EEA Report | No 24/2016

Trends and projections in the EU ETS in 2016

The EU Emissions Trading System in numbers

ISSN 1977-8449

European Environment Agency

EEA Report | No 24/2016

Trends and projections in the EU ETS in 2016

The EU Emissions Trading System in numbers

European Environment Agency

Cover design: EEA
Cover photo: © Nivellen77/http://www.istockphoto.com
Left illustration: © EEA
Right photo: © Alexander Khodarev/http://freeimages.com
Layout: Rosendahls Schultz

More information on the European Union is available on the Internet (http://europa.eu).

Luxembourg: Publications Office of the European Union, 2016

ISBN 978-92-9213-817-2
ISSN 1977-8449
doi:10.2800/71685

Authors

This report was prepared by the European Environment Agency (EEA) and its European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM). The ETC/ACM is a consortium of European institutes assisting the EEA in its support to European Union (EU) policy in the field of air pollution and climate change mitigation.

The authors were Sean Healy, Verena Graichen and Sabine Gores, from Öko-Institut, Germany (as partner of the ETC/ACM).

The EEA project manager was François Dejean.

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Contents

List of figures and tables

Figures

Tables

Abbreviations

CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
CDM	Clean development mechanism
CER	Certified emission reductions
EEA	European Environment Agency
EEX	European Energy Exchange
EFTA	European Free Trade association
EIB	European Investment Bank
ERU	Emission reduction unit
ESD	Effort Sharing Decision
ETS	Emission Trading System
EU	European Union
EUA	EU emission allowance
EUAA	EU aviation allowance
EUTL	EU Transaction Log
GDP	Gross domestic product
GHG	Greenhouse gas
GVA	Gross value added
ICAO	International Civil Aviation Organization
ICE	Intercontinental Exchange
IPCC	Intergovernmental Panel on Climate Change
JI	Joint implementation
MBM	Market-based mechanism
MMR	Monitoring Mechanism Regulation

MSR	Market stability reserve
NACE	Statistical classification of economic activities in the European Community
NAP	National allocation plan
NAT	National allocation table
NER	New Entrants' Reserve
NIM	National implementation measure
OTC	Over-the-counter
PFC	Perfluorocarbon
QA	Quality assurance
QC	Quality control
RES	Renewable energy source
TAiC	Total number of allowances in circulation
UCTE	Union for the Coordination of Transmission of Electricity
WAM	With additional measures
WEM	With existing measures

Executive summary

About this report

This 2016 report of the European Environment Agency (EEA) provides an analysis of past, present and future emissions trends under the EU Emissions Trading System (ETS), based on the latest data and information available from the European Commission (i.e. May 2016 data on verified emissions and compliance by operators under the EU ETS for the years up until 2015) and Member States (projections of EU ETS emissions until 2030, reported under the EU Monitoring Mechanism Regulation (MMR) (EU, 2013c)). The report also analyses the balance between supply of and demand for allowances in the market. The report's annexes provide extensive material describing the functioning, scope and cap of the EU ETS.

Main findings

Recent trends: the surplus of EU ETS allowances has stabilised and is now starting to decline

In 2015, the greenhouse gas (GHG) emissions covered by the EU ETS declined by 0.7 % compared with 2014. The majority of this reduction was delivered by combustion installations (mostly power plants), which account for the majority of EU ETS emissions. This reduction was achieved despite an increase in electricity demand over the same period. Emissions also decreased overall in the other types of installations, although emissions by refineries, chemical plants and the non-metallic minerals sector, as well as the aviation sector, increased.

Whereas combustion installations had to buy most of their allowances (through auctioning or in the secondary market) in 2015, the other industrial sectors received free allowances because they are deemed to be exposed to a risk of carbon leakage. Free allocation was mostly at 100 % of the corresponding benchmark value (before applying the cross-sectoral correction factor). In the case of the iron and steel, cement and lime, pulp and paper, and chemicals sectors, these free allowances were sufficient to fully cover these sectors' emissions. The aviation sector had to meet a net demand for allowances by purchasing EU allowances (EUAs) from the stationary installations sector in order to comply with its emissions cap.

In parallel with the slight decrease in emissions, in 2015 the EU ETS saw a 17 % reduction in the supply of EUAs to be used for compliance (allowances freely allocated, auctioned or sold, as well as emission credits from international emission-reducing projects). As this decline was more pronounced than the reduction in emissions, the surplus of 2.1 billion allowances that had accumulated in the system since 2008 was cut by around 300 million in 2015. With back-loading in place, the surplus has stabilised and is now starting to decline although it remains substantial: equivalent to 1 year's worth of EU ETS emissions. With the objective of ensuring the orderly functioning of the market and addressing the structural supply–demand imbalance, the market stability reserve (MSR) will come into operation in 2019.

Average EUA prices from auctioning platforms rose slightly in 2015, to around EUR 8 per tonne CO_2-eq. At current levels, the price signal of the EU ETS provides limited incentive for the more expensive abatement options necessary to decarbonise the European economy in the long term.

Long-term trends: emission reductions in power generation have been driving the emission decreases observed in the EU ETS since 2005

Stationary EU ETS emissions decreased by 24 % between 2005 and 2015 and, in 2014, fell below the cap set for 2020 ([1]). The decrease was mostly driven by emission reductions in power generation, although electricity generation declined only slightly over the

([1]) The emission reduction between 2005 and 2015 is estimated based upon the current scope of the EU ETS in the third trading period (EEA/EU ETS Data viewer, 2016).

Figure ES.1 Emissions, allowances, surplus and prices in the EU ETS, 2005–2015

Notes: Verified emissions and allocations were adjusted to reflect the latest scope of the EU ETS in the third trading period (see Table A2.4 in Annex 2).

The supply of allowances presented takes into account a redistribution by the EEA of annual volumes of allowances auctioned/sold on the primary market, from the year when they were released to the market to the years from which they arise. For example, the volumes of allowances relative to the second trading period (2008–2012) but sold/auctioned in the first months of 2013 are added here to the 2012 figures. For more details, see Tables 2.1 and 2.2, and Section 2.1.2.

The average EUA price represents historic spot price data from the secondary market in the first and second trading periods. In the case of 2008, only EUA spot prices for the second trading period are considered in the calculation of the average. In the third trading period, the EUA price refers to primary market auctioning clearing prices from the European Energy Exchange (EEX) and Intercontinental Exchange (ICE) trading platforms.

The break in the EUA price between 2007 and 2008 reflects the absence of banking provisions between the first and second trading periods. However, trade in future EUA contracts did take place during this time period (see Figure 2.11).

The cumulative surplus refers to the build-up of unused allowances (including net demand from aviation). This differs from the total number of allowances in circulation (TAiC), which also takes into account the additional surplus held back in the MSR (i.e. back-loaded allowances).

Sources: Point Carbon, 2012; EEA, 2016a; EEA/EU ETS Data viewer, 2016; EEX, 2016; ICE, 2016.

same period. The reduction in emissions was largely the result of changes in the mix of fuels used to produce heat and electricity, in particular less use of hard coal and lignite fuels and a jump in the use of renewables, which almost doubled over the period.

The trend at the EU level does not fully reflect the quite different situations observed at the Member State level. For example, in Poland, electricity generation still largely relies on the use of solid fossil fuels, and there is a risk that longer term emissions will be 'locked in' because other sources of electricity generation are limited and because the fossil power supply infrastructure is still relatively young. In contrast, in the United Kingdom, power generation from coal is currently being phased out.

Emissions from the other industrial activities covered by the EU ETS have also decreased since 2005, but remained stable in the last 3 years of the current trading period (2013–2015).

EU allowances, necessary for compliance under the EU ETS, can be allocated to operators in several ways. Auctioning is the default method of allocating allowances within the EU ETS, especially for the power sector. The proportion of allowances to be auctioned is expected to increase every year over the period 2013–2020, which means that firms have to purchase an increasing number of allowances (via auctions/primary market sales or in the secondary market). As a consequence of the back-loading decision, the volumes of allowances auctioned in 2014 and 2015 were significantly lower than in 2013.

In order to ensure equal treatment of new industrial installations, a reserve of 480 million EUAs (the New Entrants' Reserve, or NER) was set aside at the start of the third trading period for new installations or to accommodate increases in the capacity of existing installations ([2]). Between 2013 and 2015, most allowances from the NER were allocated to support capacity extensions. Overall, the set-aside allowances are used to a relatively limited extent in comparison with the overall envelope of the reserve. After 3 years of the current 8-year trading period, only 20 % of the allowances in the NER have been used or reserved for future use. Use in the coming years is subject to uncertainty, as it will depend to a large extent on future economic developments.

In eight Member States, some installations in the electricity generation sector (which would normally have to buy their allowances) receive a transitional free allocation under Article 10c of the ETS Directive, so that the value of these allowances is invested in efforts to modernise electricity generation. Just under half of the maximum budget (i.e. 49 %) for Article 10c allowances was used between 2013 and 2015. There are insufficient data to evaluate directly the performance of completed investments; however, the available sources suggest that there is no basis on which to establish the extent to which such investments have contributed to diversifying the energy mix. Furthermore, a large part of the investments generated by transitional free allocation seems to be used to modernise existing fossil fuel capacity (e.g. extending the lifetime of fossil-fuel based electricity generation units).

To comply with their legal obligation, operators liable under the EU ETS are also allowed to use a limited number of credits generated by emission-reducing projects. By the end of 2015, almost the entire quantity of emission credits allowed for the whole trading period had been used up, with only 4 % of entitlements remaining ([3]). Qualitative restrictions for project types have been tightened over the years; 2015 was the first year that emission reduction generated in the first Kyoto period (2008–2012) could no longer be used for compliance.

Projections: Member States project a significant slowdown of GHG reductions in the EU ETS. New policies are being developed to achieve the EU's 2030 climate and energy targets.

According to the projections reported by EU Member States in 2015 under EU legislation, EU ETS emissions will continue to decrease with the current policies and measures in place, by a total of 7 % between 2015 and 2020, and by a further 5 % between 2020 and 2030. This would result in an overall 12 % decrease between 2015 and 2030. The projected average annual decrease in EU ETS emissions between 2015 and 2030 is much less than the average annual decrease in EU ETS emissions achieved between 2005 and 2014. As many as 13 EU Member States project increasing EU ETS emissions between 2015 and 2030. These national projections differ from the reference scenario used by the European Commission in its proposal for a 2030 framework for climate and energy policies, which assumes that EU ETS emissions between 2015 and 2030 will decrease in all Member States except for Latvia, Luxembourg, Malta and Slovenia.

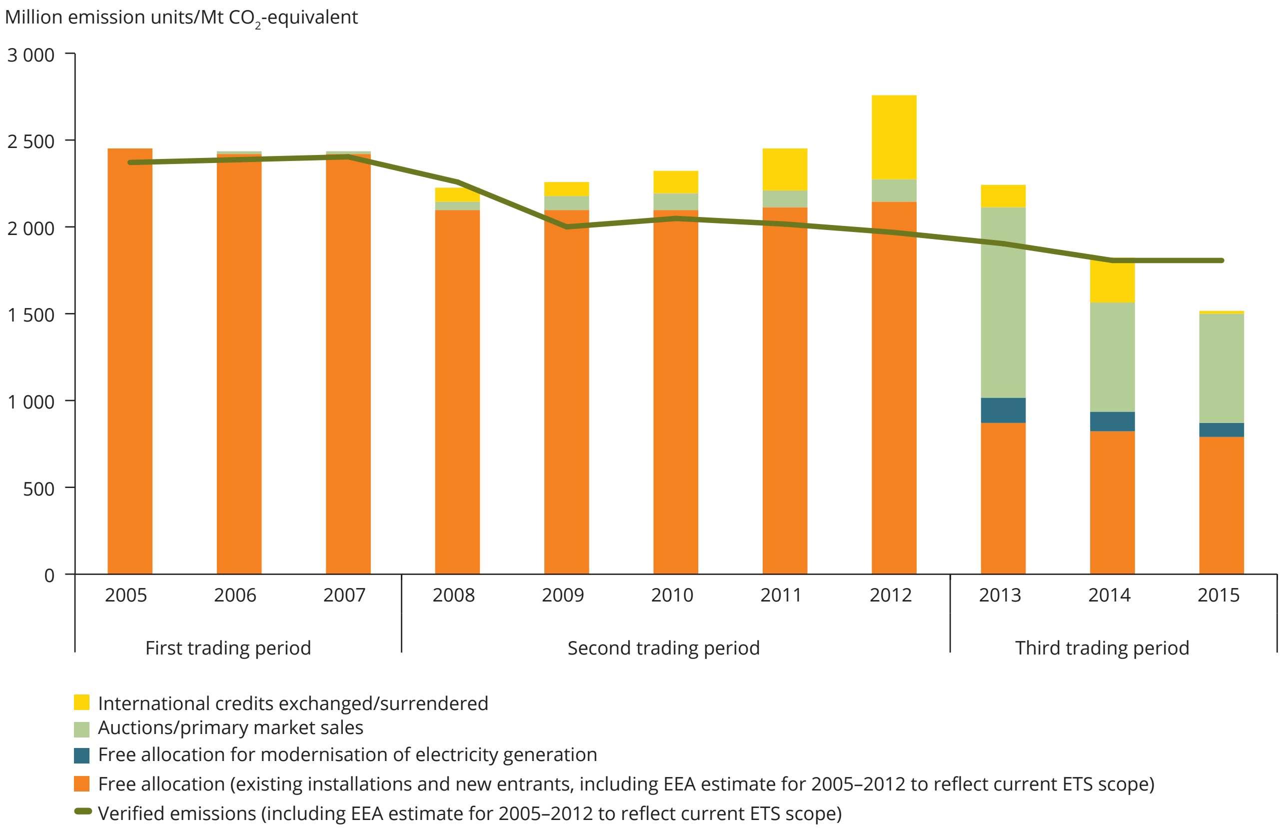
In October 2014, European leaders endorsed a binding EU target of a domestic reduction in GHG emissions of at least 40 % by 2030 compared with 1990, with a contribution from the EU ETS amounting to a 43 % reduction compared with 2005. This reduction should be achieved by increasing the annual reduction in the cap from 1.74 % (third trading period) to 2.2 % from 2021 onwards, as proposed by the European Commission. Taking this additional factor into account, and using the projections available from Member States, the EU ETS surplus could be absorbed by the MSR in 2029, but the projected reductions would not be sufficient to achieve the 43 % reduction below 2005 levels expected from the EU ETS.

