | 144 | 5,878 | 5,112 | 767 | 115.0 % | 4,257 | 83.3 % |
| | Chemical industry | 227 | 18,092 | 16,899 | 1,194 | 107.1 % | 16,633 | 98.4 % |
| | Other combustion plants | 37 | 421 | 566 | −145 | 74.5 % | 421 | 74.4 % |
| | | **918** | **119,946** | **119,043** | **902** | **100.8 %** | **103,509** | **87.0 %** |
| **Total** | | **1,851** | **140,840** | **362,955** | **−222,116** | **38.8 %** | **140,840** | **38.8 %** |

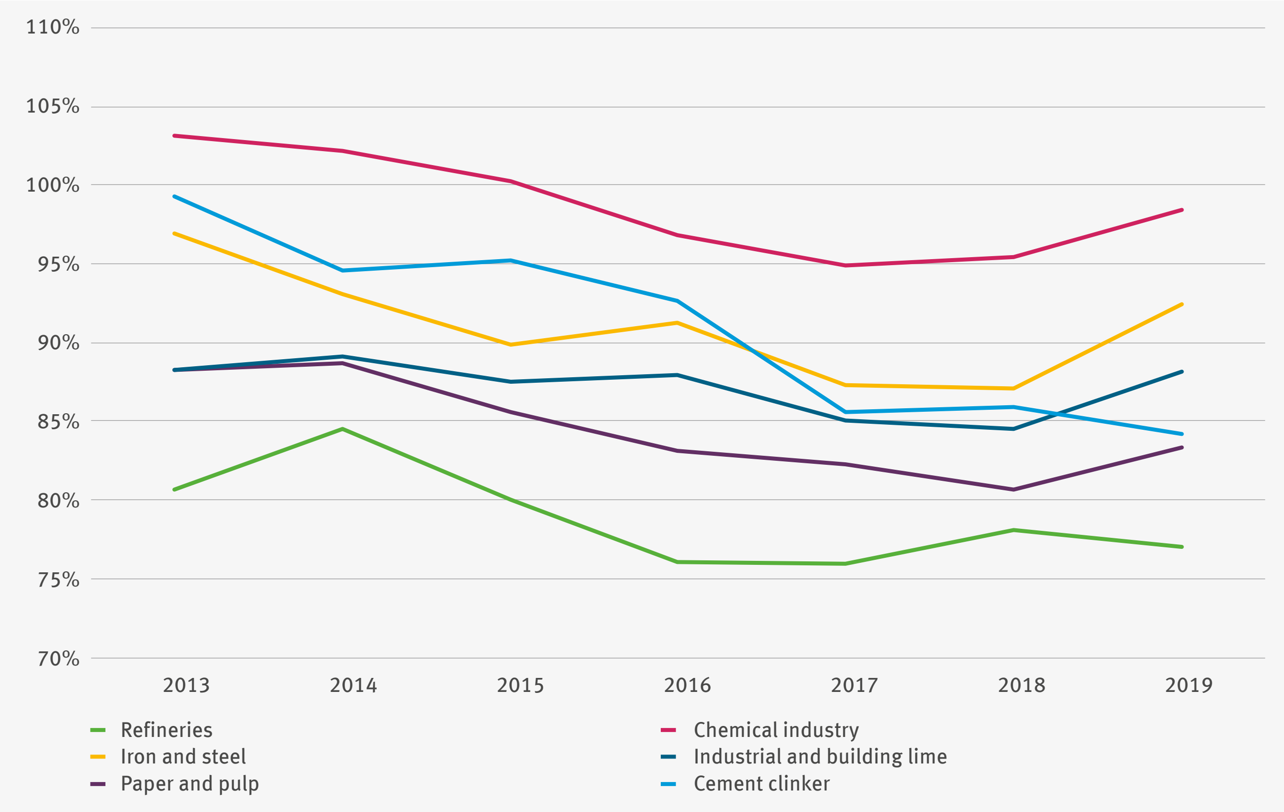
As of 04/05/2020
* Without considering possible adjustments for the transfer of waste gases and for heat imports
** Considering possible adjustments for the transfer of waste gases and for heat imports

Table 23 and Figure 49 show the trend for adjusted allocation coverage in the course of the third trading period. Relative to 2013, both energy and industrial installations will on average receive a decreasing allocation in the first year of the third trading period. However, 2019 saw a slight increase in allocation coverage for both energy and industrial installations compared to the previous year (see Table 23). Broken down to sector level, this slight increase can be seen in all sectors with the exception of refineries and the cement industry. For the majority of sectors, the change in the adjusted allocation was more than compensated for by a greater offsetting reduction in emissions.

Table 23: Adjusted allocation coverage since 2013

| Industry / sector | 2013 allocation coverage* | 2014 allocation coverage* | 2015 allocation coverage* | 2016 allocation coverage* | 2017 allocation coverage* | 2018 allocation coverage* | 2019 allocation coverage* |
|---|---|---|---|---|---|---|---|
| Energy | 15.4 % | 15.4 % | 14.7 % | 14.1 % | 13.8 % | 13.4 % | 15.3 % |
| Industry | 92.9 % | 92.0 % | 89.6 % | 88.1 % | 84.9 % | 85.0 % | 87.0 % |

As of 04/05/2020
* Considering possible adjustments for the transfer of waste gases and for heat imports




As of 04/05/2020

Figure 50: Adjusted allocation coverage trends for the largest emitters within the industrial sectors since 2013

## Allocation status for the whole period 2008 to 2019

For further consideration of the current allocation status, the following section includes not only the allocation surpluses (and deficits) for 2019 but also the corresponding figures from previous years for the installations considered in this report. This seems appropriate, as the emission allowances allocated since 2008 have been converted into emission allowances for the current trading period and can therefore continue to be used for surrender obligations in emissions trading (banking).

For industrial activities in the second trading period (2008 to 2012), the free allocation and verified emissions balance was a cumulative surplus amounting to 99.9 million allowances.[84] Assuming that the allocations for transferred waste gases from iron, steel and coke production and imported heat (131 million allowances for 2013 to 2019) are offset between industrial and energy sector operators, the industrial sector shows a cumulative deficit of 99.1 million emission allowances for the first seven years of the current trading period. This deficit has increased continuously in recent years. So far, it has been compensated for, at least in terms of calculation, by the surpluses accumulated in the second trading period. In 2019 this imputed surplus has now almost completely melted away. The total allocation surplus for industrial activities in the period 2008 to 2019 would still amount to around 0.8 million emission allowances. Table 24 summarises the aggregated results, differentiated at sector level.

Table 24: Aggregated allocation status in the second and third trading period

| Industry /sector | | Cumulative allocation surplus | | | |
|---|---|---|---|---|---|
| | | No. of installations | 2008–2012 adjusted* [M EUA] | 2013–2019 adjusted** [M EUA] | 2008–2019 total adjusted** [M EUA] |
| Energy | Energy installations | 933 | −361.8 | −1,854.2 | −2,216.0 |
| | | **933** | **−361.8** | **−1,854.2** | **−2,216.0** |
| Industry | Refineries | 24 | 14.8 | −36.5 | −21.7 |
| | Iron and steel | 125 | 52.1 | −22.9 | 29.2 |
| | Non-ferrous metals | 39 | 0.0 | −1.3 | −1.3 |
| | Cement clinker | 36 | 4.9 | −12.5 | −7.6 |
| | Industrial and building lime | 39 | 9.5 | −6.5 | 3.0 |
| | Other mineral processing industry | 247 | 6.1 | −11.5 | −5.4 |
| | Paper and pulp | 144 | 7.5 | −5.9 | 1.6 |
| | Chemical Industry | 227 | 5.0 | −1.6 | 3.4 |
| | Other combustion plants | 37 | 0.0 | −0.5 | −0.5 |
| | | **918** | **99.9** | **−99.1** | **0.8** |
| **Total** | | **1,851** | **−261.9** | **−1,953.3** | **−2,215.2** |

As of 04/05/2020
* Incl. redistribution of emission allowances for transferred waste gases pursuant to Section 11 Allocation Act
** Considering possible adjustments for the transfer of waste gases and for heat imports

84 Including redistribution of emission allowances for transferred waste gases pursuant to Section 11 Allocation Act 2012

In contrast to the industrial sector, the energy installations already had a shortfall of 361.8 million emission allowances in the second trading period. In addition to the ambitious level of the benchmarks at that time and the proportionate reduction to secure the budget, this is also due to the fact that in Germany in the second trading period, the free allocation for electricity generation had already been reduced in favour of the auctioning of emission allowances.[85] Since the beginning of the third trading period, full auctioning has been in effect for electricity generation throughout Europe. As a result, the energy sector's cumulative shortfalls, up to and including 2019, increased to a total of 2,216 million emission allowances (of which 1,854 million allowances are in the third trading period). This takes into account the balance from the second trading period and assumes offsetting the free allocation for waste gases from iron, steel and coke production and heat imports between the industrial sector and the energy sector.

## Use of project credits

When assessing cumulative under and over allocation, it should be noted that in the second trading period, operators were able to surrender project credits (CERs/ERUs from CDM/JI projects) in addition to emission allowances (EUA). German operators were allowed to surrender CER/ERUs up to an amount corresponding to 22 percent of their allocation. Unused claims generally remain in place in the third trading period.[86] Operators without a previous claim may in principle use CER/ERUs up to an amount corresponding to 4.5 percent of their aggregated emissions in the third trading period. Since the prices for project credits are always below the price level of EUA, the usage claims lead to an effective relaxation of the allocation status for the installations concerned (see Section 3.3 on price trends with Figure 53 and Table 26).

For the 1,851 installations considered in this report, the total claim for the use of project credits is currently 421 million allowances. This claim relates to the entire period from 2008 to 2020.[87] Of these, 277.7 million project credits have already been surrendered in the second trading period (2008 to 2012). In the current trading period, a further 137.7 million credits were used by the installations under consideration for exchange into EUA.

Based on the total claim reported, this currently leaves a residual claim for the use of 5.5 million project credits. This corresponds to approximately 1.3 percent of the reported total claim for all German installations. For the 933 energy installations, the residual claims amount to 2.9 million project credits or about one percent of their total claim. Of the 918 industrial installations, a total of 2.7 million credits can still be exchanged for EUA (corresponding to 1.7 percent of their total claim). Figure 25 summarises the aggregated results broken down by industry and energy sectors.

Table 25: Surrendered and converted project credits in the second and third trading period

| Industry | No. of installations | 2008–2020 total claim for CER/ERU use [M] | 2008–2012 surrendered CER/ERU [M] | 2013–2020 converted CER/ERU [M] | 2008–2020 residual claim for CER/ERU use [M] |
|---|---|---|---|---|---|
| Industry | 918 | 154.8 | 124.0 | 28.1 | 2.7 |
| Energy | 933 | 266.2 | 153.7 | 109.7 | 2.9 |
| **Total** | **1,851** | **421.0** | **277.7** | **137.7** | **5.5** |

As of 04/05/2020

85 The free allocation for electricity generation was increased by 38 million allowances annually in accordance with the provisions of Section 20 Allocation Act 2012, to be be reduced in favour of the disposal budget.

86 However, CER/ERUs can no longer be surrendered directly but must be converted into EUAs in the Union Registry.

87 The total claim reported takes into account claims from the second trading period as well as claims derived from emissions for the reporting years 2013 to 2018. In the course of the third trading period, the total claim will increase further depending on the verified emissions for the years 2019 to 2020.

# 3 Germany and Europe: emission trends, surpluses, prices and auctions

The emissions from the approximately 10,800 ETS installations in the 31 countries participating in the European Emissions Trading Scheme[88] in 2019 were nine percent below the emissions in 2018 and, according to the European Commission, amounted to about 1.53 billion tonnes of carbon dioxide equivalents.[89] As in all years since the beginning of the third trading period, the emissions from stationary installations were significantly lower than the maximum number of allowances available for 2019 (nominal cap) of 1.86 billion emission allowances. The reduction in emissions of around 155 million tonnes of carbon dioxide equivalents compared with the previous year was thus almost four times as large as the annual reduction in the nominal cap (minus 38 million emission allowances).

The Market Stability Reserve (MSR) came into force at the beginning of 2019. The EUA volume to be auctioned was reduced by almost 400 million EUA[90] across the EU in accordance with the MSR mechanism. This means that the emissions of ETS installations in 2019 were above the actual supply available through free allocation, auctioning and exchange quotas for project credits. According to the European Commission, the surplus at the end of 2019 amounted to around 1.39 billion emission allowances[91] and thus decreased to a lesser extent than the reduction in auction amounts at the end of 2018 (minus 270 million EUA, while auction amounts were reduced by almost 400 million EUA).