The updated projections that Member States will submit in 2017 are expected to better reflect the new policy framework for 2030 and current policy proposals being discussed at EU level, as well as the dynamic effects of the MSR.

([2]) The NER originally amounted to 780 million allowances; however, 300 million allowances were set aside under the NER300 Programme, with the revenues from the sale of these allowances used to fund innovative low-carbon energy demonstration projects.

([3]) Individual entitlements for some installations are calculated on the basis of their aggregated verified emissions in the third trading period and are thus expected to change in the future. This is also the case for all aircraft operators. The impact on overall amounts is expected to be minor.

Figure ES.2 Supply and demand balance for stationary installations, 2005–2015



Note: Both verified emissions and free allocation (existing installations and new entrants) include, in the years 2005–2012, an estimate to reflect the current scope of the EU ETS (EEA, 2016a). As this addition is applied to both the supply of and demand for allowances, it does not affect the supply–demand balance.

The supply of allowances presented takes into account a redistribution by the EEA of annual volumes of allowances auctioned/sold on the primary market, from the year when they were released to the market to the years from which they arise. For example, the volumes of allowances relative to the second trading period (2008–2012) but sold/auctioned in the first months of 2013 are added here to the 2012 figures. Auctioned allowances that were 'back-loaded' are not shown in the graph. For more details, see Tables 2.1 and 2.2, and Section 2.1.2.

Source: EEA/EU ETS Data viewer, 2016.

1 Recent trends

Between 2014 and 2015, total emissions covered by the ETS Directive ([4]) declined by 0.7 % ([5]). Although emissions in the stationary sector (power plants and industrial installations) declined slightly, aviation emissions increased. Stationary installations accounted for 97 % of the total emissions covered by the EU ETS in 2015, with aviation accounting for the remaining 3 % (EEA/EU ETS Data viewer, 2016). The total supply of allowances declined at a faster rate than emissions in 2015. The surplus of allowances in the system was therefore around 300 Mt CO_2-eq. lower. However, a large surplus remains and is equivalent in size to 1 year's worth of EU ETS emissions. The average annual EUA clearing prices on the EEX and ICE auctioning platforms rose compared with the previous year but still continue at low levels (around EUR 8 per tonne of CO_2-eq. in 2015).

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

1.1 Stationary installations

1.1.1 Emission trends

In 2015, verified emissions in the stationary sector were 0.7 % lower than in 2014, with the majority of the reduction delivered by combustion installations. The main source of emissions in the EU ETS is the combustion of fuel, occurring mainly in power and heat plants ([6]). Combustion installations emitted 1 225 Mt CO_2-eq. in 2015, equivalent to 68 % of total verified emissions from stationary installations (see Figure 1.1), and about a quarter of total EU GHG emissions in the participating countries. Cement and lime account for 146 Mt CO_2-eq. or 8 % of total verified emissions covered under the EU ETS. Refineries as well as iron and steel activities each account for 7 % of total stationary emissions.

In 2015, verified emissions from combustion activities declined by 0.9 % compared with 2014 levels (see Figure 1.2). This decline coincided with an increase in electricity demand in the EU in 2015, as a consequence of both economic activity and, to a lesser extent, higher demand for heating due to relatively colder temperatures (EC, 2015f, 2015g, and 2015h). The EU power sector is therefore decarbonising, in particular through the increasing deployment of renewables. In May 2015, renewable energy sources contributed 35 % of all electricity generated in the EU (EC, 2015g). The recent reduction in oil and gas prices has also helped to improve the profitability of gas-fired power plants, further reducing the emission intensity of electricity generation. National policies have also contributed to the declining trend in combustion emissions.

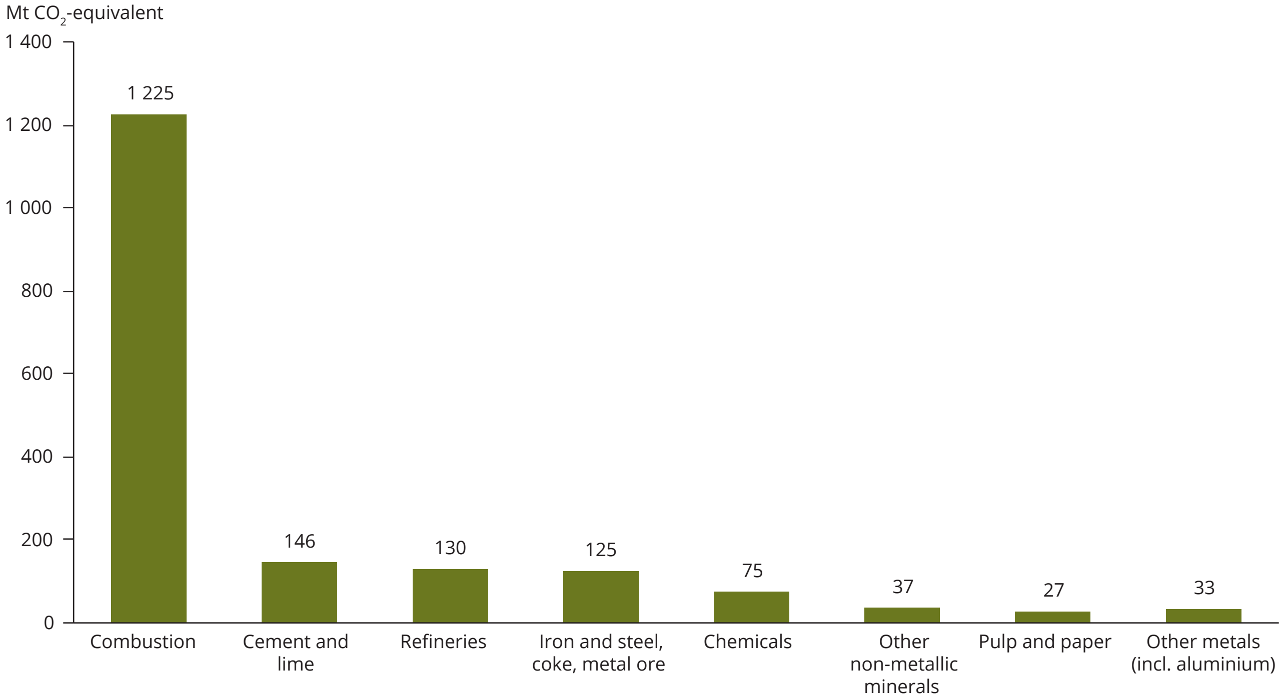
Verified emissions from industrial activities, on average, remained stable in 2015, although trends differed, depending on the activity concerned. For example, refineries experienced a 2.0 % increase in their verified emissions in 2015 (see Figure 1.2) — primarily as a result of the decline in the oil price improving profit margins and therefore increasing levels of activity. Conversely, the verified emissions of both the cement and lime sector and the iron and steel sector declined in 2015. The oversupply of both cement and steel products in global markets is likely to have contributed to excess capacity and therefore a reduction in activity levels. Furthermore improvements in energy

([4]) Directive 2009/29/EC amending Directive 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community (EU, 2009a) will be referred to as the ETS Directive throughout the report. For more information on the activities covered refer to Section A1.2 of Annex 1.

([5]) The reduction of 0.7 % refers to the change in the absolute volume of emissions between 2014 and 2015, which may include installations that have stopped operation as well as new entrants.

([6]) Furthermore, the ETS information reported under this activity type covers industrial installations carrying out activities not specifically stated in the Annex of the ETS directive (e.g. breweries). Blast furnace power plants may also be included under combustion rather than iron and steel activity type codes.

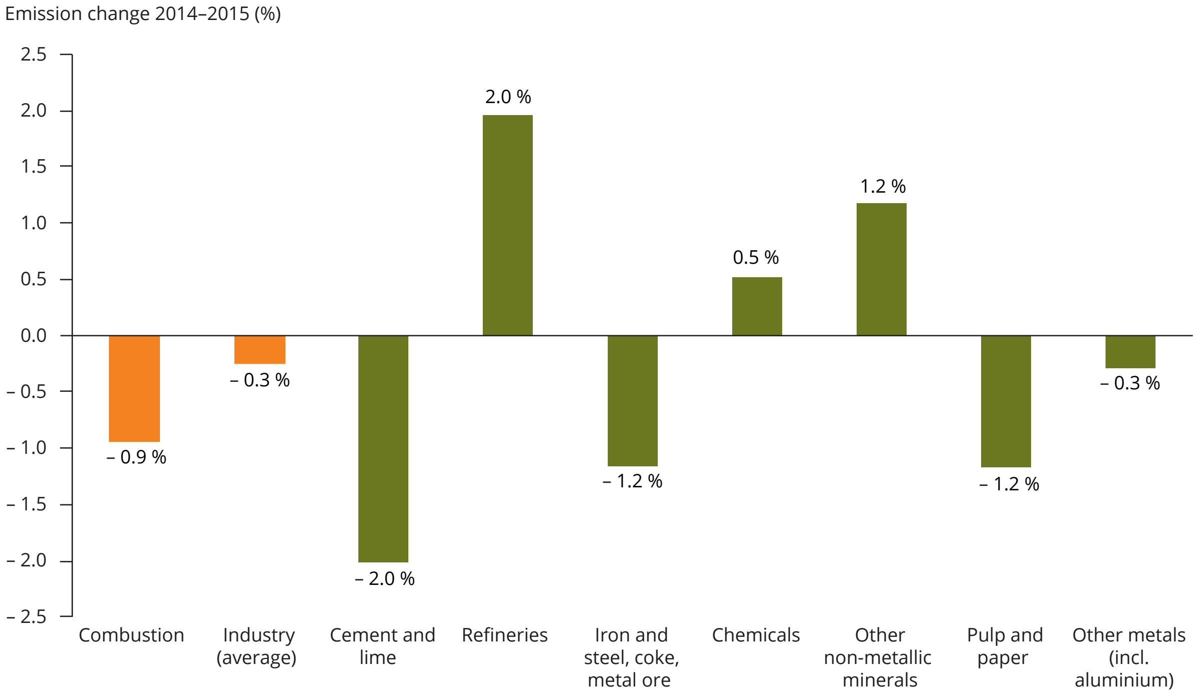
Figure 1.1 EU ETS emissions by main activity type, 2015



Note: EU Transaction Log (EUTL) activity codes have been aggregated for certain sectors (see Table A1.1 for more information).

Source: EEA/EU ETS Data viewer, 2016.

Figure 1.2 Change in EU ETS emissions between 2014 and 2015, by main activity



Note: EUTL activity codes have been aggregated for certain sectors (see Table A1.1 for more information).

Source: EEA/EU ETS Data viewer, 2016.

efficiency may also have contributed to this trend. Verified emissions of the pulp and paper sector fell at a faster rate than production levels in 2015 owing to market consolidation, investments in bio-energy and improvements in energy efficiency (CEPI, 2016).

EU ETS emissions are dominated by emissions from power stations; in 2015, the 30 highest emitting power plants alone emitted 362.3 Mt CO_2-eq., 30 % of total combustion emissions in that year (Table 1.1).

Table 1.1 Top 30 emitters in 2015 (combustion plants)

EUTL ID	Company	Country code	Installation	Fuel	Installed capacity (MW)	Emissions 2015 (Mt CO_2-eq.)	Change vs. 2014 (%)
PL 1	PGE	PL	Bełchatów	Lignite	5 030	37.1	0
DE 1606	RWE	DE	Neurath	Lignite	4 168	32.1	– 1
DE 1649	RWE	DE	Niederaußem	Lignite	3 430	27.3	0
DE 1456	Vattenfall	DE	Jänschwalde	Lignite	2 790	23.3	– 4
DE 1607	RWE	DE	Weisweiler	Lignite	1 800	18.1	8
GB 381	Drax	UK	Drax Power Station	Hard coal, biomass	3 870	13.2	– 21
IT 521	ENEL	IT	Brindisi Sud	Hard coal	2 428	13.1	10
DE 1459	Vattenfall	DE	Schwarze Pumpe	Lignite	1 500	12.2	6
PL 4	ENEA	PL	Kozienice	Hard coal	2 919	11.4	4
BG 50	TPP	BG	Maritsa East 2	Lignite	1 473	11.3	10
DE 1454	Vattenfall	DE	Boxberg Werk IV	Lignite	1 497	10.8	2
IT 439	ENEL	IT	Torrevaldaliga Nord	Hard coal	1 821	10.7	– 1
GR 15	ΔEH AE	GR	Dimitrios	Lignite	1 456	10.6	– 11
DE 1460	Vattenfall	DE	Lippendorf	Lignite	1 750	10.3	– 14
GR 14	ΔEH AE	GR	Kardia	Lignite	1 110	8.9	4
PT 100	EDP	PT	Sines	Hard coal	1 192	8.7	17
SK 150	US Steel	SK	Košice	Blast furnace gas	277	8.6	– 4
DE 1453	Vattenfall	DE	Boxberg Werk III	Lignite	930	8.6	7
GB 145	EDF	UK	West Burton Power Station	Hard coal	2 012	7.7	– 16
PL 3	PGE	PL	Turów	Lignite	1 488	7.6	– 7
ES 201	Hidrocantábrico SA	ES	Aboño 1	Hard coal	843	7.5	11
ES 647	Endesa	ES	Puentes	Lignite	1 403	7.5	9
GB 593	Scottish Power	UK	Longannet Power Station	Hard coal	2 400	7.5	– 19
DE 1380	Großkraftwerk Mannheim	DE	Mannheim	Hard coal	1 115	7.3	18
FR 956	ArcelorMittal	FR	Dunkerque	Blast furnace gas	250	7.2	– 7
EE 2	Eesti Elektrijaam	EE	Narva	Oil shale	1 610	7.1	– 27
GB 202	EDF	UK	Cottam	Hard coal	2 008	6.8	– 24
GB 188	RWE	UK	Aberthaw	Hard coal	1 586	6.7	11
PL 6	EDF	PL	Oddział w Rybniku	Hard coal	1 555	6.5	– 10
ES 43	Endesa	ES	Litoral	Hard coal	1 066	6.4	29

Note: The classification of combustion plants is based on the activity code reported in the EUTL.

Sources: Platts, 2014; EU, 2016.