## 3.1 Emission trends in the EU ETS and in Germany

Although the emission development of installations participating in the EU ETS (EU 31) in 2019 was declining throughout Europe, the reduction in emissions in the German installations was greater. According to the European Commission, emissions in 2019 fell by nine percent and amounted to 1.53 billion tonnes of carbon dioxide equivalents, while emissions in Germany fell by 14 percent overall. EU-wide, emissions in 2019 were therefore still well below the nominal cap – around 330 million tonnes of carbon dioxide or just under 18 percent. As in Germany, the main reason for this trend was a reduction in emissions from electricity generation (down by around 15 percent), while emissions from industrial installations showed a comparatively moderate reduction of two percent. According to provisional figures, electricity generation from hard coal in the EU fell by around 32 percent, while electricity generation from lignite fell by 16 percent[92]. As well as a clear increase in the supply of electricity from renewable energy sources, the significantly higher price on the carbon market in 2019 compared to previous years and low gas prices contributed to an increased fuel switch and thus to the decline in emissions[93].

Over a longer period of time, however, ETS emissions across Europe have fallen more sharply than in Germany: while emissions from installations in Germany have fallen by around 30 percent since the start of emissions trading in 2005, ETS emissions across Europe were around 36 percent below the baseline in 2005 (see following figure).

88 EU 28 plus Iceland, Liechtenstein and Norway. Until its departure from the EU on 31/1/2020, the UK is counted as part of the EU 28.

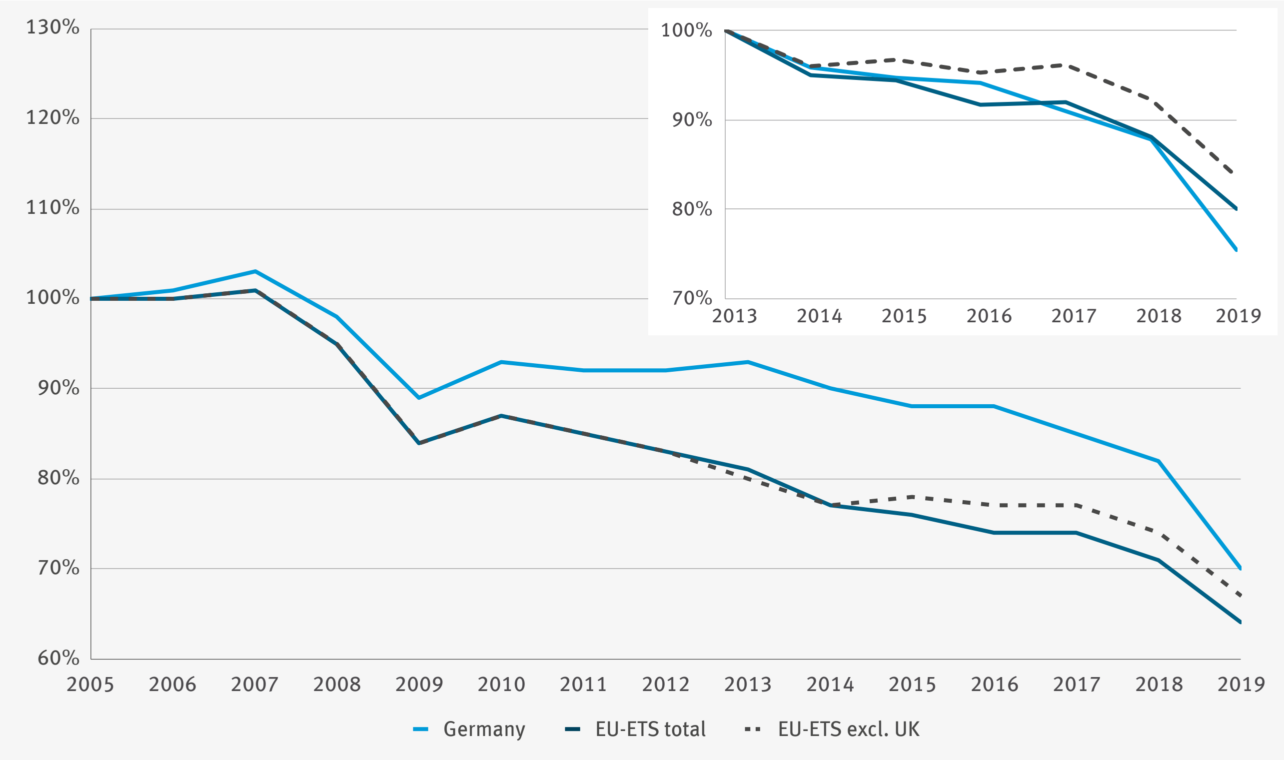
89 COM 2020d (press release of 4 May 2020)

90 The total reduction for EU 28 Member States plus Iceland, Liechtenstein and Norway was 397 million EUA. The UK accounted for about 44 million EUA. However, the regular UK auctions were initially suspended in 2019. From March 2020, the remaining amounts from 2019 will be auctioned alongside the regular UK auction amounts for 2020.

91 COM 2020c (TNAC Communication of 8 May 2020)

92 Agora energy transition/Sandbag (2020).

93 Agora energy transition/Sandbag (2020), ERCST (2020).




As of 04/05/2020

Figure 51: Emission trends in Germany compared to stationary ETS emissions in all Member States (emissions in 2005 plus emission estimate for extended scope of the third trading period = 100 percent)[94]

A notable reduction in emissions took place in the second trading period, when emissions fell by 12 percent between 2008 and 2012, or an average of 63 million tonnes of carbon dioxide per year, as a result of the economic and financial crisis. With the transition to the third trading period, the decline in emissions initially slowed down, but in 2019 the sharpest decline since 2009 was recorded. In 2019, emissions were around 20 percent below the 2013 level. On average, emissions have fallen by around 64 million tonnes of carbon dioxide equivalents per year since the start of the trading period. This is a much steeper decline than the cap, which is reduced by around 38 million emission allowances every year.

Since the introduction of the EU ETS, emission trends have varied widely across Member States. In the third trading period, the UK[95] in particular made an above-average contribution to the decline in emissions: according to provisional figures, ETS emissions in 2019 were around 47 percent below the 2013 figure (57 percent below the figure for 2005). This corresponds to an average reduction in emissions of eight percent per year. By contrast, emissions in the 30 other ETS Member States, excluding the UK, only fell by around 16 percent (or an average of just under three percent per year) between 2013 and 2019.

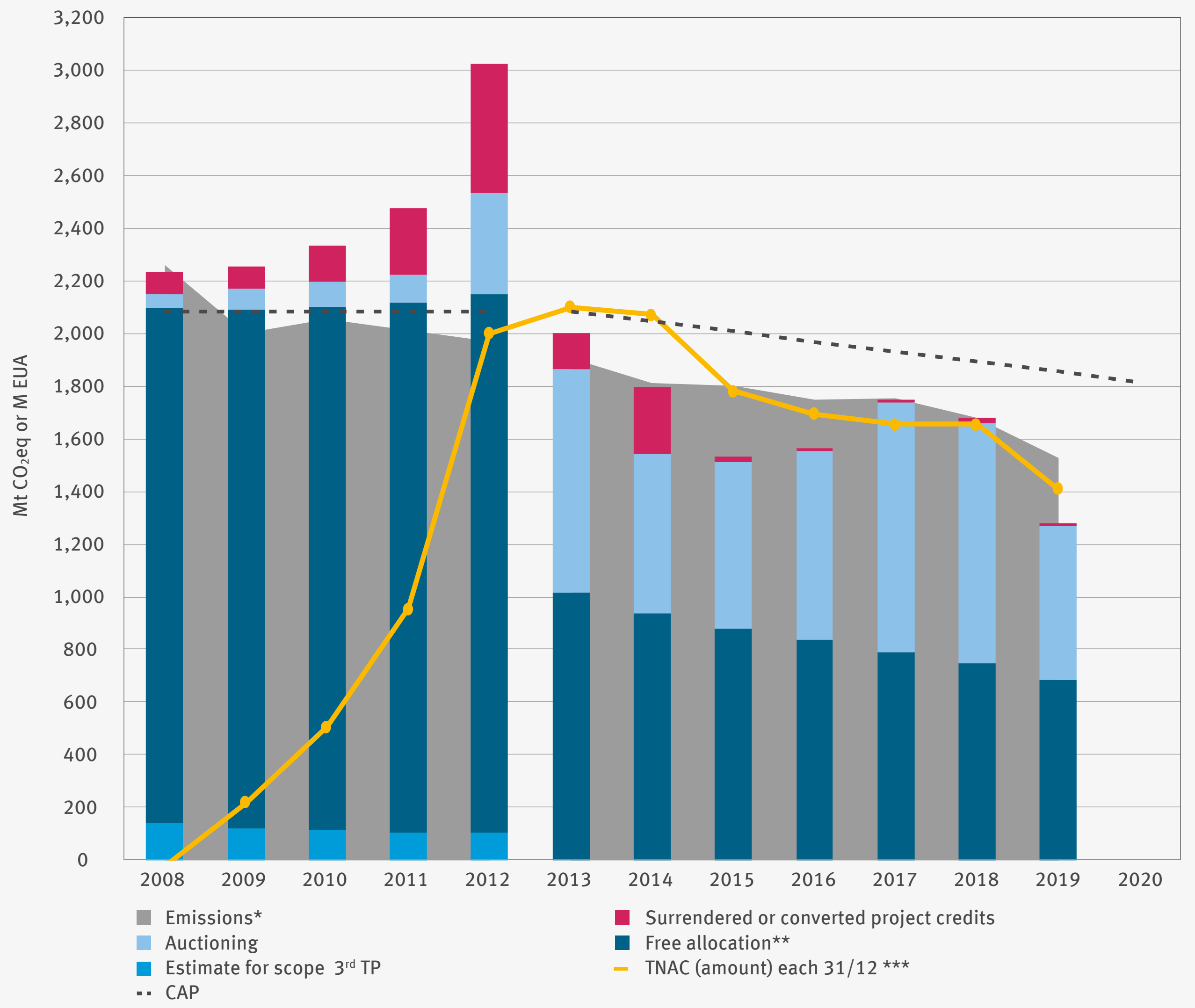
Germany recorded a 25 percent reduction in emissions between 2013 and 2019 (on average around four percent per year). This is higher than the EU-wide reduction in ETS emissions, which amounts to 20 percent since 2013.

94 Preliminary figures for 2019. Sources: EEA 2019 for the years 2005 to 2018, COM 2020d for 2019.

95 Great Britain left the EU on 31/01/2020. For the years 2019 and 2020, however, British operators and aircraft operators are still subject to the regular reporting and surrendering obligations.

## 3.2 Supply and demand of stationary installations (EU-wide)

The following figure shows the supply of emission allowances available in the EU ETS in the respective year compared to the emissions (demand) in the same year. In addition to emission allowances allocated free of charge and auctioned as well as project credits surrendered or exchanged, the nominal annual emission caps are also shown. In addition, the TNAC[96] (amount in circulation) is also shown as an indicator for the surplus. This figure determined each year in May by the European Commission, for the previous year, is essential for the auction amount reduction through the Market Stability Reserve (MSR). However, the TNAC refers exclusively to the stationary sector. This figure does **not** take into account the cumulative net demand from air transport according to EUA since 2012. This additional demand for EUAs from aviation reduces the availability of emission allowances for stationary installations (see section 'Emissions from aviation').




As of 04/05/2020
*Incl. estimate of scope for third trading period
**Incl. transitional free allocation as per Article 10c
***Data from EU COM

Figure 52: Demand and supply in the overall system: comparison of emissions with the available emission allowances and trends in the amount in circulation since 2008 as determined by the European Commission[97]

96 Total Number of Allowances in Circulation (TNAC).

97 Sources: EEA 2019 for the years 2005 to 2018, COM 2020a and 2019 for 2018 or further, provisional data published by the EU Commission and information from EEX/ICE for the auction amounts. The data on TNAC is taken from the European Commission's 2012 to 2017 Carbon Market Reports and the information about the 2018 to 2020 TNAC.