Germany and Poland account for the majority of the 30 highest emitters in the power sector. The largest emitter of all EU ETS installations is the lignite-fired power plant in Bełchatów, Poland. Following the construction of a new block in 2011, it has an installed capacity of 5 GW, and is thus the second largest power plant in the world. Bełchatów power plant emits 37 Mt CO_2-eq. per year to produce 34 TWh electricity, which is about 22 % of national electricity production in Poland ([7]). The emissions intensity is 1 069 g CO_2/kWh. Together with the power plants in Kozienice (hard coal), Turów (lignite) and Oddział w Rybniku, Polish power plants account for 17 % of total emissions on this top 30 list. Bełchatów is followed in the ranking by four German lignite-fired power plants: Neurath, Niederaußem, Jänschwalde and Weisweiler. Together, these plants emitted 101 Mt CO_2-eq. in 2015, and generated 87.3 MWh electricity, which is about 13 % of total generation in Germany ([8]). The nine German power plants (eight out of them lignite fired) were together responsible for 41 % of the total emissions from this top 30.

In 2015, the United Kingdom accounted for 12 % of the total emissions of the top 30 highest emitting power installations. Four of the five United Kingdom hard coal plants showed a significant decline in emissions in 2015 compared with the previous year (Table 1.1). This reflects the lower electricity generation from hard coal in the United Kingdom as a result of a decline in the profitability of coal-fired power plants. For example, Scottish Power closed the Longannet hard coal power station in March 2016 because of a combination of old age, high transmission costs and high CO_2 taxes (Macalister, 2016); this power station ranked 23rd in 2015. This is, in turn, explained by a variety of economic and policy-related factors, such as lower gas prices and higher carbon taxes, in particular a carbon price floor introduced at the national level.

This trend is consistent with the country's declared intention to phase out unabated coal-fired power stations by 2025 (as long as security of electricity supplies is maintained). The decline in emissions can also be attributed to the conversion of some coal-powered plants to enable them to use biomass. For example, Drax power station has achieved emission reductions by converting two of its units from coal to biomass. A third unit has been 85 % converted, with completion awaiting a decision by the European Commission on whether or not state aid rules have been breached (BBC News, 2016).

The industrial sectors accounting for the highest emissions are the iron and steel sector and the refinery sectors (see Table 1.2).

In 2015, the iron and steel sector accounted for 59 % of total emissions by the 30 highest emitting industrial plants (i.e. all non-combustion EU ETS installations) (Table 1.2, activity type code 24). This relatively high proportion reflects the emission-intensive nature of iron and steel production (i.e. the smelting of iron ores in blast furnaces in order to produce molten steel). The decline in emissions in several installations in 2015 coincided with downward pressure on profit margins, primarily due to a slowdown in the Chinese economy (which accounts for approximately half of the world's production of steel). The resulting oversupply on world markets is jeopardising the financial viability of several plants in Europe. For example, the emissions of the Teesside Integrated Iron and Steel Works declined by 31 % in 2015 (compared with the previous year) as a result of the partial closure of the plant on 18 September 2015. The owners of the plant, SSI, cited the decline in world steel prices and United Kingdom operating costs for the decision to 'pause' production (Tighe and Pooler, 2015).

In 2015, refineries accounted for 28 % of all emissions by the 30 highest emitting industrial plants in the EU ETS. In contrast to the iron and steel sector, in the majority of European refineries listed in Table 1.2 (activity type code 21) emissions increased from 2014 to 2015. This reflects the increase in the average utilisation rates for European refineries to 85 % in 2015 as a consequence of increased global demand for refinery products (Petrosyan, 2016). The recent drop in the oil price has led to European refineries earning higher margins, which is likely to have led to increased production and therefore higher emissions. Weak crude prices have brought some relief to a European refining sector presently under significant pressure from increased complex refining capacity in the Middle East, Far East and Russia (S&P Global Platts, 2015).

([7]) https://www.elbelchatow.pgegiek.pl/index.php/o-oddziale/ (accessed 26 May 2016). ENTSO-E data suggest 32 TWh electricity production (including gap filling by the Öko-Institut) (ENTSO-E, 2016).

([8]) Based on transparency data published by ENTSOE with gaps filled by the Öko-Institut (ENTSO-E, 2016).

Table 1.2 Top 30 emitters in 2015 (industrial plants, excluding combustion only)

EUTL ID	Company	Country code	Installation	Activity type code	Emissions 2015 (Mt CO_2-eq.)	Change vs. 2014 (%)
AT 16	Voestalpine Stahl GmbH	AT	Voestalpine Stahl Linz	24	8.7	0
DE 69	Thyssenkrupp Steel Europe Ag	DE	Integriertes Hüttenwerk Duisburg	24	8.2	3
FR 628	Arcelormittal	FR	Arcelormittal Méditerranée	24	7.9	– 1
GB 325	Tata Steel UK Limited	UK	Port Talbot Steelworks	24	7.6	– 9
IT 575	Sarlux Srl	IT	Impianti Di Raffinazione	21	6.6	15
HU 142	Mátrai Erõmû Zrt.	HU	Rt. Visontai Eromu	27	6.4	– 1
IT 515	Ilva SPA	IT	Stabilimento Di Taranto	24	6.3	– 16
NL 144	Tata Steel Ijmuiden BV	NL	Tata Steel Ijmuiden Bv Bkg 1	24	6.2	6
ES 212	Arcelormittal España, SA	ES	Arcelormittal España, SA	24	5.9	19
GB 321	Longs Steel UK Limited	UK	Scunthorpe Integrated Iron & Steel	22	5.7	10
DE 53	Hüttenwerke Krupp Mannesmann GmbH	DE	Glocke Duisburg	24	4.8	2
DE 52	Rogesa Roheisengesellschaft Saar Mbh	DE	Roheisenerzeugung Dillingen	24	4.5	5
NL 99	Shell Nederland Raffinaderij BV	NL	Shell Nederland Raffinaderij BV	21	4.3	1
GB 1263	Sahaviriya Steel Industries Uk Ltd	UK	Teesside Integrated Iron & Steel	24	4.1	– 31
DE 19	Pck Raffinerie GmbH	DE	Pck Raffinerie Glocke Schwedt	21	4.0	8
BE 203912	Arcelormittal Belgium	BE	Arcelormittal Gent 1	22	4.0	– 2
DE 43	Salzgitter Flachstahl GmbH	DE	Glocke Salzgitter	24	4.0	– 4
FI 445	Ssab Europe Oy	FI	Raahen Terästehdas	24	3.9	4
BE 127	Total Raffinaderij Antwerpen	BE	Total Raffinaderij Antwerpen	21	3.8	4
DE 4	Ruhr Oel GmbH	DE	Werk Scholven — CO_2-Glocke	21	3.2	– 5
AT 13	Voestalpine Stahl Donawitz GmbH	AT	Sinteranlage, Hochöfen	24	3.0	6
IT 180	Eni SPA	IT	Raffineria Di Sannazzaro	21	2.8	6
CZ 73	Arcelormittal Ostrava AS	CZ	Arcelormittal Ostrava AS	24	2.8	– 1
AT 26	Omv Refining & Marketing GmbH	AT	Raffinerie Schwechat	21	2.8	3
DE 60	Arcelormittal Bremen GmbH	DE	Einheitliche Anlage Bremen	24	2.8	15
LT 18	Ab Achema	LT	Amoniako Paleidimo Katilinės	41	2.8	1
GB 86	Esso Petroleum Company Limited	UK	Esso Petroleum Company Ltd	21	2.7	0
FR 253	Total Raffinage France	FR	Raffinerie De Normandie	21	2.7	– 3
PL 362	Polski Koncern Naftowy Orlen SA	PL	Rafineria	21	2.6	15
FI 533	Neste Oil Oyj	FI	Porvoon Jalostamo	21	2.6	– 5

Note: The classification of industrial plants is based on the activity codes as reported in the EUTL.

Sources: Platts, 2014; EU, 2016.

1.1.2 *Supply of and demand for allowances*

Verified emissions from stationary installations declined slightly between 2014 and 2015; however, verified emissions were importantly higher than the overall supply of allowances in 2015. Recent development of the EU ETS are summarised in Table 1.3, which shows how verified emissions and the supply of allowances developed between 2014 and 2015. As a consequence, stationary installations exhibited a negative balance in 2015, which was one of the factors contributing to the increased EUA price on auctioning platforms in 2015 relative to 2014.

Table 1.3 Summary of EU ETS developments, 2014–2015 (stationary installations)

	2014	2015	Change (%)
Verified emissions (Mt CO_2-eq.)	**1 813.6**	**1 800.4**	**– 0.7**
Combustion emissions	1 237.1	1 225.4	– 0.9
Industrial emissions	576.4	575.0	– 0.3
Total supply of allowances (millions of EUAs) ([a])	**1 821.4**	**1 517.7**	**– 16.7**
Free allocation (incumbents, new entrants)	830.8	792.7	- 4.6
For existing installations	817.2	778.5	– 4.7
For new entrants and capacity extensions	13.6	14.2	+ 4.2
Transitional free allocation for electricity generation	103.5	78.1	– 24.5
Auctioned amounts/primary market sales ([b])	631.4	624.8	– 1.0
International credits exchanged	255.6	22.2	– 91.3
Supply/demand balance (millions of EUA)			
Annual balance all ETS	– 8.0	– 300.6	+ 3 679
Balance stationary installations only	7.8	– 282.6	
Net demand in EUAs from aviation ([c])	– 15.8	– 18.0	+ 14
Cumulated surplus (since 2008) ([d])	2 073.2	1 772.6	– 14.5
EUA price (EUR) ([e])	**5.9**	**7.6**	**+ 29.2**

Notes: ([a]) Free allocation for existing installations is provided under Article 10a(1) of the ETS Directive. Free allocation for new entrants and capacity extensions is provided under Article 10a(7) of the ETS Directive. Transitional free allocation for modernising electricity generation (in Eastern European Member States) is provided under Article 10c of the ETS Directive.

([b]) The annual volumes of allowances auctioned/sold on the primary market presented in this table were attributed by the EEA to the years from which they arose. For 2014 and 2015, this operation concerns Croatia and NER300 ([9]) allowances. Croatia started auctioning only in 2015: the volumes sold in 2015 corresponding to 2013 and 2014 are attributed to the appropriate years (4.9 million EUAs to 2013 and 3.012 million EUAs to 2014). The second tranche of NER300 sales (100 million EUAs sold at the end of 2013/beginning of 2014) is attributed to 2014. Therefore, the total volumes presented do not correspond to the volumes that were effectively released to the market each year and to the numbers produced by the auctioning platforms. The volumes of allowances effectively released to the market in 2014 and 2015 were 601.3 and 632.7 million EUAs, respectively. For more details, see Table 2.1 in Section 2.1.2.

([c]) See Table 2.4 for details on the supply of and demand for allowances in the aviation sector.

([d]) The cumulative surplus refers to the build-up of unused allowances. This differs from the TAiC, which also takes into account the additional surplus held back in the MSR (i.e. back-loaded allowances).

([e]) The EUA price is based on the average annual price of primary market sales from the EEX and ICE trading platforms. The auctioning/primary market sales include adjustments for Croatia and the NER300 (see above).

Sources: EU, 2009a; EEA/EU ETS Data viewer, 2016; EEX, 2016; ICE, 2016.

([9]) NER300 is a funding programme for low-carbon energy demonstration projects, concerning in particular environmentally safe carbon capture and storage (CCS) and innovative renewable energy (RES) technologies on a commercial scale within the European Union. It is funded from the sale of 300 million emission allowances from the New Entrants' Reserve (NER) set up for the third phase of the EU ETS. The funds from the sales are to be distributed to projects selected through two rounds of calls for proposals, covering 200 and 100 million allowances respectively.

The total supply of 1 518 million allowances in 2015 comprised free allocation, allowances auctioned ([10]) and exchange of international credits (certified emission reductions (CERs) and emission reduction units (ERUs)) ([11]).

The supply of total allowances allocated for free (without transitional allocation for the modernisation of electricity generation) was 4.6 % lower in 2015 than in 2014. There have been changes in allocation to both existing installations and new entrants. Free allocation to existing installations is declining every year depending on the cross-sectoral correction factor or the linear reduction factor of that year as well as the carbon leakage status relevant for allocation ([12]). Furthermore, some of the free allowances normally allocated to existing installations under Article 10a(1) of the ETS Directive were not in fact allocated as a result of installation closures or reductions in production levels.

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

Additionally, there was a noticeable reduction in the number of transitional allowances allocated to combustion installations in eligible eastern European Member States to enable them to modernise their electricity generation (Article 10c of the ETS Directive; see also Sections 2.1.2 and A2.2 in Annex 2).

The number of allowances sold in the primary market in 2015 was unchanged from the previous year. This resulted from opposing effects of similar magnitude:

- Back-loading postponed the auctioning of 900 million allowances until 2019–2020 (EU, 2014a). These allowances are to be removed gradually; the largest withdrawal of allowances (400 million) was in 2014, followed by a smaller removal, of 300 million allowances, in 2015; removal of 200 million allowances is scheduled for 2016. It has subsequently been decided that these allowances will not re-enter the market as originally planned under the back-loading decision but will instead be transferred to the MSR (EU, 2015).
- The volumes to be auctioned will be reduced as a result of the annual linear reduction in the EU ETS cap in 2015 compared with 2014.
- However, in 2015, no selling took place in the primary market of allowances under the NER300. For comparison, over 2013 and 2014, 300 million allowances from the NER were sold in the primary market by the European Investment Bank (EIB) to fund innovative low-carbon energy projects (EIB, 2014b).
- The use of international credits was greatly reduced, by 91 %, in 2015 compared with the previous year as the budget for CER/ERU use until 2020 (see Article 11a(8) of the ETS Directive) has been nearly entirely used up (see also Sections 2.1.2 and A2.6 in Annex 2).