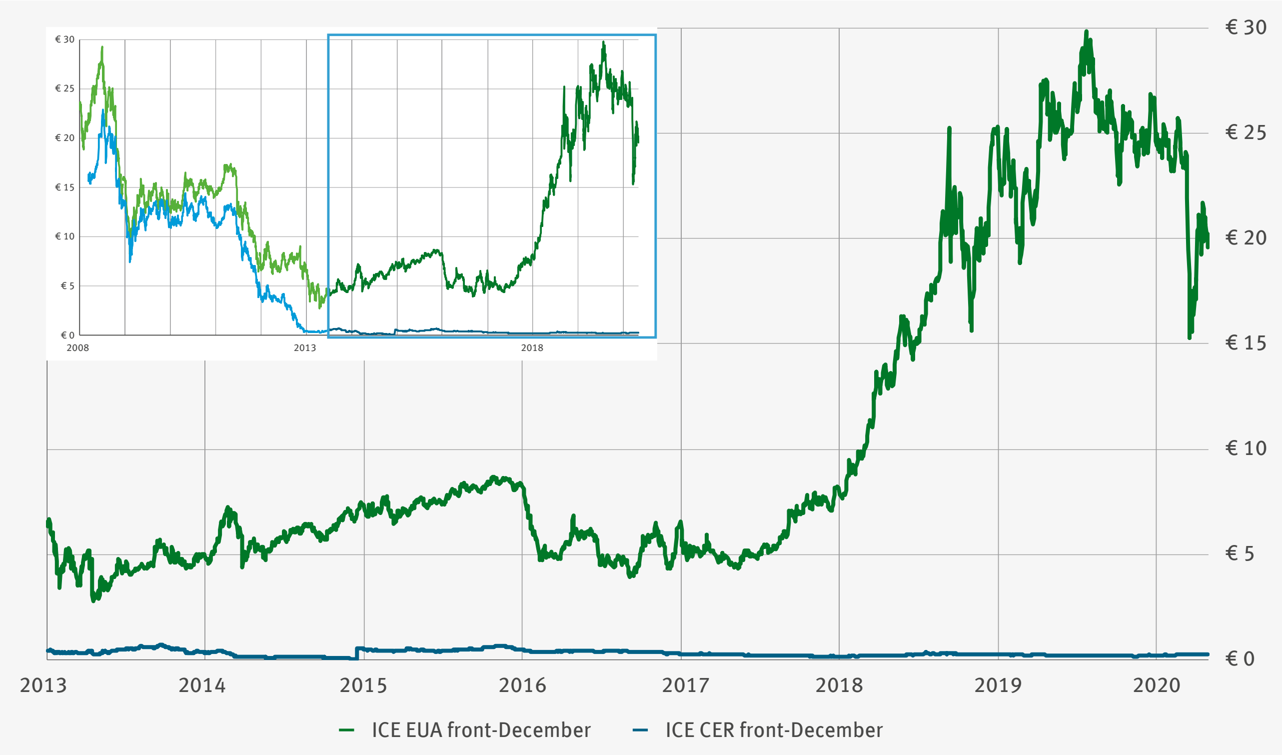
The amount of surplus emission allowances (EUA) in the EU ETS has decreased significantly since 2014, when backloading[98] began. Since the beginning of 2019, the Market Stability Reserve (MSR) has also been in force. On this basis, the amount of EUA to be auctioned was further reduced EU wide. As a result, the actual market surplus, which takes into account not only supply and demand in the stationary sector but also demand from aviation, has continuously decreased to a slightly greater extent than the TNAC and has also continued to decline in 2019: The cumulative net demand from aviation since 2012 has amounted to around 150 million emission allowances (see section 'Emissions from Aviation') and reduces the surplus available on the market to this extent. In 2019, demand from the aviation sector was on a par with the previous year – around 29 million emission allowances (EUA). Continued growth in net demand from aviation would lead to increasing discrepancies between the actual market surplus and the TNAC in the future. According to the European Commission, the official figure of the amount in circulation (TNAC) at the end of 2019 was 1.39 billion emission allowances. Although the TNAC has thus fallen significantly compared to the previous year and to its lowest level since 2011, it is still above the upper MSR threshold (833 million emission allowances), above which auction amount reductions will take place. The current figure of the TNAC is essential for auction amount reduction by the MSR in the period 01/09/2020 to 31/08/2021. During this period, a total of around 333 million fewer emission allowances than planned will be auctioned and shifted to the MSR.

## 3.3 Price trends for EUA and project credits

EUA prices have fluctuated considerably in recent years. At the beginning of the second trading period, prices for EUA briefly reached a level of €25 to €30. By the beginning of 2009, prices had fallen to less than ten euros, but stabilised at around 15 euros between 2009 and 2011. From mid-2011 onwards, the price dropped continuously, driven by the growing surpluses on the carbon market. In April 2013, the price finally fell to under three euros, the lowest level since the beginning of the second trading period. By the end of 2015, the price had gradually stabilised again and climbed to a level of over eight euros. At the turn of the year 2015/2016, the price fell again to around five euros. After the price had fluctuated in a range between four and six euros, the carbon market began a steady upward trend in May 2017. This trend was significantly reinforced in 2018 with the political agreement on the amendment of the ETS Directive, which included a significant reduction in existing carbon market surpluses. In the first half of 2018 a price level of more than €15 was reached, in September 2018 the €25 mark was exceeded. In the following months the strong upward trend did not initially continue. The price trend was characterised by short-term ups and downs before reaching almost €30 in July 2019, the highest level since 2006. This meant that the price of EUA had increased six-fold in two years. At the end of 2019, the price was roughly at the same level as at the beginning of the year, at around 25 euros. As a result of the severe turbulence on the international securities and energy markets in the wake of the COVID 19 pandemic, the price of EUA fell significantly in March 2020, falling briefly to below €15. Afterwards, however, an upward movement took place with the price currently quoted at around €19 (as of 12 May 2020).

Since 2008 the price level for project credits (CER/ERU) has been consistently below the price for EUA. The relative price markdown compared to EUA has increased since the end of the second trading period. At present, an exchange traded CER is only quoted at around 20 cents. This is less than one percent of the market value of an EUA. The price trend for EUAs and CER/ERUs in the period January 2008 to April 2020 is shown in the figure below.

98 See also comments on backloading in Section 3.4.




As of 04/05/2020
Source: ICE, Refinitiv Eikon, representation DEHSt

Figure 53: Price trends for emission allowances (EUA) and international project credits (CERs) in the second and third trading period

In addition, the following table shows the average prices for EUAs and CERs for the completed second trading period, the current third trading period and the calendar year 2019. In the second trading period the relevant average price for an EUA was € 13.62 (CER € 10.00), in the period from January 2013 to April 2020 € 10.57 (CER € 0.31). In the calendar year 2019 the prices were € 24.92 (EUA) and € 0.21 (CER).

Table 26: Average prices for emission allowances (EUA) and international project credits (CERs) in the second and third trading period

| Time period | 2nd trading period 03/2008–04/2013 [€] | 3rd trading period 01/2013–04/2020 [€] | 3rd trading period 2019 reporting year [€] |
|---|---|---|---|
| Price EUA* | 13.62 | 10.57 | 24.92 |
| Price CER** | 10.00 | 0.31 | 0.21 |

* VWAP ICE EUA front-december
** ICE CER front-december
Source: ICE, Refinitiv Eikon, calculation DEHSt

## 3.4 Auction amounts and revenues

Since the start of the third trading period, auctioning has been the standard allocation method for stationary activities in the European Emissions Trading System (EU ETS) throughout Europe. This means that significantly more emission allowances are allocated to trading participants through auctions than in the previous trading periods. In principle, the Member States auction that part of the European emissions trading budget (EU cap stationary) which is not allocated free of charge to operators or tied to the new installation reserve.

Allocation through auctions complies with the polluter-pays principle and thus lays the foundation for the inclusion of climate costs in business decisions. Also, the income from auctions opens up new scope for government support for climate protection measures. In Germany since 2012, almost all auction revenues have been flowing into the Energy and Climate Fund (EKF).

The following table summarises the auction results of the current trading period for Germany and other EU Member States on an annual basis. In addition to emission allowances for stationary installations (EUA), the aviation allowances (EUAA) are also shown. The auction amounts trend in the period 2014 to 2016 was significantly influenced by the "backloading" decision.

This decision provided for the planned auction amounts to be reduced by around 900 million EUA across the EU. In accordance with this decision, the German auction amounts were also reduced by around 174 million EUA in the same period. In addition, the Market Stability Reserve (MSR) has been in force since the beginning of 2019. In line with the MSR mechanism, the EUA amount to be auctioned was reduced by around 400 million EUA across the EU, while the German auction amounts were reduced by around 85 million EUA in 2019. In addition to the adjustments of auction amounts, the EUA price trend on the lead markets had a significant effect on the revenue trend for the individual years (see Section 3.3).

Table 27: Auction amounts and revenues since 2013 for Germany and EU wide

| EUA | | | | |
|---|---|---|---|---|
| Year | Germany | | EU wide | |
| | Auction amounts in Mt | Revenues in M€ | Auction amounts in Mt | Revenues in M€ |
| 2013* | 182.6 | 791.3 | 826.3 | 3,616.9 |
| 2014 | 127.1 | 750.0 | 528.4 | 3,115.1 |
| 2015 | 143.9 | 1.093.3 | 632.7 | 4,816.0 |
| 2016 | 160.8 | 845.7 | 715.3 | 3,761.6 |
| 2017 | 196.8 | 1.141.7 | 951.2 | 5,490.6 |
| 2018 | 172.2 | 2.565.3 | 915.8 | 14,090.3 |
| 2019 | 127.6 | 3.146.1 | 588.5 | 14,503.4 |

* EU incl. NER amounts from 2nd TP; 2012 early auctions not considered
Source: EEX, ICE, DEHSt calculation

| EUAA | | | | |
|---|---|---|---|---|
| Year | Germany | | EU wide | |
| | Auction amounts in Mt | Revenues in M€ | Auction amounts in Mt | Revenues in M€ |
| 2013** | – | – | – | – |
| 2014 | – | – | 9.3 | 53.5 |
| 2015 | 2.2 | 16.9 | 16.4 | 117.3 |
| 2016 | 0.9 | 4.6 | 6.0 | 32.3 |
| 2017 | 0.7 | 5.1 | 4.7 | 34.1 |
| 2018 | 0.8 | 16.3 | 5.6 | 103.6 |
| 2019 | 0.8 | 17.9 | 5.5 | 137.5 |

** 2012 German aviation auction not considered
Source: EEX, ICE, DEHSt calculation

# 4 Emissions in aviation

## 4.1 The legal framework for including aviation in the EU ETS

In addition to stationary activities, aviation has also been included in the European Emissions Trading Scheme (EU ETS) since the beginning of 2012 and aircraft operators must surrender emission certificates equal to their verified $CO_2$ emissions.

The duty to monitor and report on emissions has been in place since the beginning of 2010. In the field of aviation, the scope of the EU ETS initially included all flights that take off or land within the European Economic Area (EEA)[99] (full scope). In principle, all aircraft operators flying on these routes, including those whose registered office is outside the European Union (EU), are subject to emissions trading.[100]

The Emissions Trading Directive provides for the delimitation of aviation emissions included in the EU ETS. The scope of the Directive was adjusted twice in previous years (see Table 28). First, the scope for the 2012 reporting year was significantly restricted by the 'stop-the-clock' EU resolution. In that year, the EU relinquished the sanctioning of reporting violations and surrender obligations for flights subject to emissions trading that started or ended outside the EEA, Switzerland or Croatia. This waivered a large number of flights to and from third-party countries from the reporting and surrendering obligation in 2012.[101]

The scope was further limited between 2013 and 2016 which was then extended up to the end of 2023. This means that de facto operators are no longer subject to emissions trading for flights that start or end outside the EEA. Unlike in 2012, this also applied to flights from the EEA to Switzerland and back. In addition, non-commercial aircraft operators are exempt from emissions trading until the end of 2030 if their annual emissions based on the original scope are lower than 1,000 tonnes of carbon dioxide.[102] [103]

The first restriction of the scope ('stop-the-clock' EU resolution) reduced the scope of emissions subject to emissions trading administered by Germany to only about 30 percent of the full scope of emissions[104]. Another restriction from 2013 onwards yielded the current reduced scope which is about 16 percent of the full scope.[105]

With these temporary scope adjustments, the EU wanted to set another positive signal for ongoing negotiations at the International Civil Aviation Organisation (ICAO) level on a global instrument for reducing international aviation emissions.[100] [101] [102]

99 In addition to EU 27, the European Economic Area (EEA) also included Norway, Iceland and Liechtenstein in 2012 and 2013. Since joining the EU in 2014, Croatia also belongs to the EEA.