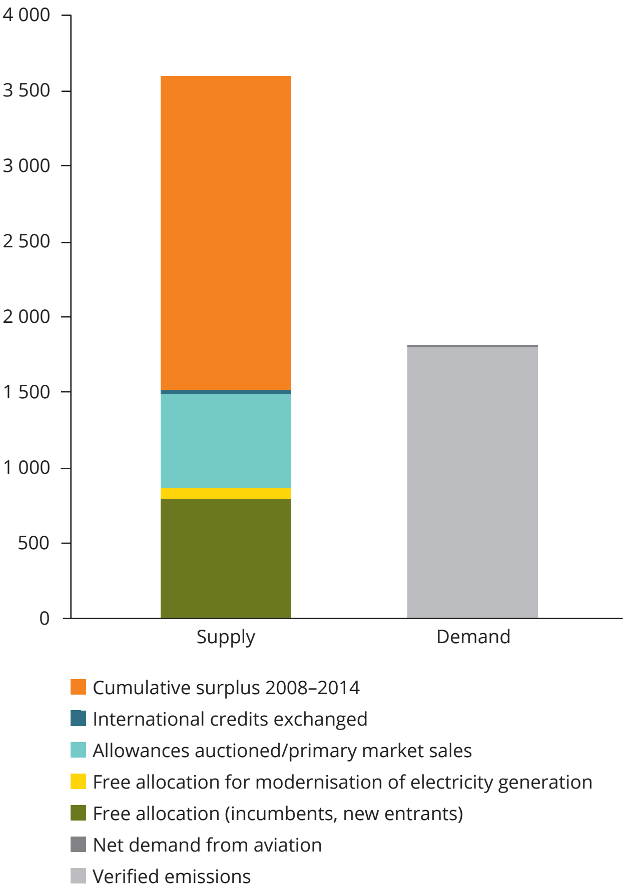
The demand was made up of 1 800 Mt CO_2-eq. from stationary installations (total verified emissions) and a net demand of 18 Mt CO_2-eq. from aviation (see Section 1.2.2). In 2015, verified emissions declined by 0.7 % compared with the previous year (i.e. at a slower rate than the decline in the supply of total allowances). As a consequence, the cumulated surplus of allowances in the EU ETS declined in 2015. A surplus remains though, equivalent in size to 1 year's worth of EU ETS emissions, which continues to undermine the price signal (Figure 1.3).

Looking at the balance by main activity type, the installations covered by the EU ETS as a result of their combustion activities had to buy most of their allowances to cover their emissions through primary market sales, from other market participants or through the purchase of international credits (see Figure 1.4). The limited number of free allowances distributed to combustion installations reflects the low risk of carbon leakage associated with this activity, i.e. the lack of international competition, in particular for electricity generation. Under Article 10a(4) of the ETS Directive, electricity generators are eligible for free allowances only for heat production. Furthermore, electricity generators in certain countries are eligible for transitional free allowances under Article 10c of the ETS Directive, to enable them to modernise the electricity system.

By contrast, the free allowances received by the other industrial installations in 2015 were higher than their verified emissions. The higher share of free allocation

([10]) There were no primary market sales in 2015. In other years they included, for example, the NER300 sales.
([11]) For more information on the cap and its components please refer to Annex 2.
([12]) Power generators have been required, since 2013, to buy all their allowances, with exceptions made for some countries. Manufacturing industry received 80 % of its allowances free in 2013. This proportion will decrease gradually year on year, down to 30 % in 2020. Sectors and subsectors facing competition from industries outside the EU that are not subject to comparable climate legislation will receive more free allowances than those that are not at risk of carbon leakage.

Figure 1.3 Supply and demand balance, 2015

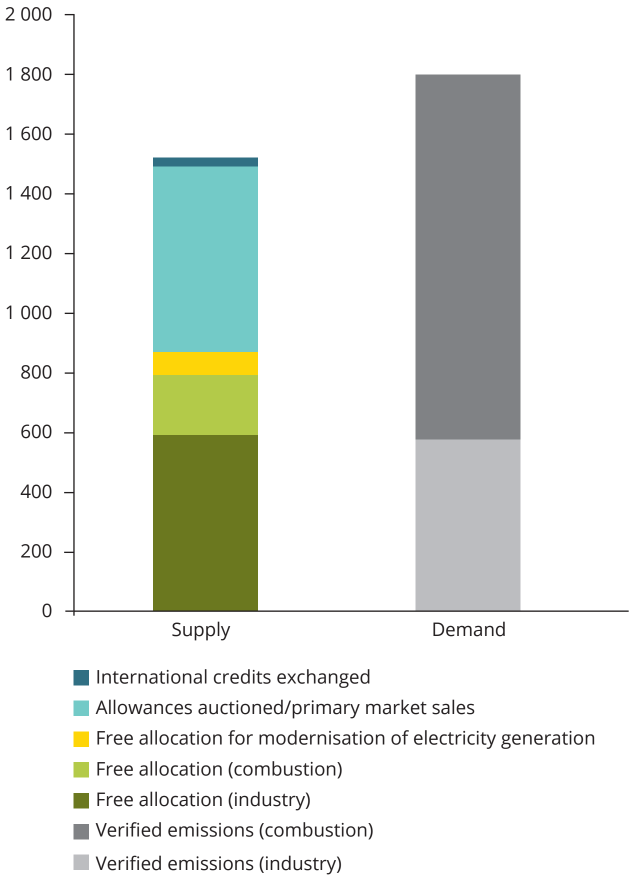


Notes: The annual volumes of allowances auctioned/sold on the primary market presented in this figure were attributed by the EEA to the years from which they arose. For 2015, this operation concerns Croatia. Croatia started auctioning only in 2015: the volumes sold in 2015 corresponding to 2013 and 2014 are attributed to the appropriate years (4.9 million EUAs to 2013 and 3.012 million EUAs to 2014) and are therefore deducted from the 2015 volumes. The total volume of allowances effectively released to the market in 2015 was 633 million EUAs via auctions. See Table 2.1 in Section 2.1.2 for more details.

The cumulative surplus refers to the build-up of unused allowances. This differs from the total number of allowances in circulation (TAiC), which also takes into account the additional surplus held back in the MSR (i.e. back-loaded allowances).

Sources: EC, 2014g, 2015j, 2016; EEA/EU ETS Data viewer, 2016.

Figure 1.4 Supply and demand balance, combustion and industry, 2015



Note The annual volumes of allowances auctioned/sold on the primary market presented in this figure were attributed by the EEA to the years from which they arise. For 2015, this operation concerns Croatia. Croatia started auctioning only in 2015: the volumes sold in 2015 corresponding to 2013 and 2014 are attributed to the appropriate years (4.9 million EUAs to 2013 and 3.012 million EUAs to 2014) and are therefore deducted from the 2015 volumes. The total volume of allowances effectively released to the market in 2015 was 633 million EUAs via auctions. See Table 2.1 in Section 2.1.2 for more details.

The balance of supply and demand is slightly overestimated for the industrial sector, and underestimated in the combustion sector, as a result of the way in which verified emissions are reported (see note to Figure 1.5).

Sources: EC, 2014g, 2015j, 2016c; EEA/EU ETS Data viewer, 2016.

to industry reflects concerns about the exposure of industrial sectors to international competition. In 2015, most free allowances to industrial installations under Article 10a(1) of the ETS Directive were distributed by applying harmonised allocation rules that were based on EU ETS-wide benchmarks and on historical production levels as well as whether or not the sector is on the carbon leakage list (see Section A2.2 in Annex 2).

For a number of industrial activities, verified emissions were lower than freely allocated allowances in 2015 (see Figure 1.5). This was the case for iron and steel (27 % more allowances than verified emissions), cement and lime (6 % more allowances than verified emissions), pulp and paper (19 % more allowances than verified emissions) and chemicals (5 % more allowances than verified emissions). In 2015, overall, freely allocated allowances were less than verified emissions in installations in only two industrial activities: in refineries allowances were 21 % lower than verified emissions, and in installations producing metals other than iron and steel allowances were 23 % lower than verified emissions (Figure 1.5).

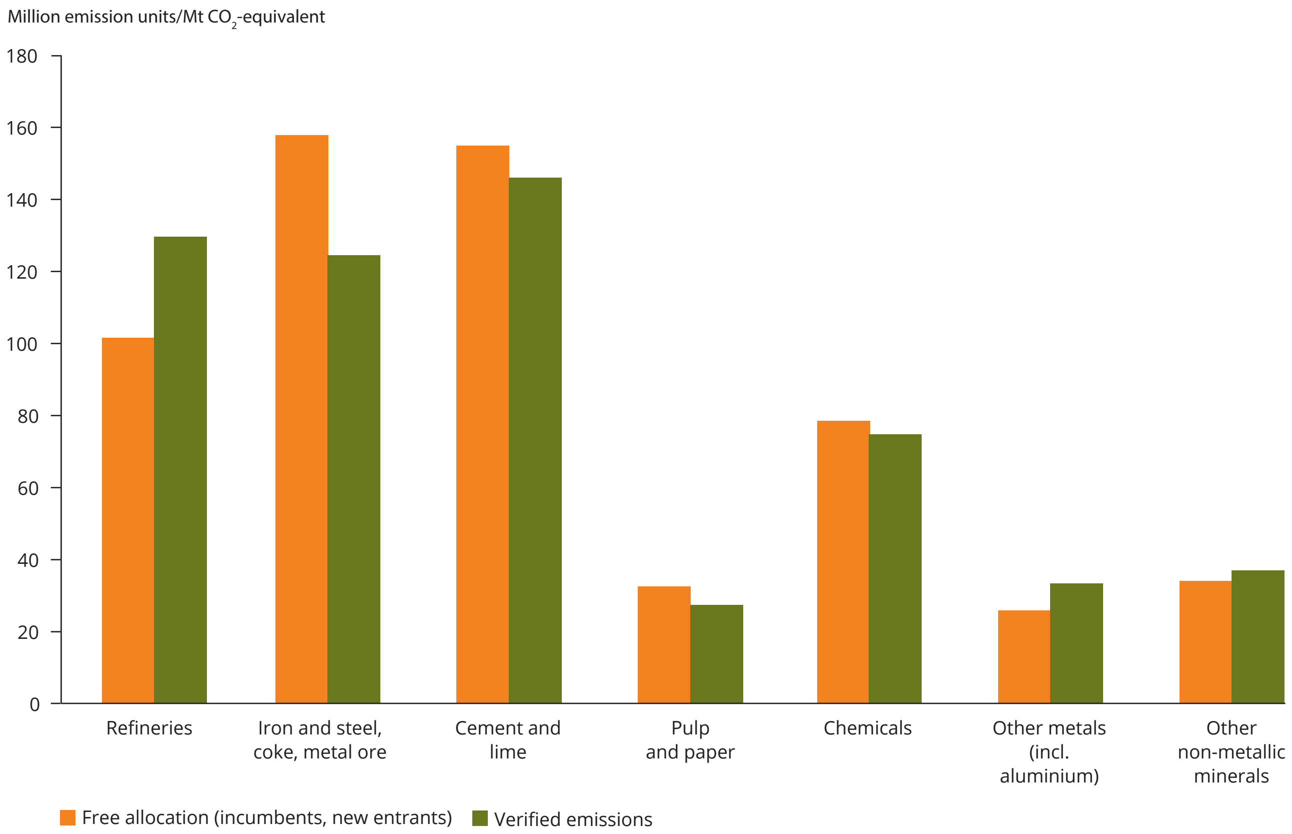
1.2 Aviation

1.2.1 Emission trends

In 2015, the aviation sector covered by the EU ETS emitted 57 Mt CO_2-eq., which represents an increase of 4 % over the previous year. For the period from 2013 through 2016, only flights within the European Economic Area are covered by the EU ETS ([13]). The seven largest aircraft operators were responsible for 44 % of these emissions (see Figure 1.6). Ryanair and EasyJet were the two highest emitters in the aviation sector in 2015, accounting for 13 % and 8 % of total aviation emissions, respectively. Lufthansa accounted for 7 % of total aviation emissions, followed by British Airways, Air France, Scandinavian Airlines System (SAS) and Norwegian Air Shuttle (all on 4 %).

In 2015, verified emissions by Ryanair and EasyJet increased by 11 % and 6 %, respectively, in comparison with 2014 (see Figure 1.7). The increases were mostly due to the growth in passenger numbers in both cases

Figure 1.5 Supply and demand balance, industrial sectors, 2015



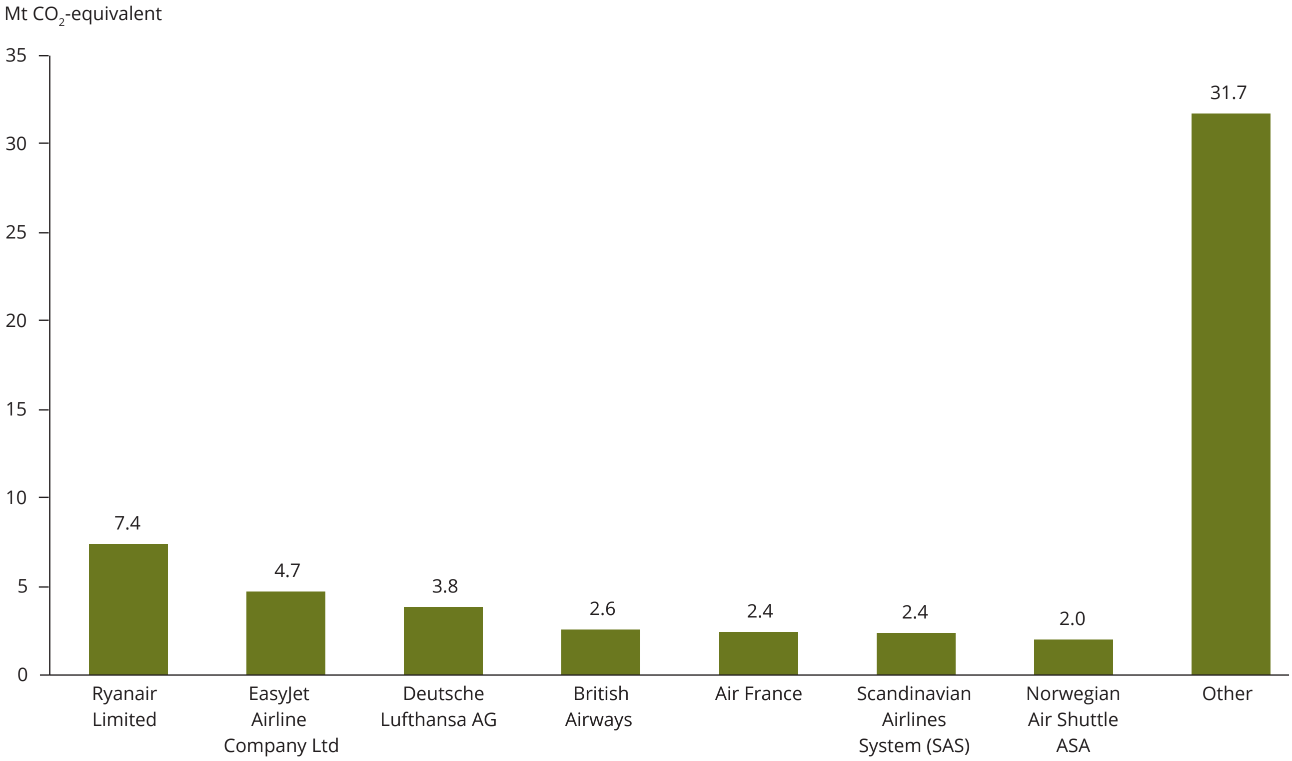
Note: EUTL activity codes have been aggregated for certain sectors (see Table A1.1 for more information).

The overall allocation presented here for the iron and steel sector includes allowances for emissions which are actually reported under combustion installations, for example if blast furnace gas is burnt in power plants. Likewise, albeit to a lesser extent, the allocations presented for the pulp and paper sector and the chemical sector include allowances related to emissions reported under combustion installations, for example if paper production or chemical facilities buy heat from other installations. In other words, allowances are allocated to these sectors, whereas corresponding emissions are reported under the combustion sector.

Source: EEA/EU ETS Data viewer, 2016.

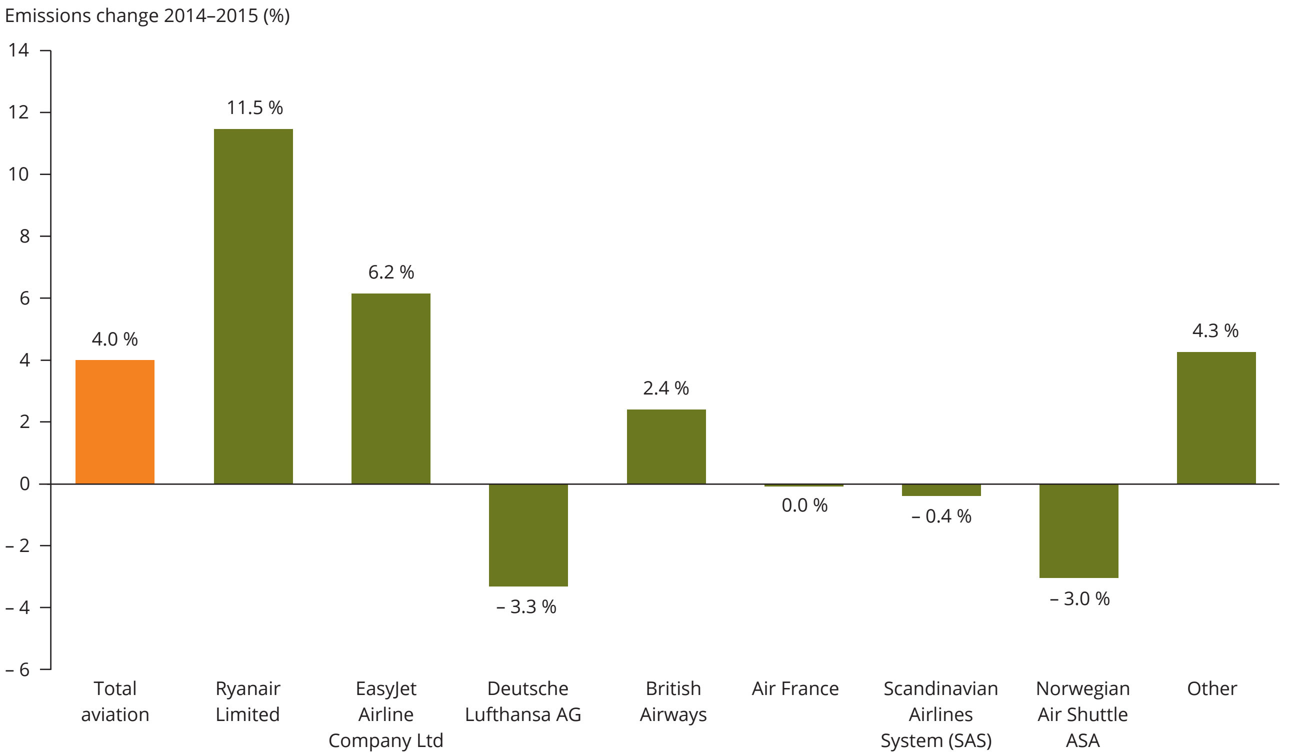
([13]) Flights between continental EEA and its outermost regions are also exempt, e.g. flights between mainland Europe and the Canary Islands (refer to Section A1.2 in Annex 1).

Figure 1.6 ETS aviation emissions by carrier, 2015



Source: EEA/EU ETS Data viewer, 2016.

Figure 1.7 Relative change in ETS aviation emissions, 2014–2015



Source: EEA/EU ETS Data viewer, 2016.

(+ 11 % for Ryanair, up to 90.6 million (Ryanair, 2015), and + 6 % for EasyJet, up to 68.6 million (EasyJet, 2015)). Based on past research, in terms of fuel efficiency, both companies tend to perform better than 'legacy' airlines that continue to operate older aircraft (Cranfield University, 2008).

Indeed, in response, several legacy airlines have created their own budget subsidiaries in order to stem losses in their short-haul operations. This may partly explain the 3 % decline in verified emissions for Deutsche Lufthansa, which transferred flights to its Germanwings subsidiary in 2015 (Lufthansa News, 2015). Interestingly, Norwegian Air Shuttle increased passenger numbers in 2015, to 25.8 million (from 24 million in 2014) whilst also reducing emissions by 3 % (Norwegian Air Shuttle ASA, 2015). The airline was recently named the most fuel-efficient airline on transatlantic routes by the International Council for Clean Transportation (2015) and attributes recent reductions in emissions to the investment in new aircraft with an average fleet age of only 3.6 years as of January 2016 ([14]).

1.2.2 Supply of and demand for allowances

In 2015, aviation emissions covered by the EU ETS increased by 4 % compared with the previous year. At the same time, the supply of European Union Aviation allowances (EUAAs) and the estimated use of international credits remained stable. As a consequence, the net demand for allowances increased to 18 million in 2015, requiring the aviation sector to purchase EUAs from the stationary sector in order to comply with its emissions cap (see Table 1.4).

Table 1.4 Summary of EU ETS developments in the aviation sector, 2014–2015

	2014	2015	Change (%)
Total demand (Mt CO_2-eq.)	**54.8**	**57.0**	**+ 4**
Aviation emissions	54.8	57.0	+ 4
Total supply (millions of EUAAs)	**39.0**	**39.0**	**0**
Aviation allocation	32.3	32.3	0
Auctioned amounts ([a])	5.4	5.4	0
International credits exchanged	1.3	1.3	0
Annual supply–demand balance (millions of EUAAs)	**15.8**	**18.0**	**+ 14**
EUAA price (EUR) ([b])	**5.8**	**7.3**	**+ 24**

Notes: ([a]) The annual volumes of auctioned allowances presented in this table were attributed by the EEA to the years in which they arose rather than to the year in which they were actually auctioned (EEA, 2016b). Auctions of aviation allowances were suspended after the 'Stop the clock' decision taken in 2012. The allowances attributable to 2013, 2014 and 2015 were all auctioned in 2015 (EC, 2015a). The volumes of aviation allowances effectively released to the market in 2014 and 2015 were 9.3 and 16.4 million EUAs, respectively. For more details, see Table 2.3 in Section 2.2.2.

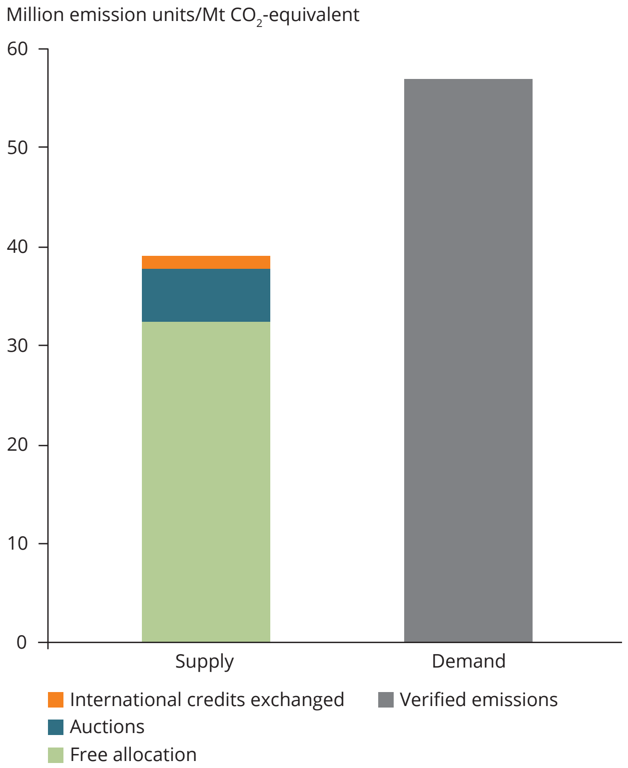
([b]) EUAA price based on average annual price, derived from auction prices in EEX and ICE reports. Primary market sales of EUAAs were done only through auctions.

Sources: EEA/EU ETS Data viewer, 2016; EEX, 2016; ICE, 2016.

([14]) http://www.norwegian.com/uk/about/company/corporate-responsibility/environment/ (accessed May 2016).

For 2015, aircraft operators were allocated 32 million EUAAs free of charge, and an additional 5.4 million EUAAs were auctioned. These allowances covered 66 % of the total aviation emissions (57 Mt CO_2-eq.). The difference in allowances necessary for compliance had to be purchased on the carbon market (Figure 1.8). Aircraft operators can use allowances from the stationary sector (EUAs) to comply with their legal obligation (but, conversely, stationary installations cannot use EUAAs for compliance). Furthermore, aircraft operators are allowed to exchange (a limited number of) international credits for EUAAs and to surrender these.

Figure 1.8 Supply and demand balance for aviation in 2015



Note: The annual volumes of auctioned allowances presented in this table were attributed by the EEA to the years in which they arose rather than to the year in which they were actually auctioned (EEA, 2016b). The volumes of allowances attributable to 2013, 2014 and 2015 (and to 2012 in the case of Poland) have been deducted from the volumes actually auctioned in 2015 (EC, 2015a). The volume of aviation allowances effectively released to the market in 2015 was 16.4 million EUAs. For more details, see Table 2.3 in Section 2.2.2.

International credit exchange is estimated to amount to 96 % of entitlements (i.e. average use of entitlements in the stationary sector and aviation).

Sources: EC, 2014g, 2015j, 2016c; EEA/EU ETS Data viewer, 2016.

2 Long-term trends

This chapter discusses stationary installations and aviation separately, focusing first on the development of emission trends between 2005 and 2015 and, second, on the implications for the supply of and demand for allowances. Given that aircraft operators can purchase allowances from stationary installations, there is a degree of interaction between stationary installations and aviation, and this is discussed throughout the chapter.

2.1 Stationary installations

In the second trading period, the number of allowances available (based upon the national allocation plans (NAPs) of the Member States in advance) was considerably greater than verified emissions, leading to an increase in the cumulative surplus (Figure 2.1). The cumulative surplus was the result of both lower than expected production levels following the economic crisis and the increased use of international credits (especially towards the end of the second trading period). The increase in the cumulative surplus coincided with the declining trend in the EUA price, from around EUR 15 to under EUR 5 per tonne CO_2-eq. However, partly as a consequence of policy interventions (i.e. back-loading of allowances and the MSR), the cumulative surplus stabilised in 2014 and actually declined in 2015, coinciding with a rise in the EUA price.

2.1.1 Emission trends

Stationary EU ETS emissions decreased from 2 377 Mt CO_2-eq. ([15]) to 1 800 Mt CO_2-eq. between 2005 and 2015. This is equivalent to a 24 % decrease during this period (see Figure 2.2). During the third trading period (between 2013 and 2015), emissions decreased by 6 %. The cap on stationary installations to be achieved by 2020, set at 1 816 Mt CO_2-eq., was already reached in 2014 ([16]).

Changes in emissions depend on changes in both activity levels and the emission intensity of production, both of which are likely to be influenced by policy (i.e. the ETS, Renewables Directive (EU, 2009b), Energy Efficiency Directive (EU, 2006)) and non-policy factors (i.e. economic shocks, oversupply of commodity markets, etc.), which makes it difficult to ascertain the extent to which emission reductions are attributable to the EU ETS.

Combustion-related emissions, which accounted for 68 % of total EU ETS emissions in 2015, depend directly on primary energy consumption levels and fuel mix:

- Primary energy consumption depends on the demand for energy by end users (i.e. electricity consumption by households and industry), transformation efficiency and overall economic activity. The last was directly affected by the extraordinary economic situation during the second trading period. Climatic conditions play an important role in annual variations in energy consumption for heating, and therefore of emissions. However, the impact of this factor is less relevant over a longer period, as it is not cumulative. Policies promoting energy efficiency also have a direct impact on energy consumption.
- The fuel mix used to transform primary energy into electricity or heat is also a determinant. It depends on energy infrastructures and is affected by relative variations in fuel prices. Energy policies also play a key role in modifying fuel mixes, for example by promoting the deployment of renewable energy sources (EEA, 2014).

([15]) Taking into account an EEA estimate of additional emissions for the period 2005–2012 in order to reflect the scope of the EU ETS for the current trading period, from 2013 to 2020.
([16]) Emissions may actually vary year on year, especially given the possibility that market entrants may choose to bank surplus allowances. Additional allocation can also be provided to new entrants from the NER.

Figure 2.1 Emissions, allowances, surplus and carbon price in the EU ETS, 2005–2015

Note: Verified emissions and allocations were adjusted to reflect the latest scope of the EU ETS in the third trading period (see Table A2.3 in Annex 2).

The supply of allowances presented takes into account a redistribution by the EEA of annual volumes of allowances auctioned/sold on the primary market, from the year in which they were released to the market to the years in which they arose. For example, the volumes of allowances relative to the second trading period (2008–2012) but sold/auctioned in the first months of 2013 are added here to the 2012 figures. For more details, see Tables 2.1 and 2.2, and Section 2.1.2.

The average EUA price represents historic spot price data from the secondary market in the first and second trading periods. In the case of 2008, EUA spot prices only for the second trading period are considered in the calculation of the average. In the third trading period the EUA price refers to primary market auctioning clearing prices from the EEX and ICE trading platforms.

The break in the EUA price between 2007 and 2008 reflects the absence of banking provisions between the first and second trading periods. However, trade in future EUA contracts did take place during this time period (see Figure 2.11).

The cumulative surplus refers to the build-up of unused allowances (including net demand from aviation). This differs from the TAiC, which also takes into account the additional surplus held back in the MSR (i.e. back-loaded allowances).

Sources: Point Carbon, 2012; EEA, 2016a; EEA/EU ETS Data viewer, 2016; EEX, 2016; ICE, 2016.