100 Exceptions are described in Table 28.

101 EU 2013. The restriction of the scope only applied to operators who also agreed to a reduced allocation.

102 EU 2014

103 EU 2017

104 It should be noted that in 2012 aircraft operators were free to choose whether to report their emissions in accordance with the full scope or, on condition that they return the free allocation for the remaining flights, only emissions for flights within the EEA. Aircraft operators whose 2012 allocation exceeded their emissions in the full scope therefore generally reported the full scope.

105 These percentages are based on a comparison of aviation emissions subject to emissions trading in 2010, 2012 and 2013 for Germany. They only give an indication about the magnitude of the restrictions on the scope due to possible structural changes in aviation between the years.

The latest resolution[102] about continuing the reduced scope, implemented the 39th ICAO General Assembly decision of the autumn of 2016 to introduce a global market-based measure to stabilise greenhouse emissions from international civil aviation at the 2019–2020 level from 2021 onwards and to compensate for excess emissions (CORSIA)[106]. States may voluntarily decide to participate[107] in the first two phases of CORSIA (2021 to 2023 and 2024 to 2026). The EU and its Member States have already announced their intention to participate in this voluntary phase.[108] As of 2027, participation will be mandatory for all states that are not exempted by the CORSIA exemption regulations.

The current regulation to reduce the scope will be reviewed following an environmental impact assessment and, where appropriate, a specification of further details of CORSIA implementation at the European level[102].

Table 28 summarises the trend of the aviation scope to date.

Table 28: Overview of the EU ETS scope in aviation

| Period | Description of scope[1] | Reporting obligation | Surrender obligation | Extent of scope | | | |
|---|---|---|---|---|---|---|---|
| | | | | Geographic | | Exclusion criteria[2] | |
| | | | | Flights within and between EU ETS member states [3] | Flights to/from third countries | Commercial operators[4] | Non-commercial operators |
| 01/01/2010 – 31/12/2011 | Full scope | x | – | x | x | Flights < 243 per four months *or* full scope emissions < 10,000 t $CO_2$/a | – |
| 01/01/2012 – 31/12/2012 | Stop-the-clock | x[5] | | x | Switzerland, Croatia | | |
| 01/01/2013 – 31/12/2023 [7] | Reduced scope | x | | x[6] | – | | Full scope emissions < 1,000 t $CO_2$/a [8] |

**[1]** See Glossary for the definitions of scope.
**[2]** In addition to the criteria listed in the table, flights with a maximum take-off weight of less than 5,700 kg, military, police, customs, non-EU governments, research, sightseeing and training flights are excluded.
**[3]** The Group of EU ETS Member States includes all EU Member States as well as Norway, Iceland and Liechtenstein (the latter has no airport). Since it joined the EU in 2014, Croatia belongs to the Group of EU ETS Member States.
**[4]** Commercial operators are defined as operators that offer public transport services in exchange for remuneration.
**[5]** Within the framework of stop-the-clock (StC) regulations, operators could choose to report for the StC scope or according to the 'full scope' and surrender accordingly.
**[6]** Flights between EEA States and European areas in the outermost regions (i. e. Canary Islands) are thus exempt from the emissions trading obligation.
**[7]** The final date has been postponed by the Regulation (EU) 2017/2392 of the European Parliament and of the Council from 31/12/2016 to 31/12/2023.
**[8]** The exemption holds according to the current view until 31/12/2030.

106 Carbon Offsetting and Reduction Scheme for International Aviation, ICAO 2016

107 As of 2019, all states are required to monitor and report the emissions from international aviation. 'Participation' in this case means the obligation not only to report emissions from international aviation, but also to compensate for any relevant excess emissions by surrendering corresponding allowances. A compensation obligation for relevant excess emissions only applies to routes between participating states. However, this obligation applies to all aircraft operators regardless of their country of origin. The aim is to avoid distortions of competition.

108 ICAO 2020

## 4.2 The part of aviation subject to emissions trading administered by Germany

### 4.2.1 The administrative assignment of aircraft operators to Member States

The assignment of ETS emissions to an EU Member State is organised fundamentally differently in aviation than in stationary activities. Stationary installations use the 'territorial principle': the emissions from all stationary installations in Germany are assigned to Germany.

Regarding emissions from aviation however, each aircraft operator is assigned to an administering Member State. This aims to simplify the administration for operators and enforcement authorities. The assignment is determined by the European country that has granted the operating license. If the operator is a non-commercial operator or the operating license was issued outside the EU, the assignment will go to the EU Member State in which the aircraft operator causes the largest estimated share of emissions.

This system also differs significantly from the emission assignment in the national greenhouse gas inventory. In that inventory, a country is accredited with all aviation emissions (whether subject to emissions trading or not) from flights starting within its territory. Within the EU ETS, Germany also administers flights that do not start in Germany; their emissions are not contained in the German greenhouse gas inventory. Furthermore, under the EU ETS, a part of the aviation emissions from flights starting in Germany are administered by other EU Member States. The emissions from these flights are in turn assigned to the German inventory.[109]

Due to the differences in assignments described above, it is not possible to draw any direct conclusions about the German aviation emissions contained in the greenhouse gas inventory based on aviation emissions trading administered by Germany. This circumstance must be taken into account when interpreting the following evaluations.

### 4.2.2 Emissions and free allocation in aviation administered by Germany

Germany is responsible for around 500 aircraft operators according to the list of administering Member States. However, this assignment is purely administrative as not all operators carry out activities subject to emissions trading in each reporting year. The list also includes aircraft operators that have ceased operations or are subject to insolvency proceedings. In addition, the number of aircraft operators with activities subject to emissions trading is considerably reduced by the exemption of non-commercial small emitters with less than 1,000 tonnes of carbon dioxide per year.

Of the approximately 500 aircraft operators, 66 have reported the emissions from their flights subject to emissions trading for 2019, and another operator is estimated to be subject to emissions trading based on data from the European Organisation for the Safety of Air Navigation. The total number of 67 operators to be classified as subject to emissions trading is thus roughly equivalent to the average number of operators subject to emissions trading since 2013. Nevertheless, as in previous years, a comparatively high fluctuation is evident among operators subject to emissions trading. Ten operators who were still subject to ET in the previous year were no longer so in 2019. By contrast, five operators were subject to emissions trading in 2019 but not in 2018.

109 In addition, emissions included in the inventory are not fully covered by the scope of emissions trading. In principle, all aircraft flights with a maximum permissible take-off mass of less than 5,700 kilogrammes and flights by military, police, customs, non-EU governments, flights for research purposes, and sightseeing and training flights are not subject to emissions trading. Also excluded are emissions from aircraft operators depending on the number of flights flown and the emissions caused (see also Table 28).

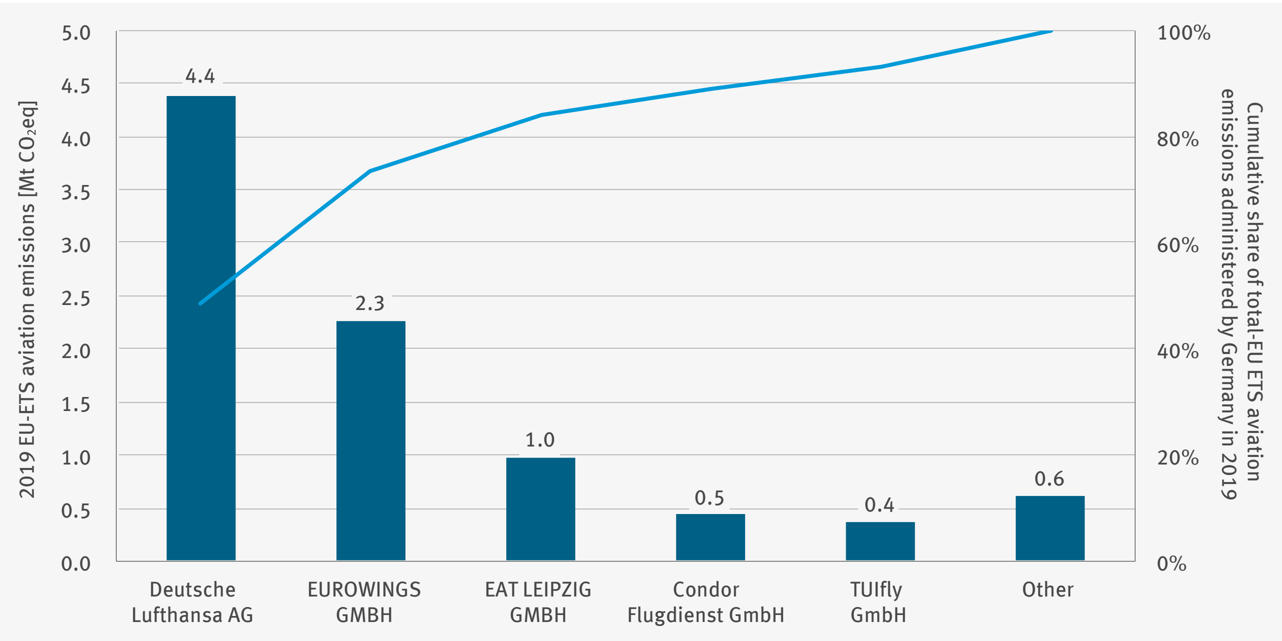
About three quarters of the operators subject to emissions trading had a commercial status and about one quarter a non-commercial status in the 2019 reporting year. This distribution has been unchanged from the previous year. The share of emissions accounted for by non-commercial operators subject to emissions trading is – as in the previous year – only 0.3 percent (see Table 29).

Table 29: Aviation (aircraft operators administered by Germany), number of aircraft operators subject to emissions trading, 2018 $CO_2$ emissions, 2019 allocation, 2019 $CO_2$ emissions and allocation coverage differentiated by commercial and non-commercial operators

| Operator category | No. of operators subject to emissions trading | 2018 emissions [kt $CO_2$eq] | 2019 emissions [kt $CO_2$eq] | No. of operators with 2019 allocation | 2019 allocation amount [1000 EUAA] | Allocation coverage |
|---|---|---|---|---|---|---|
| Commercial | 50 | 9,251 | 8,990 | 35 | 3,558 | 39.6 % |
| Non-commercial | 17 | 26 | 26 | 12 | 1 | 3.4 % |
| 2019 not subject to ETS | *10** | 109 | – | – | – | – |
| **Total** | **67** | **9,386** | **9,016** | **47** | **3,559** | **39.5 %** |

As of 04/05/2020
* 2019 not subject to ETS not included in total number of operators.

There are also no discernible changes in the major emitters within the aviation sector subject to emissions trading compared to the previous year. As in 2018, more than 90 percent of total emissions in 2019 were caused by five commercial operators (see Figure 54). Although the emissions by these five operators had very different tendencies (see subsequent Section 4.2.3), their shares in total aviation emissions administered by Germany have remained structurally unchanged.




As of 04/05/2020

Figure 54: Aviation (aircraft operators administered by Germany), emissions of the five operators with the largest emissions in 2019 (bars, left-hand side axis) and their cumulative share of total aviation emissions administered by Germany (line, right-hand side axis)

The emissions by aircraft operators administered by Germany totalled around 9 million tonnes of carbon dioxide in 2019. They fell by around 370,000 tonnes of carbon dioxide or around four percent compared to the previous year, and are almost on a par with the 2015 emissions level, the sharpest fall since the introduction of the reduced scope in 2013 (see Figure 55 and Table 30). A decrease in aviation emissions administered by Germany was last recorded in 2017. In contrast to 2017, 2019 also shows a deviation from the historical growth trend at the European level (see Section 4.3).

In 2019, as in every year, significant changes in the emissions of individual operators were observed[110]. Around half of the operators subject to emissions trading administered by Germany in 2018 and 2019 showed reductions in emissions compared to 2018. These add up to around 450,000 tonnes of carbon dioxide.[111] In addition, there were emission reductions of 109,000 thousand tonnes of carbon dioxide due to the abolition of the emissions trading obligation for ten operators who were still subject to emissions trading in 2018.[112]

For the other half of operators subject to emissions trading in 2018 and 2019, there is an increase in their emissions compared to 2018. In total, these operator-specific trends lead to an increase of 180,000 tonnes of carbon dioxide. In addition to this increase there are about 5,000 tonnes from operators that were obligated to trade in 2019 but not in 2018 (see Table 29).