Emissions from activities other than combustion are generally more strongly linked with economic activity/production levels than are combustion-related emissions (EEA, 2015c).

In the first trading period (between 2005 and 2007), EU ETS emissions increased by 1 %. Nevertheless, research findings suggest that in both 2005 and 2006 GHG emissions were between 2.5 % and 5 % lower than they would have been had the EU ETS not been in place (Ellerman and Buchner, 2008).

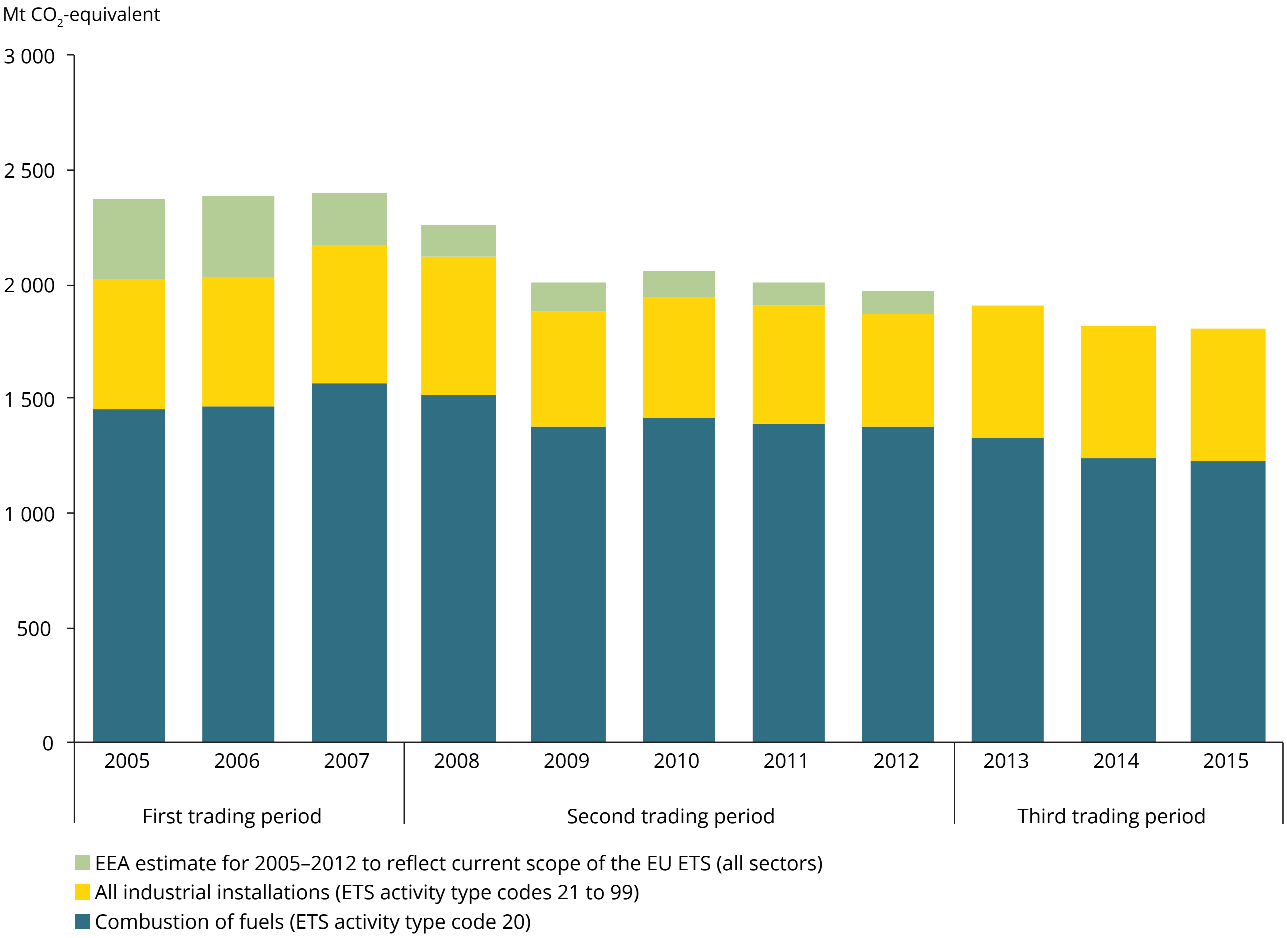
In the second trading period, emissions in the EU ETS fell below 2005 levels by 5 % in 2008, and by 17 % in 2012. The impact of the economic recession on this trend made it more difficult to evaluate the direct impact of the EU ETS on GHG abatement (Gloaguen and Alberola, 2013). Nevertheless, Egenhofer et al. (2011) estimate an emissions abatement for the first 2 years of the second trading period of 3 %, which is slightly higher than other estimates found in the literature (Cooper, 2010).

According to a review of the literature conducted by Arlinghaus (2015), numerous studies have quantified the abatement attributable to the EU ETS. The rate of abatement in these studies varies depending on the coverage of countries and sectors, as well as on the data and methodology applied. The interaction between the EU ETS (as an economic policy instrument) and other policies also makes it difficult to identify the specific role of each factor, and particularly the role played by the EU ETS in overall emission reductions, compared with the role of other policies.

Energy

Between 2005 and 2014, which is the latest year for which statistics on electricity generation are available, verified emissions for the EU-25 declined by 21 % while electricity generation declined to a lesser extent over the same time period (Figure 2.3). The reduction in emissions was largely the result of changes in the mix of fuels used to produce heat and electricity: while the use of hard coal and lignite fuels in electricity generation declined between 2005 and 2014 (by 21 % and 9 %, respectively) and electricity generation from nuclear power declined by 13 %, the generation of electricity from renewables increased by 84 % (i.e. from 498 TWh in 2005 to 916 TWh in 2014). The Renewable Energy Directive is likely to have encouraged the uptake in renewables, which was also driven by reductions in technology costs. The reduction in emissions may also have benefited from improvements in transformation efficiency for thermal electricity generation, which means that less primary energy was needed to generate the same quantity of electricity.

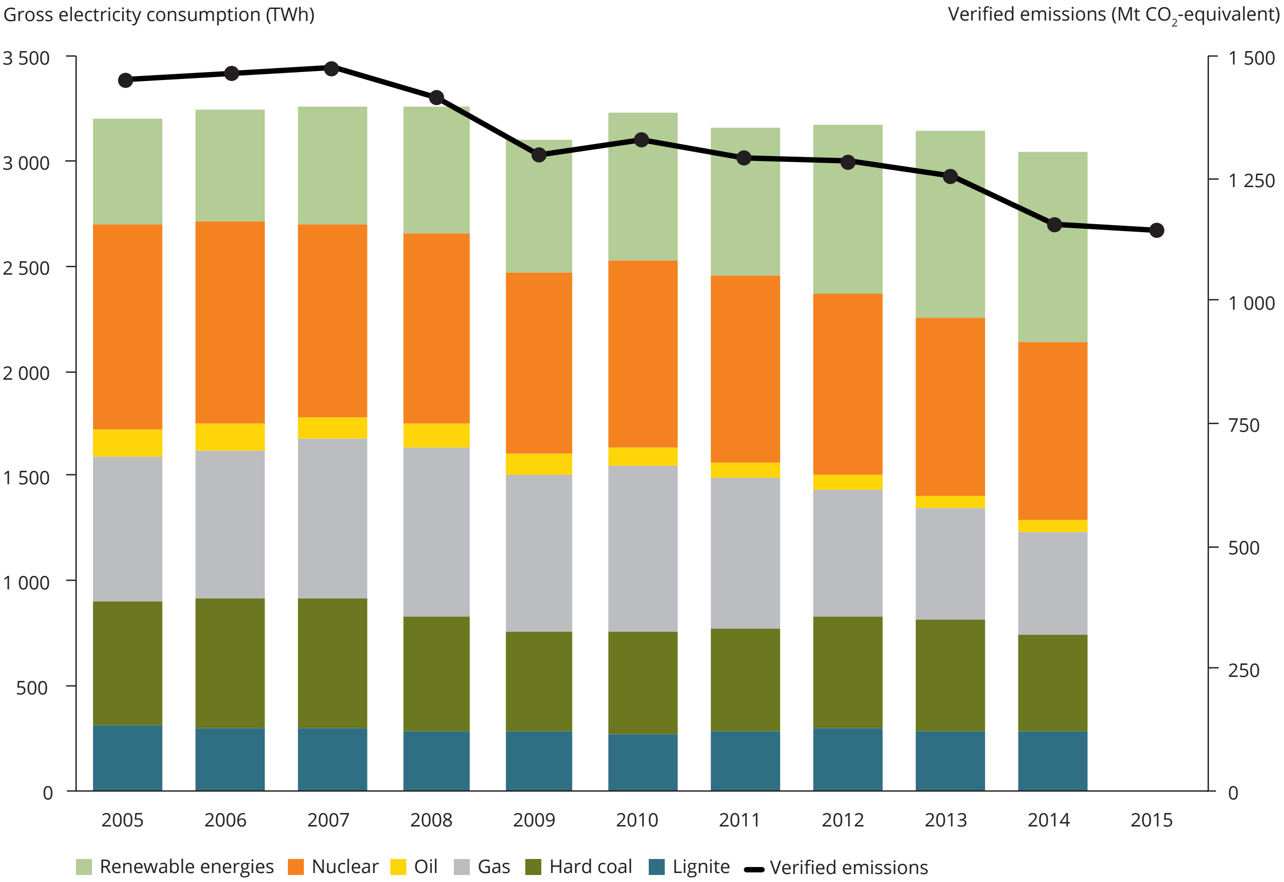
Figure 2.2 Verified emissions (2005–2015) disaggregated by combustion and industry sectors including an estimate to reflect the scope of the third trading period



Note: The estimate to reflect current scope takes into account additional emissions (not split by activity) for the period 2005–2012 to provide a consistent time series for the coverage of emissions in the third trading period.

Sources: EEA, 2016a; EEA/EU ETS Data viewer, 2016.

Figure 2.3 Gross electricity consumption by fuel in the EU-25, compared with EU ETS emissions from electricity generation



Note: Data aggregated by fuel type are based on guidance from Eurostat.

The fuel consumption data also include electricity generation not covered by EU ETS, e.g. plants producing less than 20 MW of thermal energy. However, these plants represent a very small share of total emissions from electricity generation.

Sources: EEA/EU ETS Data viewer, 2016; Eurostat, 2016.

The rate at which verified emissions were reduced in the power sector varied by Member State. For example, the top four emitters of combustion emissions (Germany, United Kingdom, Poland and Italy) progressed at very different speeds towards the decarbonisation of their electricity generation (see Figure 2.4).

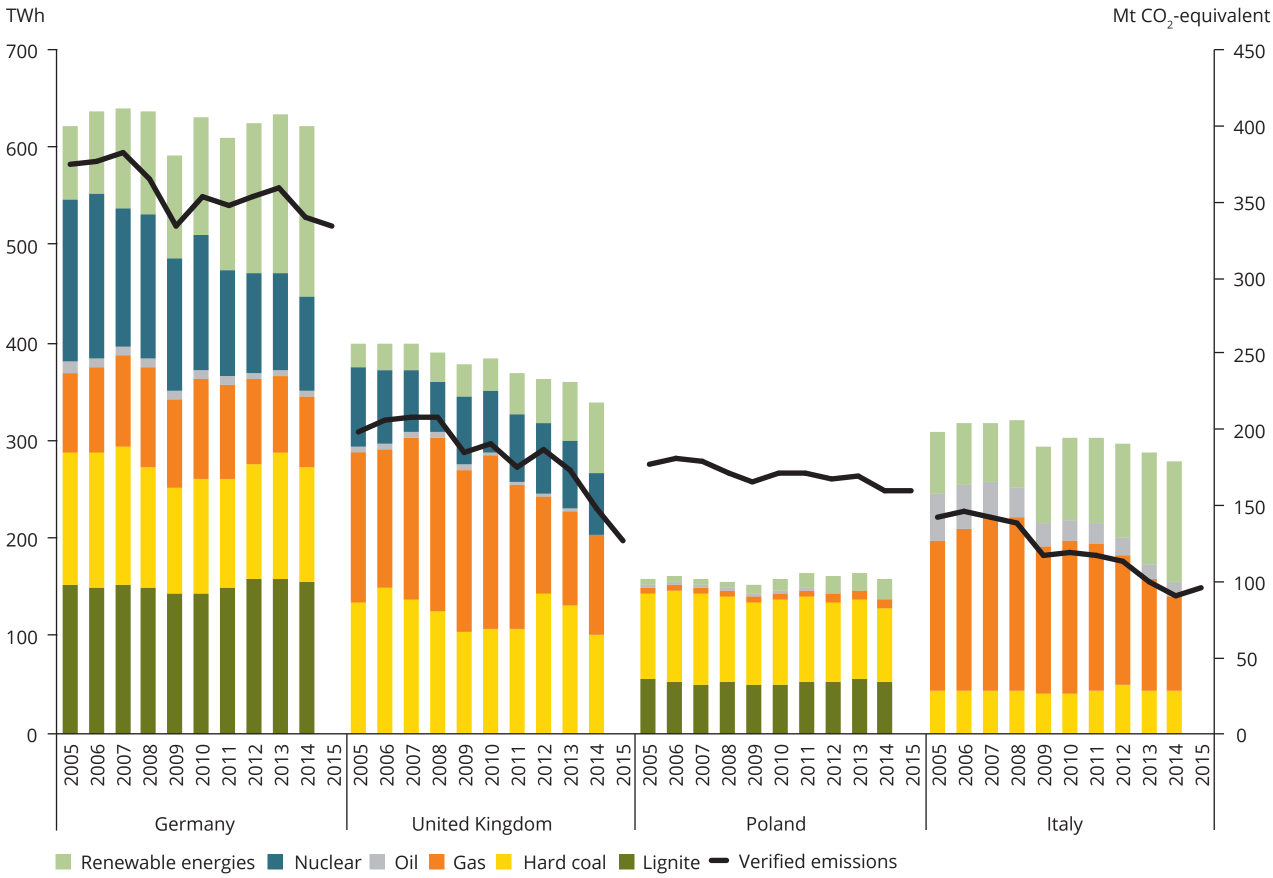
- Combustion emissions in Germany declined by 7 % from 2013 to 2015. Despite the high growth rate of renewables, emission reductions have been partly offset by the continuation of electricity generation from both coal and lignite plants (see Figure 2.4). The phase-out of nuclear power in Germany is also changing the country's fuel mix.
- Combustion emissions in the United Kingdom declined by 27 % from 2013 to 2015, coinciding with the introduction of a carbon floor price. This rate of change is higher than that achieved by the other top three emitters. The absence of lignite reserves and the ageing infrastructure in the United Kingdom have incentivised a transition to a less carbon-intensive energy system (see Figure 2.5 and case study below).
- Verified emissions from combustion in Poland over the period 2005–2015 remained relatively flat in comparison with those in other countries (Figure 2.4). Electricity generation in Poland remains more emission intensive than the other three

countries, reflecting the high proportion of hard coal and lignite in the fuel mix (see Figure 2.4 and Figure 2.5).