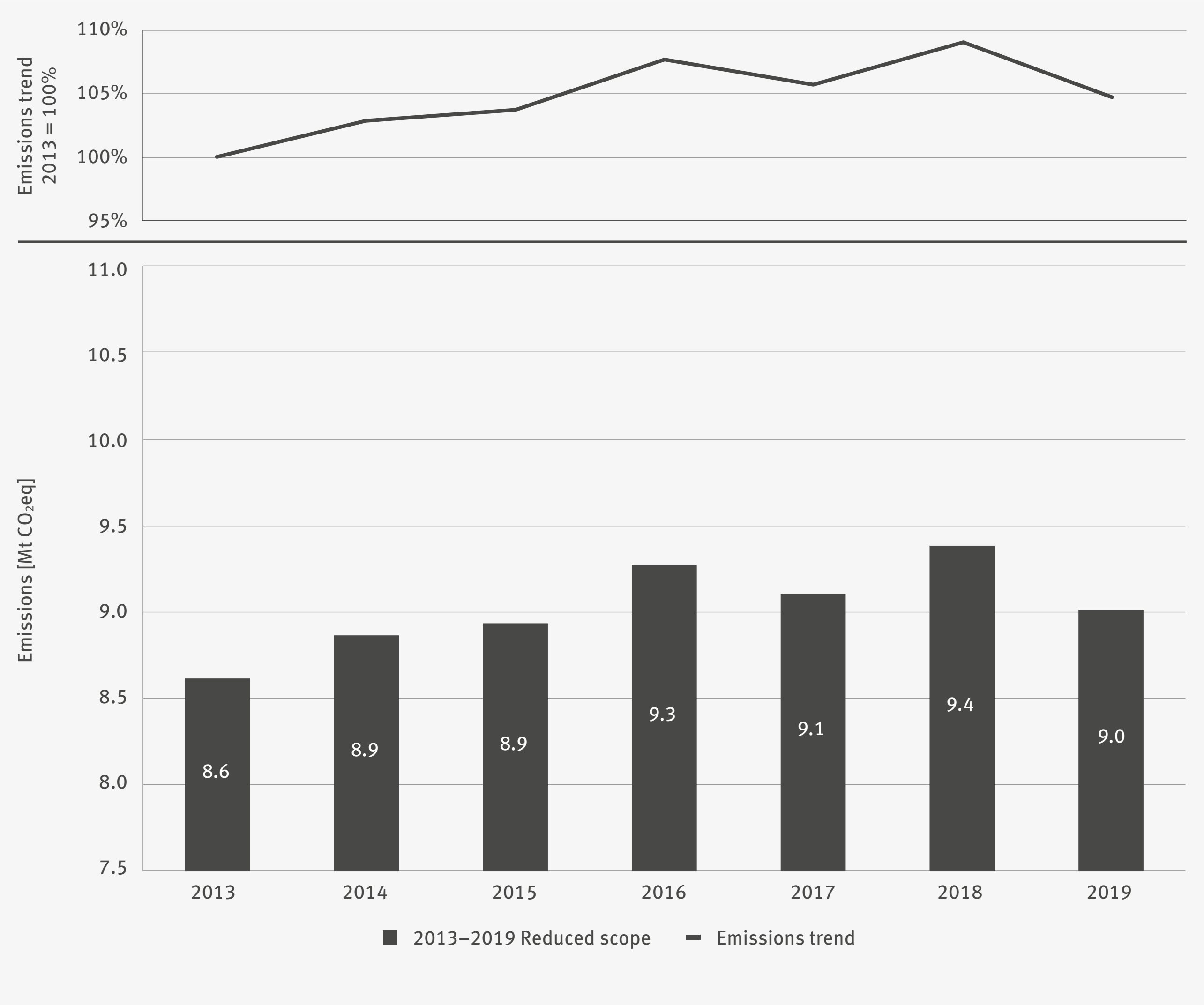
The emissions by the five operators, who together are responsible for more than 90 percent of total aviation emissions administered by Germany (see Figure 54), remained almost at the previous year's level in 2019[113] despite varying trends. However, the emissions situation changed significantly in the group of remaining operators who are responsible for less than ten percent of aviation emissions administered by Germany. This is mainly due to the 275,000-tonne reduction in emissions caused by Germania's insolvency-related cessation of operations, the largest emitter in the group of other operators in 2018. This corresponds to around three quarters of the total reduction in 2019.

110 In particular the emissions by operators with comparatively low annual emissions, which are subsumed under other participants in Figure 54 show regular changes in the two to three digit percentage range.

111 The largest operator-specific decrease of 275,000 tonnes of carbon dioxide is due to Germania's insolvency-related cessation of operations.

112 Most of the decline in 2019 for operators no longer subject to emissions trading (82,000 tonnes of carbon dioxide) is due to the closure of the operator Small Planet Airlines due to insolvency.

113 The emissions from Deutsche Lufthansa AG – almost 50 percent of aviation emissions under German administration – are almost unchanged compared to 2018. The emissions from Eurowings and Condor fell by five and four percent respectively in 2019, while those of EAT Leipzig and TUI Fly grew by eight and seven percent respectively.




As of 04/05/2020

Figure 55: Aviation (aircraft operators administered by Germany), trend of aviation emissions in the reduced scope from 2013 to 2019[114]

The amount of 2019 free allocation for aviation was around 3.6 million emission allowances (EUAA) i.e. the same level as in the previous year. Around 5.1 million EUAAs were still allocated annually between 2013 and 2017 (see Table 30). The Air Berlin insolvency was the reason for the large reduction in allocation volume. This carrier had received approx. 1.5 million EUAA per year in the period 2013 to 2017 which was stopped with the discontinuation of operations for the entire remaining trading period. However, there were no over-allocations to operators administered by Germany who stepped in to replace Air Berlin's missing transport services.

The difference between the operators' aggregated emissions and the amount of EUAA allocated to them free of charge thus increased significantly. Their average allocation coverage[115] decreased from around 57 percent between 2013 and 2017 to less than 40 percent in the following period (see Table 30).

114 The chart shows the 2014 and 2015 emissions as 8.9 million tonnes of $CO_2$ each, however columns have different heights. This is due to rounding after the decimal point. If they are rounded to the second digit after the decimal point, the figures are 8.86 million tonnes of $CO_2$ for 2014 and 8.93 million tonnes of $CO_2$ for 2015.

115 The allocation coverage denotes the average ratio of free allocation to emissions subject to surrender (see also Glossary).

Table 30: Aviation (aircraft operators administered by Germany), overview about the 2013 – 2019 period

| Year | No. of operators subject to ET | Allocation amount [1000 EUAA] | Emissions [kt $CO_2$eq] | Allocation coverage |
|---|---|---|---|---|
| 2013 | 62 | 5,160 | 8,610 | 59.9 % |
| 2014 | 67 | 5,149 | 8,861 | 58.1 % |
| 2015 | 67 | 5,101 | 8,929 | 57.1 % |
| 2016 | 67 | 5,100 | 9,274 | 55.0 % |
| 2017 | 72 | 5,098 | 9,105 | 56.0 % |
| 2018 | 72 | 3,577 | 9,386 | 38.1 % |
| 2019 | 67 | 3,559 | 9,016 | 39.5 % |

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## 4.3 Emissions and available emission allowances for aviation at the European level

The previous sections presented the allocation and emission trends for aircraft operators administered by Germany. The emissions of these aircraft operators accounted for around 14 percent of total European aviation emissions under the EU ETS in 2019.[116]

In 2019, the emissions of all aircraft operators subject to emissions trading in the EU ETS were around 68 million tonnes, up by around 1 percent on the previous year. Since 2013, total emissions from aviation subject to emissions trading increased by an average of 4.5 percent per year from around 53 million tonnes of carbon dioxide to around 67 million in 2018.

According to the International Air Transport Association (IATA), deviations from the long-term continuous growth trend in aviation in 2019 also occurred globally. With regard to possible causes, IATA pointed to slowing economic growth, slower growth in world trade and political and geopolitical tensions. With regard to European operators, a cooling business climate in connection with strikes, uncertainties due to Brexit and the insolvencies of some operators were decisive for the trend in the market.[117] The economic effects of the Covid 19 pandemic, which began in spring 2020, had no influence on the emissions situation in 2019 as presented in this report.

The multi-year growth trend in emissions has been encountered by an almost constant allocation since 2016 which included not only EUAAs allocated free of charge but also ones from auctions. In principle, the Emissions Trading Directive provides almost constant allocation and auction volumes for the entire 2013 – 2020 period.[118] In the 2012 – 2015 period, however, there were delays in the planned auctions which resulted from the two legislative procedures which adapted the scope of the Emissions Trading Directive at EU level (see Section 4.1). In 2014 and 2015, significantly more EUAAs were auctioned than originally planned because the 2013 auctions were wholly suspended.

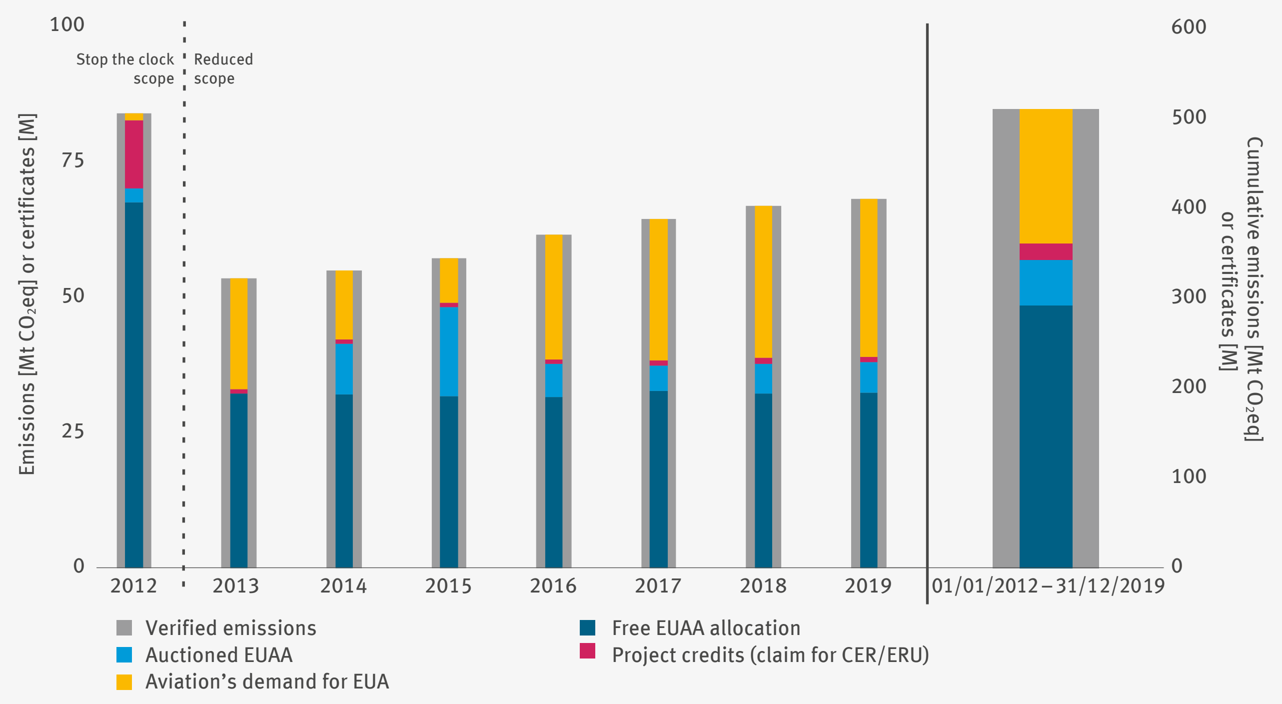
116 The share was also about 14 percent in the two previous years, just over 16 percent at the beginning of the trading period and still at around 19 percent under stop-the-clock. There were no European total figures published for 2010 and 2011, meaning that no German share can be derived for this period.

117 IATA (2020). The central indicator referred to in the report is not emissions but the number of passenger kilometres travelled (technical term: RPK – Revenue Passenger Kilometres). There is a connection to the emissions trend in that RPKs are one of the central determinants of aviation emissions.

118 The total amount of EUAA allocated free of charge and auctioned is to amount to 97 percent of historical aviation emissions (average from 2004 to 2006) in 2012 and 95 percent of historical emissions multiplied by eight for each year of the period for the third trading period (2013 to 2020). The EU Auctioning Regulation provides for 15 percent of the volume of EUAA in circulation to be auctioned each year.

Irrespective of the auction features described above, total emissions – in all years of the third trading period – were significantly higher than the EUAA allocation volume.[119] In the 2012 – 2019 period, the overall surrender obligation was missing a total of about 170 million EUAAs.

However, operators were able to offset the missing certificates by purchasing EUAs from the stationary EU ETS[120] and, to a limited extent, by buying international project credits as these could be used to fulfil their surrender liability. The demand by aviation for EUAs from the stationary EU ETS is obtained[121] by subtracting the international project credits from the coverage gap. This was around 150 million tonnes in the period from 2012 to 2019, i. e. since the beginning of the surrender obligation in aviation (see Figure 56). Since the scheduled auction amounts were met in 2016, the annual aviation demand for EUAs increased by an average of 11 percent per year from around 23 million tonnes to around 28 million tonnes in 2018. In 2019, the aviation demand for EUAs rose to 29 million tonnes.




As of 04/05/2020

Figure 56: Aviation (aircraft operators administered by Germany), emissions, supply of usable emission allowances (EUAA, CER/ERU) and aviation demand for EUAs for aviation subject to emissions trading in Europe (left: 2012 to 2018 annual figures, right: cumulative)

119 The special situation regarding free allocation in 2012 (optionally according to complete or stop-the-clock scope) requires attention in this case (also see Section 4.1). This option resulted in a lower relative deficit compared to the following years.

120 However, operators of stationary installations cannot rely on EUAAs.

121 The actual use of claims has not been reported in the EUTL since 2013, which is why the use of claims are utilised in this case. For 2012, the claims accounted for 15 percent of the emissions verified that year (about 12.6 million allowances, with just under 11 million surrendered). Between 2013 and 2020, the total demand corresponded to 1.5 percent of the verified total emissions during the period concerned.

## 5 States (Länder)

Table 31: Overview of the 2018 verified emissions per state (Land), by activities

| 2018 emissions [kt $CO_2$eq] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Activity | BB | BE | BW | BV | HB | HE | HH | MW | LS | NW | RP | SH | SL | SN | ST | TH | Total |
| 1 | Combustion | 31 | 0 | 27 | 51 | 0 | 1 | 4 | 6 | 141 | 1,449 | 404 | 0 | 0 | 0 | 92 | 11 | 2,218 |
| 2 | Energy conversion >= 50 MW RTI | 38,784 | 5,298 | 16,422 | 7,551 | 6,173 | 5,188 | 7,781 | 2,528 | 18,211 | 128,200 | 4,659 | 3,260 | 2,620 | 33,452 | 10,554 | 1,004 | 291,685 |
| 3 | Energy conversion 20–50 MW RTI | 123 | 150 | 551 | 787 | 108 | 386 | 202 | 40 | 719 | 1,061 | 285 | 99 | 193 | 112 | 121 | 112 | 5,050 |
| 4 | Energy conversion 20–50 MW RTI, other fuels | 0 | 0 | 9 | 3 | 0 | 0 | 0 | 0 | 25 | 66 | 16 | 0 | 0 | 0 | 0 | 31 | 150 |
| 5 | Prime movers (engines) | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 6 | Prime movers (turbines) | 387 | 0 | 61 | 271 | 0 | 87 | 0 | 0 | 192 | 170 | 31 | 0 | 0 | 1 | 25 | 132 | 1,356 |
| 7 | Refineries | 3,790 | 0 | 2,692 | 3,358 | 0 | 0 | 828 | 0 | 1,194 | 7,160 | 0 | 2,318 | 0 | 0 | 2,600 | 0 | 23,941 |
| 8 | Coking plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,881 | 0 | 0 | 972 | 0 | 0 | 0 | 3,853 |
| 9 | Processing of metal ores | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 0 | 0 | 0 | 0 | 0 | 0 | 81 |
| 10 | Production of pig iron and steel | 1,612 | 0 | 113 | 170 | 2,621 | 41 | 83 | 0 | 4,676 | 13,777 | 0 | 0 | 5,397 | 80 | 0 | 48 | 28,617 |
| 11 | Processing of ferrous metals | 295 | 0 | 214 | 92 | 622 | 450 | 318 | 0 | 486 | 1,608 | 119 | 0 | 806 | 134 | 89 | 62 | 5,294 |
| 12 | Production of primary aluminium | 0 | 0 | 0 | 0 | 0 | 0 | 288 | 0 | 0 | 740 | 0 | 0 | 0 | 0 | 0 | 0 | 1,029 |
| 13 | Processing of non-ferrous metals | 0 | 0 | 19 | 165 | 0 | 0 | 218 | 0 | 154 | 720 | 59 | 0 | 48 | 113 | 138 | 0 | 1,633 |
| 14 | Production of cement clinker | 1,141 | 0 | 3,689 | 3,807 | 0 | 336 | 0 | 0 | 1,230 | 5,307 | 828 | 1,064 | 0 | 0 | 1,587 | 1,011 | 19,998 |

| 2018 emissions [kt $CO_2$eq] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Activity | BB | BE | BW | BV | HB | HE | HH | MW | LS | NW | RP | SH | SL | SN | ST | TH | Total |
| 15 | Lime production | 425 | 0 | 449 | 1,107 | 0 | 452 | 0 | 83 | 805 | 3,995 | 509 | 0 | 0 | 0 | 1,430 | 183 | 9,437 |
| 16 | Glass production | 132 | 0 | 155 | 698 | 0 | 4 | 0 | 23 | 340 | 1,037 | 307 | 38 | 0 | 235 | 585 | 242 | 3,797 |
| 17 | Ceramics production | 117 | 0 | 95 | 728 | 29 | 25 | 0 | 0 | 218 | 294 | 166 | 0 | 25 | 155 | 97 | 97 | 2,046 |
| 18 | Production of mineral fibres | 0 | 0 | 47 | 102 | 0 | 0 | 0 | 0 | 8 | 82 | 0 | 0 | 0 | 101 | 64 | 0 | 405 |
| 19 | Gypsum production | 97 | 0 | 22 | 86 | 0 | 0 | 0 | 0 | 18 | 25 | 0 | 0 | 0 | 23 | 0 | 0 | 271 |
| 20 | Pulp production | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 80 | 54 | 157 |
| 21 | Paper production | 53 | 0 | 762 | 775 | 0 | 270 | 0 | 6 | 895 | 1,472 | 410 | 133 | 0 | 401 | 128 | 19 | 5,322 |
| 22 | Carbon black production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 621 | 0 | 0 | 0 | 0 | 0 | 0 | 621 |
| 23 | Nitric acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 163 | 0 | 52 | 371 | 0 | 0 | 36 | 38 | 0 | 661 |
| 24 | Adipic acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 86 | 0 | 112 |
| 25 | Production of glyoxal and glyoxylic acid | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 11 |
| 26 | Ammonia production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 598 | 1,403 | 0 | 0 | 0 | 2,592 | 0 | 4,593 |
| 27 | Production of bulk organic chemicals | 0 | 0 | 52 | 550 | 0 | 59 | 0 | 5 | 243 | 3,925 | 1,499 | 183 | 0 | 1,341 | 164 | 0 | 8,021 |
| 28 | Production of hydrogen and synthesis gas | 39 | 0 | 0 | 51 | 0 | 0 | 55 | 0 | 18 | 374 | 372 | 109 | 0 | 0 | 716 | 0 | 1,735 |
| 29 | Soda production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 149 | 69 | 0 | 0 | 0 | 322 | 0 | 540 |
| **Total** | | **47,026** | **5,448** | **25,379** | **20,381** | **9,554** | **7,298** | **9,779** | **2,855** | **29,587** | **175,869** | **11,517** | **7,205** | **10,062** | **36,183** | **21,508** | **3,005** | **422,655** |

As of 04/05/2020

Table 32: Overview of the 2019 VET entries per state (Land), by activities

| 2019 VET [kt $CO_2$eq] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Activity | BB | BE | BW | BV | HB | HE | HH | MW | LS | NW | RP | SH | SL | SN | ST | TH | Total |
| 1 | Combustion | 18 | 0 | 22 | 48 | 0 | 1 | 5 | 7 | 147 | 1,349 | 365 | 0 | 0 | 0 | 88 | 13 | 2,063 |
| 2 | Energy conversion >= 50 MW FWL | 31,535 | 4,529 | 11,841 | 7,254 | 5,657 | 4,706 | 6,158 | 2,389 | 15,070 | 98,855 | 4,881 | 2,471 | 2,517 | 30,341 | 8,285 | 898 | 237,387 |
| 3 | Energy conversion 20–50 MW RTI | 111 | 151 | 531 | 852 | 112 | 394 | 188 | 33 | 732 | 1,117 | 311 | 96 | 176 | 85 | 117 | 106 | 5,113 |
| 4 | Energy conversion 20–50 MW RTI, other fuels | 0 | 6 | 6 | 3 | 0 | 0 | 0 | 0 | 25 | 62 | 16 | 0 | 0 | 0 | 0 | 32 | 149 |
| 5 | Prime movers (engines) | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 6 | Prime movers (turbines) | 307 | 0 | 52 | 220 | 0 | 105 | 0 | 0 | 184 | 196 | 28 | 4 | 0 | 2 | 17 | 110 | 1,225 |
| 7 | Refineries | 3,419 | 0 | 2,660 | 3,160 | 0 | 0 | 984 | 0 | 1,195 | 7,228 | 0 | 2,399 | 0 | 0 | 2,163 | 0 | 23,208 |
| 8 | Coking plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,747 | 0 | 0 | 988 | 0 | 0 | 0 | 3,735 |
| 9 | Processing of metal ores | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 79 |
| 10 | Production of pig iron and steel | 1,628 | 0 | 106 | 148 | 2,177 | 26 | 69 | 0 | 4,392 | 13,405 | 0 | 0 | 4,849 | 74 | 0 | 47 | 26,921 |
| 11 | Processing of ferrous metals | 286 | 0 | 178 | 74 | 571 | 382 | 278 | 0 | 469 | 1,461 | 111 | 0 | 697 | 125 | 76 | 61 | 4,769 |
| 12 | Production of primary aluminium | 0 | 0 | 0 | 0 | 0 | 0 | 262 | 0 | 0 | 694 | 0 | 0 | 0 | 0 | 0 | 0 | 955 |
| 13 | Processing of non-ferrous metals | 0 | 0 | 17 | 174 | 0 | 0 | 207 | 0 | 182 | 698 | 57 | 0 | 45 | 110 | 135 | 0 | 1,625 |
| 14 | Production of cement clinker | 1,209 | 0 | 3,500 | 4,004 | 0 | 312 | 0 | 0 | 1,184 | 5,194 | 860 | 1,083 | 0 | 0 | 1,612 | 1,031 | 19,990 |
| 15 | Lime production | 375 | 0 | 424 | 1,012 | 0 | 439 | 0 | 79 | 772 | 3,674 | 498 | 0 | 0 | 0 | 1,336 | 167 | 8,776 |
| 16 | Glass production | 129 | 0 | 143 | 725 | 0 | 3 | 0 | 24 | 352 | 981 | 260 | 39 | 0 | 222 | 583 | 234 | 3,694 |

| 2019 VET [kt $CO_2$eq] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Activity | BB | BE | BW | BV | HB | HE | HH | MW | LS | NW | RP | SH | SL | SN | ST | TH | Total |
| 17 | Ceramics production | 112 | 0 | 87 | 717 | 28 | 25 | 0 | 0 | 223 | 274 | 159 | 0 | 26 | 155 | 100 | 87 | 1,994 |
| 18 | Production of mineral fibres | 0 | 0 | 44 | 88 | 0 | 0 | 0 | 0 | 9 | 68 | 0 | 0 | 0 | 101 | 51 | 0 | 361 |
| 19 | Gypsum production | 100 | 0 | 22 | 85 | 0 | 0 | 0 | 0 | 18 | 24 | 0 | 0 | 0 | 24 | 0 | 0 | 273 |
| 20 | Pulp production | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 70 | 49 | 141 |
| 21 | Paper production | 60 | 0 | 730 | 697 | 0 | 276 | 0 | 6 | 862 | 1,304 | 423 | 89 | 0 | 380 | 124 | 19 | 4,971 |
| 22 | Carbon black production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 579 | 0 | 0 | 0 | 0 | 0 | 0 | 579 |
| 23 | Nitric acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 171 | 0 | 40 | 268 | 0 | 0 | 43 | 36 | 0 | 558 |
| 24 | Adipic acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 91 | 0 | 114 |
| 25 | Production of glyoxal and glyoxylic acid | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 |
| 26 | Ammonia production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 512 | 1,465 | 0 | 0 | 0 | 2,387 | 0 | 4,363 |
| 27 | Production of bulk organic chemicals | 0 | 0 | 50 | 549 | 0 | 59 | 0 | 4 | 239 | 3,916 | 1,500 | 181 | 0 | 940 | 154 | 0 | 7,592 |
| 28 | Production of hydrogen and synthesis gas | 39 | 0 | 0 | 48 | 0 | 0 | 58 | 0 | 12 | 352 | 416 | 114 | 0 | 0 | 675 | 0 | 1,715 |
| 29 | Soda production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 124 | 77 | 0 | 0 | 0 | 356 | 0 | 557 |
| **Total** | | **39,330** | **4,686** | **20,412** | **19,891** | **8,546** | **6,730** | **8,208** | **2,712** | **26,094** | **144,957** | **11,704** | **6,477** | **9,299** | **32,602** | **18,456** | **2,853** | **362,955** |