- In contrast, Italy experienced a steady decline in emissions between 2005 and 2015. This is due to increased use of a less emission-intensive fuel mix and the fact that an increasing proportion of electricity is generated from renewable energy sources. In addition, the Italian energy company Enel has decided to shut down 13 GW of its fossil-fuel based capacity in Italy by 2020, which will further reduce future emissions from combustion (Ottery, 2015).

Given the differences in the fuel mix and age of power plants, the challenge of decarbonising the power sector differs across Member States.

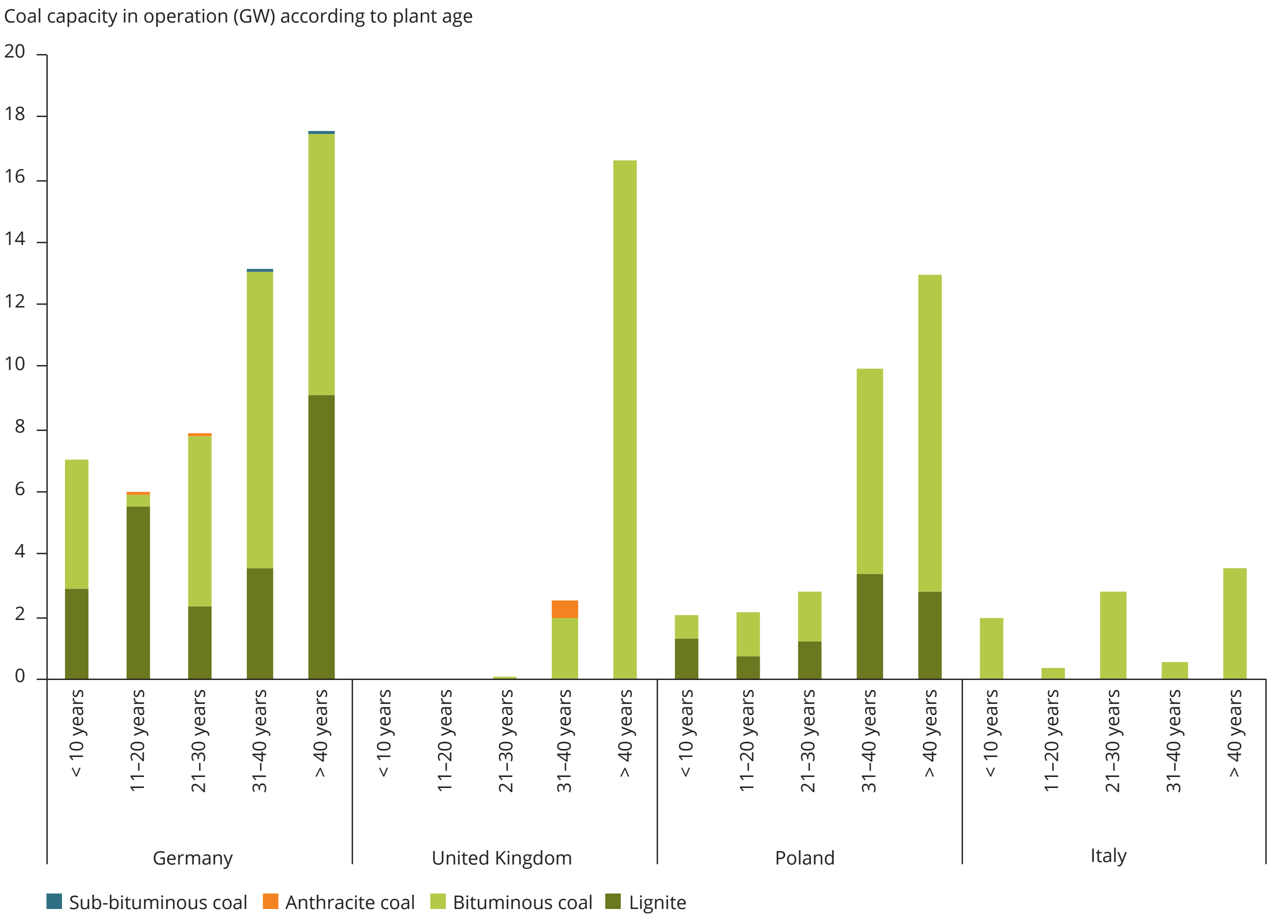
Figure 2.4 Verified emissions and fuel mix between 2005 and 2015 in the top four countries for combustion emissions



Note: The bars show energy production as on the left hand axis and the lines show emissions as on the right hand axis.

Sources: EEA/EU ETS Data viewer, 2016; Eurostat, 2016; authors' own calculation.

Figure 2.5 Coal capacity in operation in 2015 according to plant age



Sources: Platts, 2014; authors' own calculation.

Box 2.1 Case study: Market and policy drivers of CO_2 emission trends in the United Kingdom

During the first trading period and the beginning of the second period (from 2005 to 2009), the fuel accounting for the highest proportion of electricity generated in the United Kingdom was coal (Figure 2.7). During this period, operators frequently switched between coal and natural gas. These operational decisions resulted from the consideration of different factors, such as differentials in fuel prices (between coal and gas), climatic conditions or carbon prices.

At the start of 2009, natural gas overtook coal as the major fuel used to generate electricity when its price fell considerably in the United Kingdom, partly as a result of a contraction in demand for gas after the financial crisis but also because of a dramatic reduction in gas imports to the USA following the 'shale gas' revolution and increased global supplies of liquefied natural gas (Timera Energy, 2011). This led to a temporary convergence between the profitability of coal power plants (i.e. measured by the clean dark spread) and the profitability of gas power plants (i.e. measured by the clean spark spread) during this period (see Figure 2.8).

The seasonal variation in the rate of fuel switching during this period demonstrates the influence of climatic variations (i.e. during colder winters electricity needs to be generated from hard coal in order to meet demand). Coal again displaced gas for electricity generation towards the second half of 2010 after a rapid rebound in gas demand as a result of relatively colder weather (Timera Energy, 2011).

The decision whether to use gas or coal to generate electricity was also affected by CO_2 prices in the EU ETS. For example, in 2005 and 2006, when the average CO_2 price was EUR 22 per EUA and EUR 17 per EUA, respectively, use of combined cycle gas turbines (CCGTs) was 19–24 % higher than would have otherwise been expected during that period, while the use of coal was 16–18 % lower (McGuinness and Ellerman, 2008).

Box 2.1 Case study: Market and policy drivers of CO_2 emission trends in the United Kingdom (cont.)

Wholesale electricity prices in the United Kingdom over the past decade have largely been driven by changes in the gas price. This is because gas-fired generation is often the marginal source of supply and hence sets the electricity price (Ofgem, 2015). Given that many long-term contracts for gas in Europe are linked to the oil price, the recent fall in the oil price has had a downward effect on wholesale electricity prices.

Following the introduction of the carbon price floor in the United Kingdom in April 2013, in addition to the EU-wide carbon price, CO_2 costs have increased considerably in the country. The floor price (which is a supplement to the EUA price) was initially set at GBP 4.9 per tonne (EUR 6 per tonne) in 2013. It was increased in April 2014 to GBP 9.6 per tonne (EUR 12 per tonne) and then to GBP 18.1 per tonne (EUR 25 per tonne) in April 2015. In March 2014, it was decided to cap the price floor at a maximum of GBP 18 per tonne from 2016 until 2019 ([17]).

The developments in both wholesale electricity prices and CO_2 costs have had a greater negative effect on the profitability of the generation of electricity from hard coal than on the profitability of gas-powered plants, because combustion of coal is more CO_2 intensive than gas combustion, and natural gas is often the marginal source of electricity generation. This is reflected in the trends in clean dark spread and clean spark spread (see Figure 2.8). The clean spark spread (for gas) increased throughout 2015, primarily as a result of lower gas prices. As a consequence, electricity generation from gas increased in 2015, gas displaced the more inefficient coal (see Figure 2.7), and the generation of electricity from hard coal declined at a faster rate than the historic trend.

National and European policies also play a significant role in operational decisions and investment decisions on capacity. As previously mentioned, the carbon price floor for power generation introduced by the government of the United Kingdom in April 2013 led to an increase in the CO_2 price. By the end of 2015, the carbon price for power generation in the United Kingdom was approximately four times that in the rest of Europe ([18]). The long-term effects of the carbon price floor remain difficult to evaluate, especially with regards to future investments. Investments in the power sector are generally characterised by long lead times of several years. Other factors, such as the carbon budgets set under the Climate Change Act ([19]), may also drive low-carbon investment decisions in the energy sector of the United Kingdom, and these may also be affected by a range of additional energy policies, such as the national capacity mechanism.

Power plants that were responsible for 45 Mt CO_2 in 2008 have, or will be, closed in the first half of 2016 (see Figure 2.6). For example, the Longannet and Ferrybridge coal power plants were recently retired. Furthermore, the government of the United Kingdom declared its intention to phase out all unabated coal-fired power stations and the government announced a consultation on proposals to close remaining coal-fired power plants in operation by 2025, subject to the availability of sufficient gas as an alternative (Rudd, 2015).

As the number of coal power plants continues to decline, additional electricity could instead be generated from other sources of energy such as renewable sources and nuclear energy (including the use of interconnectors with neighbouring countries). Although a higher CO_2 price in the United Kingdom can act as an incentive for the deployment of both nuclear and renewable sources of electricity generation, these low-carbon technologies still depend upon considerable state intervention (i.e. feed-in tariffs, research and development investment).

The growth of renewables between 2013 and 2015 has been especially significant compared with the previous period, with peak generation (primarily from wind energy) occurring in winter and offsetting the decline in peak generation from coal. Renewable energy sources are increasingly displacing conventional fossil fuel sources for electricity generation because technologies such as wind power are associated with zero marginal costs. This leads to a decline in the wholesale power price when the share of renewable electricity is high. This, in turn, also reduces the profitability of conventional fossil fuel-powered plants. However, the lower availability of renewable energy sources in the summer months (i.e. because there is less wind) necessitates an increase in electricity generation from gas-powered plants in order to meet demand. The integration of renewables therefore has wider implications for how electricity will be priced in the future and how the security of supply will be ensured.

The EEA report *Transforming the EU power sector: avoiding a carbon lock-in* (EEA, 2016c) further examines issues related to the risk of excess capacity for fossil fuel-based electricity generation compared with the cost-effective levels derived from the scenarios of the European Commission's *Energy Roadmap 2050*, in line with the EU's long-term decarbonisation objectives.

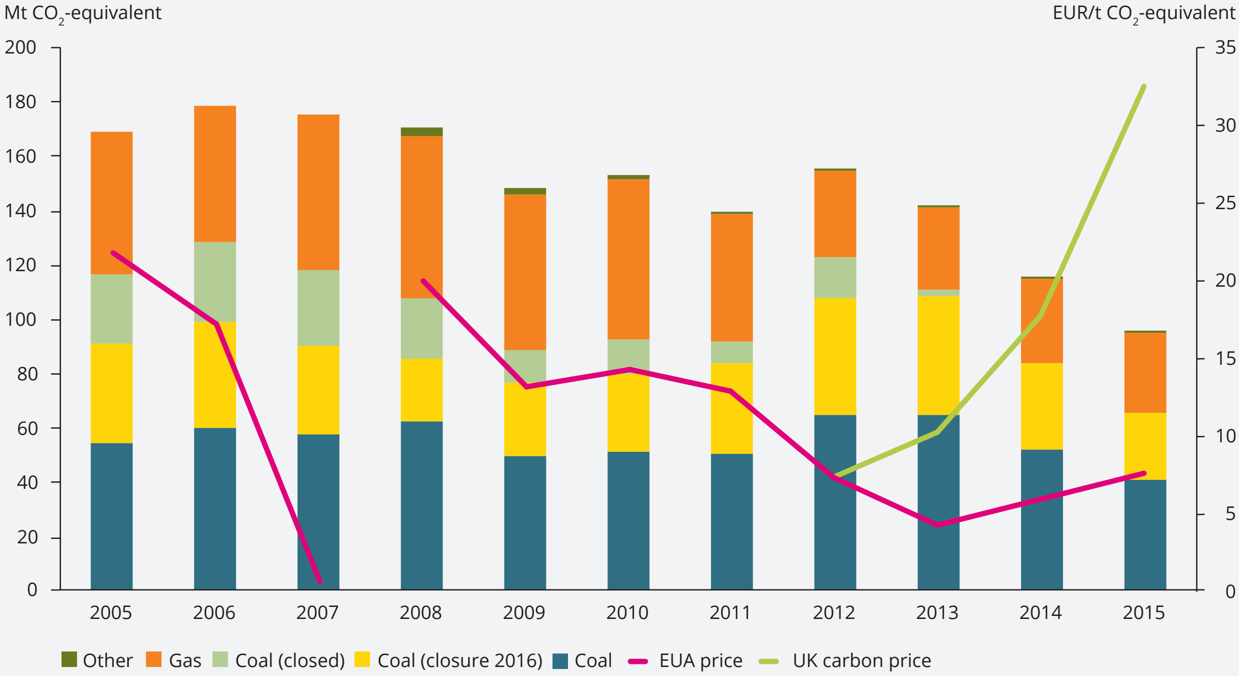
([17]) www.gov.uk/government/uploads/system/uploads/attachment_data/file/293849/TIIN_6002_7047_carbon_price_floor_and_other_technical_amendments.pdf.

([18]) The carbon price floor was introduced on 1 April 2013 with an equivalent of GPB 4.9 per tonne. It was increased in April 2014 to GBP 9.6 per tonne and in April 2015 to GBP 18.1 per tonne.

([19]) The Climate Change Act set a target for the United Kingdom to reduce its emissions by at least 80 % from 1990 levels by 2050. To ensure that progress, carbon budgets are set every five years. The first four carbon budgets have now been set in law. The fourth carbon budget (2023–2027) will require emissions from the United Kingdom to be reduced by 50 % from 1990 levels by 2025.