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Table 33: Overview of the 2019 allocation amounts per state (Land), by activities

| 2019 allocation amount [1000 EUA] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Activity** | **BB** | **BE** | **BW** | **BV** | **HB** | **HE** | **HH** | **MW** | **LS** | **NW** | **RP** | **SH** | **SL** | **SN** | **ST** | **TH** | **Total** |
| 1 | Combustion | 34 | 0 | 26 | 18 | 0 | 43 | 2 | 7 | 104 | 1,019 | 387 | 0 | 0 | 0 | 92 | 1 | 1,733 |
| 2 | Energy conversion >= 50 MW RTI | 896 | 881 | 1,215 | 1,813 | 129 | 1,255 | 395 | 261 | 2,239 | 5,498 | 1,848 | 422 | 286 | 693 | 1,044 | 284 | 19,160 |
| 3 | Energy conversion 20–50 MW RTI | 47 | 64 | 325 | 419 | 52 | 270 | 143 | 30 | 485 | 602 | 156 | 39 | 89 | 42 | 44 | 81 | 2,887 |
| 4 | Energy conversion 20–50 MW RTI, other fuels | 0 | 0 | 34 | 25 | 0 | 0 | 0 | 0 | 22 | 11 | 9 | 0 | 0 | 0 | 0 | 6 | 108 |
| 5 | Prime movers (engines) | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 6 | Prime movers (turbines) | 113 | 0 | 28 | 76 | 0 | 48 | 0 | 0 | 111 | 90 | 12 | 0 | 0 | 0 | 10 | 58 | 546 |
| 7 | Refineries | 1,813 | 0 | 2,041 | 2,754 | 0 | 0 | 855 | 0 | 962 | 6,203 | 0 | 1,930 | 0 | 0 | 2,150 | 0 | 18,708 |
| 8 | Coking plants | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,371 | 0 | 0 | 267 | 0 | 0 | 0 | 1,638 |
| 9 | Processing of metal ores | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| 10 | Production of pig iron and steel | 2,768 | 0 | 142 | 139 | 3,926 | 45 | 68 | 0 | 5,584 | 22,540 | 0 | 0 | 5,728 | 86 | 0 | 44 | 41,071 |
| 11 | Processing of ferrous metals | 240 | 0 | 209 | 74 | 258 | 362 | 294 | 0 | 419 | 1,632 | 113 | 0 | 598 | 101 | 92 | 56 | 4,446 |
| 12 | Production of primary aluminium | 0 | 0 | 0 | 0 | 0 | 0 | 198 | 0 | 0 | 657 | 0 | 0 | 0 | 0 | 0 | 0 | 855 |
| 13 | Processing of non-ferrous metals | 0 | 0 | 14 | 130 | 0 | 0 | 259 | 0 | 176 | 588 | 61 | 0 | 43 | 117 | 105 | 0 | 1,492 |
| 14 | Production of cement clinker | 1,256 | 0 | 2,719 | 3,152 | 0 | 230 | 0 | 0 | 962 | 4,778 | 664 | 934 | 0 | 0 | 1,627 | 852 | 17,174 |
| 15 | Lime production | 292 | 0 | 486 | 910 | 0 | 320 | 0 | 53 | 622 | 3,111 | 462 | 0 | 0 | 0 | 960 | 169 | 7,385 |
| 16 | Glass production | 97 | 0 | 124 | 588 | 0 | 4 | 0 | 6 | 280 | 790 | 181 | 32 | 0 | 193 | 455 | 183 | 2,932 |

| 2019 allocation amount [1000 EUA] | | State (Land) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Activity | BB | BE | BW | BV | HB | HE | HH | MW | LS | NW | RP | SH | SL | SN | ST | TH | Total |
| 17 | Ceramics production | 90 | 0 | 93 | 615 | 27 | 23 | 0 | 0 | 165 | 278 | 149 | 0 | 23 | 135 | 75 | 87 | 1,762 |
| 18 | Production of mineral fibres | 0 | 0 | 23 | 78 | 0 | 0 | 0 | 0 | 5 | 68 | 0 | 0 | 0 | 59 | 53 | 0 | 285 |
| 19 | Gypsum production | 93 | 0 | 27 | 89 | 0 | 0 | 0 | 0 | 23 | 33 | 0 | 0 | 0 | 23 | 0 | 0 | 288 |
| 20 | Pulp production | 0 | 0 | 8 | 9 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 41 | 21 | 87 |
| 21 | Paper production | 391 | 0 | 828 | 1,230 | 0 | 307 | 0 | 6 | 1,024 | 1,044 | 451 | 161 | 0 | 312 | 110 | 128 | 5,991 |
| 22 | Carbon black production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 430 | 0 | 0 | 0 | 0 | 0 | 0 | 430 |
| 23 | Nitric acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 263 | 0 | 157 | 177 | 0 | 0 | 25 | 32 | 0 | 654 |
| 24 | Adipic acid production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 550 | 0 | 0 | 0 | 232 | 0 | 991 |
| 25 | Production of glyoxal and glyoxylic acid | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| 26 | Ammonia production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 508 | 1,364 | 0 | 0 | 0 | 1,762 | 0 | 3,634 |
| 27 | Production of bulk organic chemicals | 0 | 0 | 24 | 469 | 0 | 90 | 0 | 3 | 494 | 4,337 | 2,281 | 154 | 0 | 938 | 181 | 0 | 8,971 |
| 28 | Production of hydrogen and synthesis gas | 22 | 0 | 0 | 55 | 0 | 0 | 37 | 0 | 12 | 423 | 583 | 63 | 0 | 0 | 322 | 0 | 1,516 |
| 29 | Soda production | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 209 | 96 | 0 | 0 | 0 | 722 | 0 | 1,027 |
| **Total** | | **8,151** | **945** | **8,366** | **12,649** | **4,393** | **2,998** | **2,251** | **628** | **13,703** | **56,652** | **9,551** | **3,735** | **7,034** | **2,724** | **10,106** | **1,970** | **145,857** |

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# 6 Main fuels by sectors

Table 34: 2013–2019 emissions for stationary installations in EU ETS using the main fuels natural gas, lignite and hard coal

| Sector/activity | Main fuel | 2013 emissions [kt $CO_2$eq] | 2014 emissions [kt $CO_2$eq] | 2015 emissions [kt $CO_2$eq] | 2016 emissions [kt $CO_2$eq] | 2017 emissions [kt $CO_2$eq] | 2018 emissions [kt $CO_2$eq] | 2019 emissions [kt $CO_2$eq] |
|---|---|---|---|---|---|---|---|---|
| Energy installations | Lignite | 169,562 | 162,222 | 162,044 | 157,903 | 157,659 | 153,949 | 120,364 |
| | Hard coal | 118,082 | 111,857 | 107,127 | 102,069 | 82,747 | 77,577 | 54,249 |
| | Natural gas | 36,477 | 31,952 | 31,566 | 36,987 | 39,607 | 36,545 | 38,484 |
| Other combustion plants | Lignite | 271 | 276 | 251 | 235 | 246 | 243 | 228 |
| | Hard coal | 115 | 129 | 126 | 130 | 131 | 133 | 125 |
| | Natural gas | 98 | 79 | 82 | 77 | 71 | 72 | 70 |
| Refineries | Natural gas | 4,154 | 2,710 | 2,532 | 1,544 | 1,651 | 1,534 | 1,627 |
| Iron and steel | Lignite | | | 3,974 | | 222 | 230 | 185 |
| | Hard coal | 144 | 4,315 | 4,905 | 4,500 | 4,452 | 9,454 | 9,396 |
| | Natural gas | 17,743 | 14,007 | 9,712 | 13,509 | 14,398 | 9,248 | 8,338 |
| Non-ferrous metals | Hard coal | 51 | 51 | 49 | 52 | 55 | 54 | 60 |
| | Natural gas | 1,266 | 1,315 | 1,397 | 1,444 | 1,419 | 1,472 | 1,425 |
| Cement clinker | Lignite | 2,592 | 2,165 | 1,224 | 2,065 | 2,000 | 2,433 | 2,376 |
| | Hard coal | 180 | 180 | | | | | |
| Industrial and building lime | Lignite | 4,587 | 4,822 | 5,470 | 5,121 | 4,806 | 5,551 | 5,086 |
| | Hard coal | 1,300 | 1,301 | 937 | 957 | 1,191 | 857 | 858 |
| | Natural gas | 1,370 | 1,293 | 962 | 1,109 | 1,132 | 899 | 839 |
| Other mineral processing industry | Lignite | 638 | 681 | 646 | 681 | 740 | 735 | 652 |
| | Hard coal | 616 | 629 | 507 | 596 | 630 | 672 | 613 |
| | Natural gas | 6,751 | 6,912 | 6,729 | 6,754 | 6,799 | 6,828 | 6,566 |

| Sector/activity | Main fuel | 2013 emissions [kt $CO_2$eq] | 2014 emissions [kt $CO_2$eq] | 2015 emissions [kt $CO_2$eq] | 2016 emissions [kt $CO_2$eq] | 2017 emissions [kt $CO_2$eq] | 2018 emissions [kt $CO_2$eq] | 2019 emissions [kt $CO_2$eq] |
|---|---|---|---|---|---|---|---|---|
| Paper and pulp | Lignite | 660 | 617 | 391 | 519 | 308 | 536 | 518 |
| | Hard coal | 864 | 853 | 846 | 776 | 752 | 712 | 613 |
| | Natural gas | 3,581 | 3,622 | 3,933 | 3,838 | 4,091 | 3,835 | 3,591 |
| Chemical industry | Lignite | 44 | 161 | 151 | 40 | 150 | 126 | 128 |
| | Hard coal | 569 | 521 | 510 | 491 | 525 | 471 | 480 |
| | Natural gas | 8,785 | 8,214 | 8,482 | 8,445 | 8,544 | 8,723 | 8,428 |
| **Sum** | | **380,503** | **360,884** | **354,553** | **349,844** | **334,325** | **322,889** | **265,299** |
| Complement: main fuel is not natural gas, hard coal or lignite | | 100,387 | 100,153 | 100,832 | 102,989 | 103,302 | 99,918 | 97,656 |
| **Total** | | **480,890** | **461,037** | **455,385** | **452,833** | **437,627** | **422,807** | **362,955** |

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The basis for determining the main fuel of an installation is the information provided by the operator in the annual emission reports at source stream level. Minor differences between emissions and number of installations in Tables 34 and 35 and Table 4 in the introduction to this report are due, among others, to the fact that Tables 34 and 35 for the years 2013 to 2018 only include installations that have also submitted an emissions report.

Table 35: Number of stationary installations 2013 – 2019 in EU ETS using the main fuels natural gas, lignite and hard coal

| Sector/activity | Main fuel | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| Energy installations | Lignite | 31 | 29 | 27 | 27 | 24 | 23 | 22 |
| | Hard coal | 75 | 76 | 73 | 70 | 66 | 59 | 59 |
| | Natural gas | 700 | 695 | 685 | 672 | 673 | 664 | 651 |
| Other combustion plants | Lignite | 9 | 6 | 6 | 4 | 3 | 3 | 2 |
| | Hard coal | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Natural gas | 12 | 10 | 13 | 13 | 10 | 11 | 11 |
| Refineries | Natural gas | 7 | 6 | 6 | 5 | 5 | 5 | 5 |
| Iron and steel | Lignite | | | 1 | | 1 | 1 | 1 |
| | Hard coal | 4 | 6 | 5 | 6 | 6 | 7 | 7 |
| | Natural gas | 101 | 98 | 96 | 96 | 95 | 95 | 95 |
| Non-ferrous metals | Hard coal | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Natural gas | 28 | 30 | 31 | 31 | 32 | 32 | 32 |
| Cement clinker | Lignite | 6 | 5 | 4 | 5 | 4 | 5 | 5 |
| | Hard coal | 1 | 1 | | | | | |
| Industrial and building lime | Lignite | 16 | 17 | 20 | 17 | 17 | 21 | 21 |
| | Hard coal | 13 | 13 | 12 | 11 | 10 | 10 | 10 |
| | Natural gas | 13 | 12 | 10 | 10 | 9 | 8 | 7 |
| Other mineral processing industry | Lignite | 6 | 6 | 6 | 6 | 6 | 5 | 5 |
| | Hard coal | 9 | 9 | 8 | 9 | 8 | 8 | 8 |
| | Natural gas | 244 | 244 | 237 | 232 | 228 | 227 | 222 |
| Paper and pulp | Lignite | 6 | 6 | 5 | 5 | 4 | 5 | 5 |
| | Hard coal | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| | Natural gas | 106 | 110 | 111 | 111 | 109 | 107 | 107 |

| Sector/activity | Main fuel | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| Chemical industry | Lignite | 1 | 2 | 2 | 1 | 2 | 2 | 2 |
| | Hard coal | 4 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Natural gas | 78 | 77 | 78 | 74 | 73 | 75 | 74 |
| **Sum** | | **1,477** | **1,468** | **1,446** | **1,414** | **1,394** | **1,382** | **1,360** |
| Complement: main fuel is not natural gas, hard coal or lignite | | 443 | 435 | 437 | 443 | 435 | 478 | 491 |
| **Total** | | **1,920** | **1,903** | **1,883** | **1,857** | **1,829** | **1,860** | **1,851** |

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The basis for determining the main fuel of an installation is the information provided by the operator in the annual emission reports at source stream level. Minor differences between emissions and number of installations in Tables 34 and 35 and Table 4 in the introduction to this report are due, among others, to the fact that Tables 34 and 35 for the years 2013 to 2018 only include installations that have also submitted an emissions report.

# 7 Industries, sectors and activities in the EU ETS

Table 36: Activities (short description) according to Annex 1 TEHG and grouping in sectors and industries

| TEHG No. | Activity | Sectors | Industry |
|---|---|---|---|
| 2 | Energy conversion ≥ 50 MW RTI | Energy installations | Energy |
| 3 | Energy conversion 20–50 MW RTI | | |
| 4 | Energy conversion 20–50 MW RTI, other fuels | | |
| 5 | Prime movers (engines) | | |
| 6 | Prime movers (turbines) | | |
| 1 | Combustion | Other combustion plants, iron and steel, non-ferrous metals, mineral processing industry, chemical industry | Industry |
| 7 | Refineries | Refineries | |
| 8 | Coking plants | Iron and steel | |
| 9 | Processing of metal ores | | |
| 10 | Production of pig iron and steel | | |
| 11 | Processing of ferrous metals | | |
| 12 | Production of primary aluminium | Non-ferrous metals | |
| 13 | Processing of non-ferrous metals | | |
| 14 | Production of cement clinker | Mineral processing industry | |
| 15 | Lime production | | |
| 16 | Glass production | | |
| 17 | Ceramics production | | |
| 18 | Mineral fibres production | | |
| 19 | Gypsum production | | |
| 20 | Pulp production | Paper and pulp | |
| 21 | Paper production | | |
| 22 | Carbon black production | Chemical Industry | |
| 23 | Nitric acid production | | |
| 24 | Adipic acid production | | |
| 25 | Production of glyoxal and glyoxylic acid | | |
| 26 | Ammonia production | | |
| 27 | Production of bulk organic chemicals | | |
| 28 | Production of hydrogen and synthesis gas | | |
| 29 | Soda production | | |

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Table 37: Activities (short description) according to Annex 1 TEHG and equivalent in Union Registry (Registry Activity)

| TEHG No. | TEHG activity | RegVO-No. | Registry VO activity |
|---|---|---|---|
| 2 | Energy conversion ≥ 50 MW RTI | 20 | Combustion and energy |
| 3 | Energy conversion 20–50 MW RTI | | |
| 4 | Energy conversion 20–50 MW RTI, other fuels | | |
| 5 | Prime movers (engines) | | |
| 6 | Prime movers (turbines) | | |
| 1 | Combustion | | |
| 7 | Refineries | 21 | Refineries |
| 8 | Coking plants | 22 | Coking plants |
| 9 | Processing of metal ores | 23 | Processing of metal ores |
| 10 | Production of pig iron and steel | 24 | Production of pig iron and steel |
| 11 | Processing of ferrous metals | 25 | Processing of ferrous metals |
| 12 | Production of primary aluminium | 26 | Production of primary aluminium |
| 13 | Processing of non-ferrous metals | 27 | Production of secondary aluminium |
| | | 28 | Production and processing of non-ferrous metals |
| 14 | Production of cement clinker | 29 | Production of cement clinker |
| 15 | Lime production | 30 | Lime production |
| 16 | Glass production | 31 | Glass production |
| 17 | Ceramics production | 32 | Ceramics production |
| 18 | Production of mineral fibres | 33 | Production of mineral fibres |
| 19 | Gypsum production | 34 | Gypsum production |
| 20 | Pulp production | 35 | Pulp production |
| 21 | Paper production | 36 | Paper production |
| 22 | Carbon black production | 37 | Carbon black production |
| 23 | Nitric acid production | 38 | Nitric acid production |
| 24 | Adipic acid production | 39 | Adipic acid production |
| 25 | Production of glyoxal and glyoxylic acid | 40 | Production of glyoxal and glyoxylic acid |
| 26 | Ammonia production | 41 | Ammonia production |
| 27 | Production of bulk organic chemicals | 42 | Production of bulk organic chemicals |
| 28 | Production of hydrogen and synthesis gas | 43 | Production of hydrogen and synthesis gas |
| 29 | Soda production | 44 | Soda production |

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# 8 Emissions and scope estimation

Table 38: German EU-ETS emissions and scope estimation in the stationary sector since 2005

| | Energy emissions [Mt $CO_2$eq] | Industry emissions [Mt $CO_2$eq] | N. l. ETS energy emissions [Mt $CO_2$eq] | N. l. ETS industry emissions [Mt $CO_2$eq] | Estimated emissions [Mt $CO_2$eq] | Total [Mt $CO_2$eq] |
|---|---|---|---|---|---|---|
| 2005 | 349,0 | 99,1 | 23,0 | 3,9 | 39,9 | 514,9 |
| 2006 | 350,0 | 101,0 | 23,7 | 3,3 | 39,7 | 517,8 |
| 2007 | 356,0 | 104,0 | 24,0 | 3,1 | 43,6 | 530,8 |
| 2008 | 341,1 | 108,4 | 20,3 | 2,8 | 33,1 | 505,7 |
| 2009 | 315,7 | 95,5 | 15,6 | 1,6 | 30,5 | 458,8 |
| 2010 | 331,5 | 103,0 | 19,1 | 1,3 | 25,0 | 479,9 |
| 2011 | 327,8 | 104,6 | 17,0 | 1,0 | 24,2 | 474,6 |
| 2012 | 333,1 | 101,8 | 16,9 | 0,8 | 23,4 | 476,0 |
| 2013 | 343,1 | 122,8 | 14,1 | 1,0 | 0,1 | 481,1 |
| 2014 | 327,6 | 122,8 | 10,3 | 0,7 | 0,1 | 461,4 |
| 2015 | 324,8 | 123,0 | 7,2 | 0,5 | 0,1 | 455,7 |
| 2016 | 323,5 | 123,2 | 5,8 | 0,3 | 0,1 | 452,9 |
| 2017 | 310,0 | 126,0 | 1,6 | 0,1 | 0,1 | 437,7 |
| 2018 | 298,3 | 124,4 | 0,2 | 0,0 | 0,0 | 422,9 |
| 2019 | 243,9 | 119,0 | 0,0 | 0,0 | 0,0 | 363,0 |
| No. of installations 2019 | 933 | 918 | | | | |

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# 9 Glossarary

### Allocation coverage

The ratio of free allocation to emissions. An allocation coverage of 100 percent or more means that no emission allowances need to be purchased to meet the annual surrender obligation. An allocation coverage below 100 percent means that the free allocation of one year is not sufficient to meet the surrender obligation using emission allowances from the current allocation. In this case, emission allowances must be purchased or certificates from the second trading period must be used.

### Adjusted allocation coverage

The ratio of free allocation to emissions, adjusted by the allocation for transferred waste gases from iron, steel and coke production of the iron and steel industry and imported heat quantities of the paper and chemical industry. Producers of waste gases from iron, steel and coke production and heat importers receive a free allocation for this purpose although emissions arise from waste gas users or heat producers. The adjusted allocation coverage is based on the assumption that producers of waste gases from iron, steel and coke production and heat importers transfer emission allowances to the installations that produce the emissions. The respective amounts are estimated for this report. The amounts are subtracted from the actual free allocation for industry sectors and added to energy installations.

### Clean Spread

The 'clean spreads' relate fuel prices, the price of electricity, the price of emission allowances and variable operating costs with one another and thus allow conclusions to be drawn about contribution margins for a power plant (for natural gas power plants: clean spark spread, for hard coal power plants: clean dark spread, for lignite power plants: clean lignite spread).

### CSCF

The abbreviation CSCF stands for cross-sectoral correction factor (see explanation below).

### EU-Allowances (EUA)

Emission certificates at a corporate level for emissions trading in Europe (EU Emissions Trading Scheme). Emission certificates are referred to as emission allowances (EAs). They have been tradable within the EU since 2005 and are issued to installations subject to emissions trading in the EU. One EUA legitimises the emission of one tonne of $CO_2$ (carbon dioxide) or $CO_2$ equivalent ($CO_2$eq).

EU allowances (EUAs) and emission allowances (EAs) can be transferred in accordance with the European Emissions Trading Directive (EHRL) and the Greenhouse Gas Emissions Trading Act (§6(1) TEHG). EUAs enable operators to comply with their annual obligation to surrender emission allowances.

### Full scope of EU ETS in aviation

It includes carbon dioxide emissions from all flights which land at or take off from airports in the European Economic Area States. Exceptions are described in Section 4.1.

### Commercial aircraft operator

An aircraft operator that provides scheduled or non-scheduled air transport services to the public and carries passengers, cargo or mail in exchange for remuneration (Article 3 p, Emissions Trading Directive).

### Main fuel

The main fuel in an installation is the fuel most used in the total energy of all fuel streams used in this installation. In contrast, previous VET reports until 2014 assigned an installation to a main fuel only if more than 80 percent of the energy consumption of an installation could be assigned to a fuel. The main fuel allocation of an installation for the reporting year corresponds to the main fuel allocation based on the emission report of the year before the reporting year.

### Linear factor

The factor is applied to power producers and new market entrants for a linear reduction of the annual allocation amount. The linear factor is reduced by 1.74 percent annually from the 2013 baseline 1.

### Installations no longer subject to emissions trading (n. l. ETS)

Installations no longer subject to emissions trading include, for example, decommissioned installations and installations that continue to exist but are no longer subject to emissions trading because as energy installations they fall below the 20 MW RTI limit.

### Reduced scope of EU ETS in aviation

Valid from 01/01/2013 to 31/12/2023. Compared to the full scope, operators are effectively no longer subject to emissions trading for emissions from flights that take off or land outside the European Economic Area. Further exceptions are described in Section 4.1.

### Cross-sectoral correction factor

Correction factor (cross-sectoral correction factor – CSCF) to adjust the total amount of allowances allocated free of charge for non-power producers to the maximum amount of free allocation pursuant to Article 10a(5) of the EU Emissions Trading Directive (ETD). This factor is determined by the European Commission every single year and applies uniformly throughout the EU to all industrial sectors (in a cross-sectoral way).

### Scope correction or estimate before 2013 (scope estimate)

Estimated emissions before 2013 to correct the scope over each trading period. In the transition from the second to the third trading period, in particular, the scope of European Emissions Trading was extended and installations for the production and processing of non-ferrous metals and in the chemical industry were added. In the relevant figures in the report, this adjustment of timelines is referred to as a scope estimate in the legends. More detailed explanations can be found in the introductory chapter of the report.

# 10 Sources and Publications


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German Emissions Trading Authority (DEHSt) at the German Environment Agency
City Campus
Buidling 3, entrance 3A
Buchholzweg 8
D-13627 Berlin
www.dehst.de/Englisch | emissionstrading@dehst.de