Box 2.1 Case study: Market and policy drivers of CO_2 emission trends in the United Kingdom (cont.)

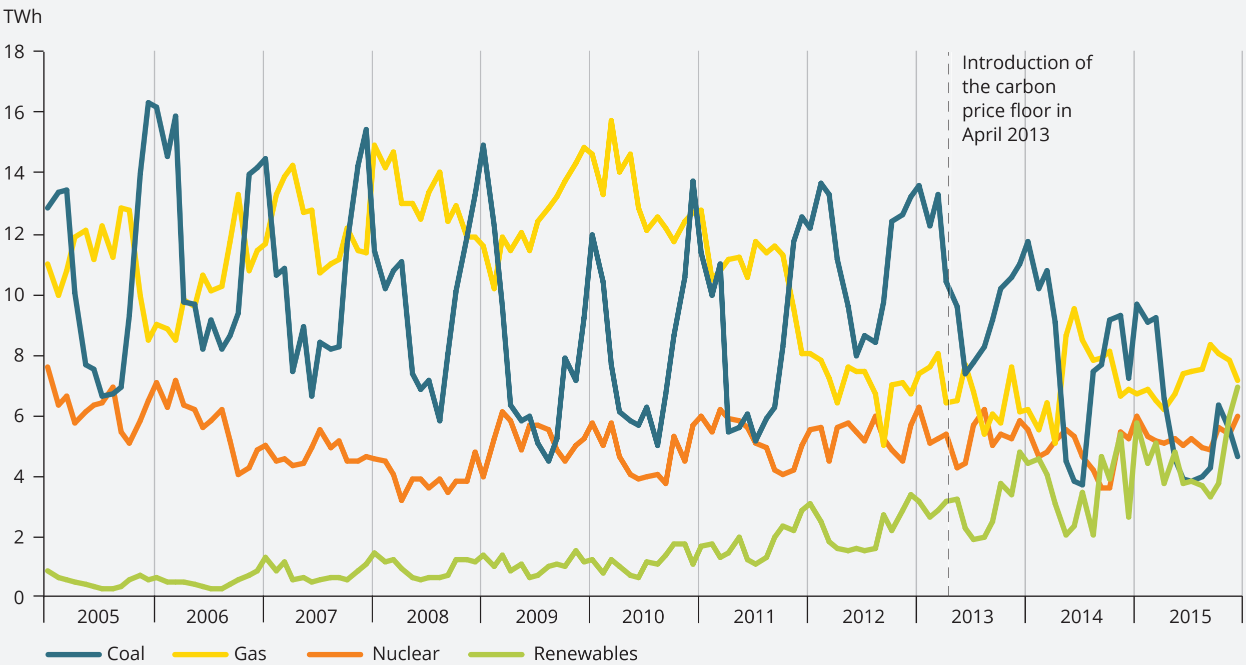
Figure 2.6 Verified emissions by power plants covered by the ETS in the United Kingdom energy sector and the development of the United Kingdom carbon price



Note: The gap in EUA carbon price between 2007 and 2008 reflects different trading periods and the ability to bank allowances from the second trading period onwards.

Sources: EEA/EU ETS Data viewer, 2016; authors' own calculation.

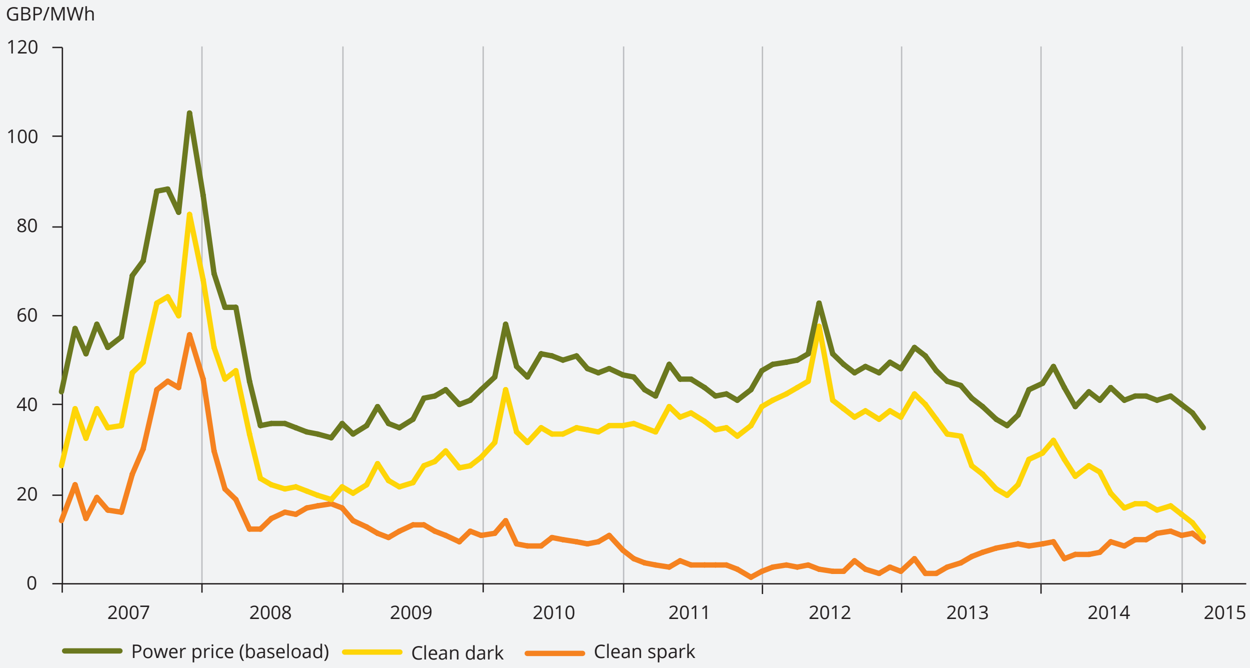
Figure 2.7 Monthly electricity generation in the United Kingdom by energy carrier



Source: DECC, 2016.

Box 2.1 Case study: Market and policy drivers of CO_2 emission trends in the United Kingdom (cont.)

Figure 2.8 Development of spark and dark spreads between 2007 and 2015



Note: The term 'clean dark' refers to coal-fired electricity generation, while the term 'clean spark' refers to gas-fired electricity generation. Clean spark and dark spreads indicate the average revenue a power station can expect from generating a unit of electricity during 'baseload' operation, after fuel and carbon costs. Other costs (i.e. capital, operational costs) are not considered in the graph.

Source: Ofgem, 2016.

Industry

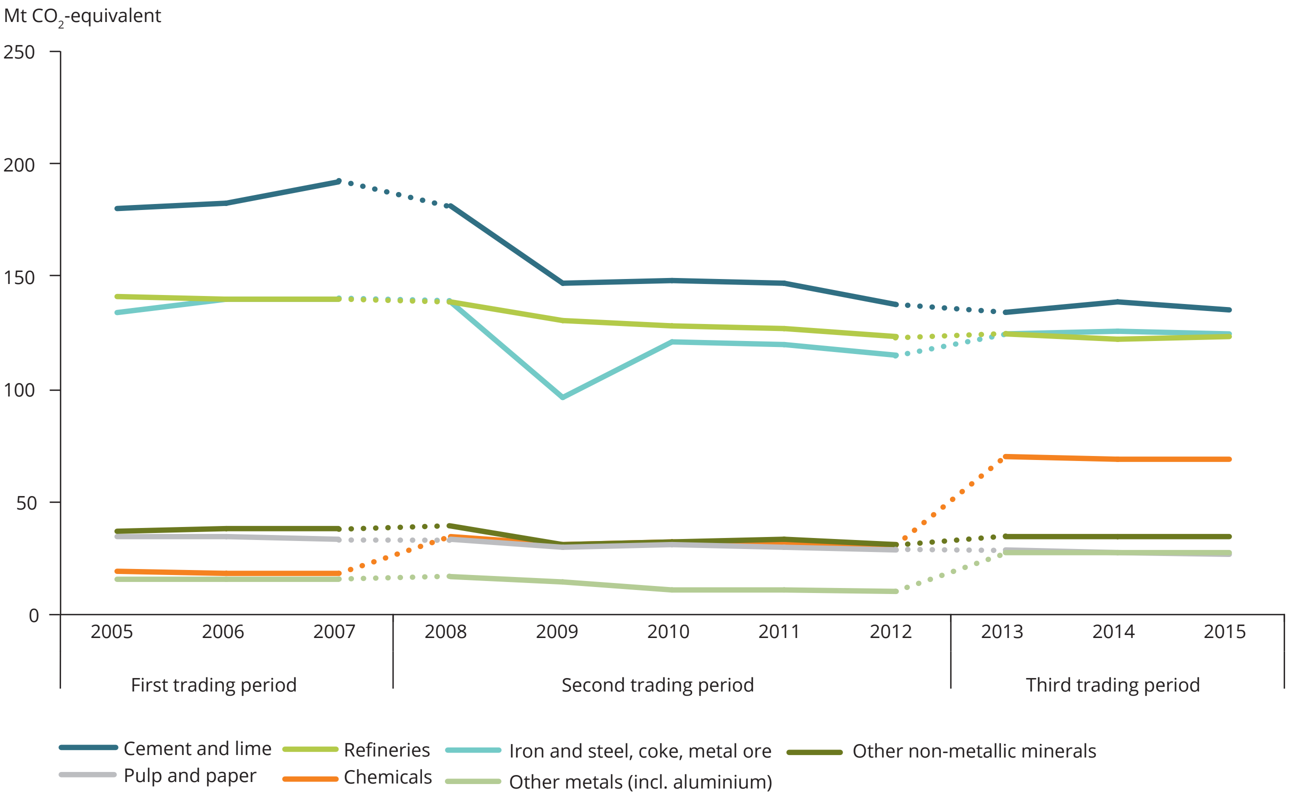
In the third trading period, emissions remained relatively stable across the different industrial sectors (Figure 2.9). In most of the major industrial activities, 2015 EU ETS emissions were below the emission levels recorded in the first and second trading periods. These emission reductions are due to a combination of economic conditions (i.e. the fall in production following the financial crisis) and improvements in energy efficiency and the increased use of biomass and wastes. In order to ascertain the extent to which the specific emissions of production were reduced, a comprehensive review of transparent and comparable data on both production levels and verified emissions will be required for each of the industrial sectors.

Notable differences in verified emissions are observed in the chemicals industry and the production of metals other than iron and steel, where the scope of the EU ETS increased considerably between the second and third trading periods. For both activities, the EU ETS now covers non-CO_2 gases along with CO_2 emissions:

- N_2O emissions from the production of nitric acid, and adipic acid and glyoxylic acid production;
- perfluorocarbon (PFC) emissions from the production of aluminium.

Further information on successive changes in the scope of the EU ETS is provided in Section A1.2 in Annex 1.

Figure 2.9 **EU ETS emissions by main industrial activity in the EU-25, 2005–2015**



Note: EUTL activity codes have been aggregated for certain sectors (see Table A1.1 for more information).

Source: EEA/EU ETS Data viewer, 2016.

2.1.2 Supply of and demand for allowances

EU ETS emissions decreased by 24 % between 2005 and 2015 ([20]). In all three trading periods to date, the supply of allowances has exceeded the demand (see Figure 2.10). At the start of the third trading period, the cumulated surplus of allowances in the EU ETS stood at almost 1.8 billion. However, the cumulated surplus declined in 2015, following a substantial reduction in the number of allocated allowances and international credits exchanged.

During each year of the first trading period (2005–2007), verified emissions were below the total quantity of EU allowances allocated by governments, resulting in a first oversupply of allowances. Since it was not possible to 'bank' these allowances between the first and the second trading periods, they had to be cancelled, and they therefore retained no value for possible future use. When the EU ETS was introduced in 2005, the average EUA price on the secondary market was around EUR 20 per EUA. After the publication of 2005 verified emissions in April 2006, it became clear that the number of allowances available to EU ETS operators was higher than necessary to cover verified emissions, and that this situation would remain until the end of the first trading period. Consequently, the EUA price dropped abruptly, and remained close to zero until the end of 2007 (see Figure 2.11).

([20]) The reduction is calculated taking into account a comparable EU ETS scope for these two years (i.e. after adding an estimate of 2005 verified emissions to account for the additional emissions covered by the EU ETS in the current trading phase).

Following the setting of more stringent caps for the second trading period, verified emissions exceeded the supply of allowances in 2008. The average EUA price in 2008 reached around EUR 20 per EUA (average refers only to EUAs valid in the second trading period). After 2008, activities covered by the EU ETS were greatly affected by the economic recession, and verified emissions decreased abruptly in 2008 and 2009. This unanticipated decline in emissions resulted in verified emissions being markedly lower than the cap. The supply of allowances exceeded verified emissions between 2009 and 2012, leading to the accumulation of a surplus of allowances. EUA prices on the secondary market decreased to around EUR 7 per EUA by the end of the period (see Figure 2.11). According to the European Commission, the carbon price was more sensitive and responsive to demand factors (i.e. economic activity and weather conditions) as a result of the fixed supply of allowances (set by the EU ETS cap) and the elastic demand (EC, 2014d).

The problem was further exacerbated by the intensive use, towards the end of the second trading period, of international emission credits generated under the Kyoto Protocol's flexible mechanisms and allowed under the EU ETS. The additional use of CERs and ERUs contributed to an accumulating surplus of allowances over the years 2009–2012. The increased use of these emission credits can be explained by the fact that many of them would no longer be eligible under the EU ETS in the third trading period. International credits were being traded at less than EUR 1 per unit by the end of the second trading period. The imbalance between the supply and the demand of allowances peaked in 2012.

From 2013 onwards, an increasing proportion of allowances were auctioned, which is reflected by the considerable increase in the number of EUAs sold in the primary market (auctioned by Member States and primary market sales through the NER300) in the first 3 years of the third trading period. In 2013, the price of EUAs stabilised at around EUR 4 per EUA at primary market sales. After the back-loading of 400 million allowances in 2014 (i.e. a reduction in the overall quantity of allowances to be auctioned in a certain year), the supply of and demand for allowances in 2014 were almost balanced.

In 2015, for the first time since the introduction of the EU ETS, a substantial annual shortage of allowances was recorded owing to the further back-loading of 300 million allowances in 2015, and a sharp reduction in the use of international credits as emission reductions from the first commitment period of the Kyoto Protocol (2008–2012) could no longer be used for compliance. However, the market still remains considerably oversupplied.

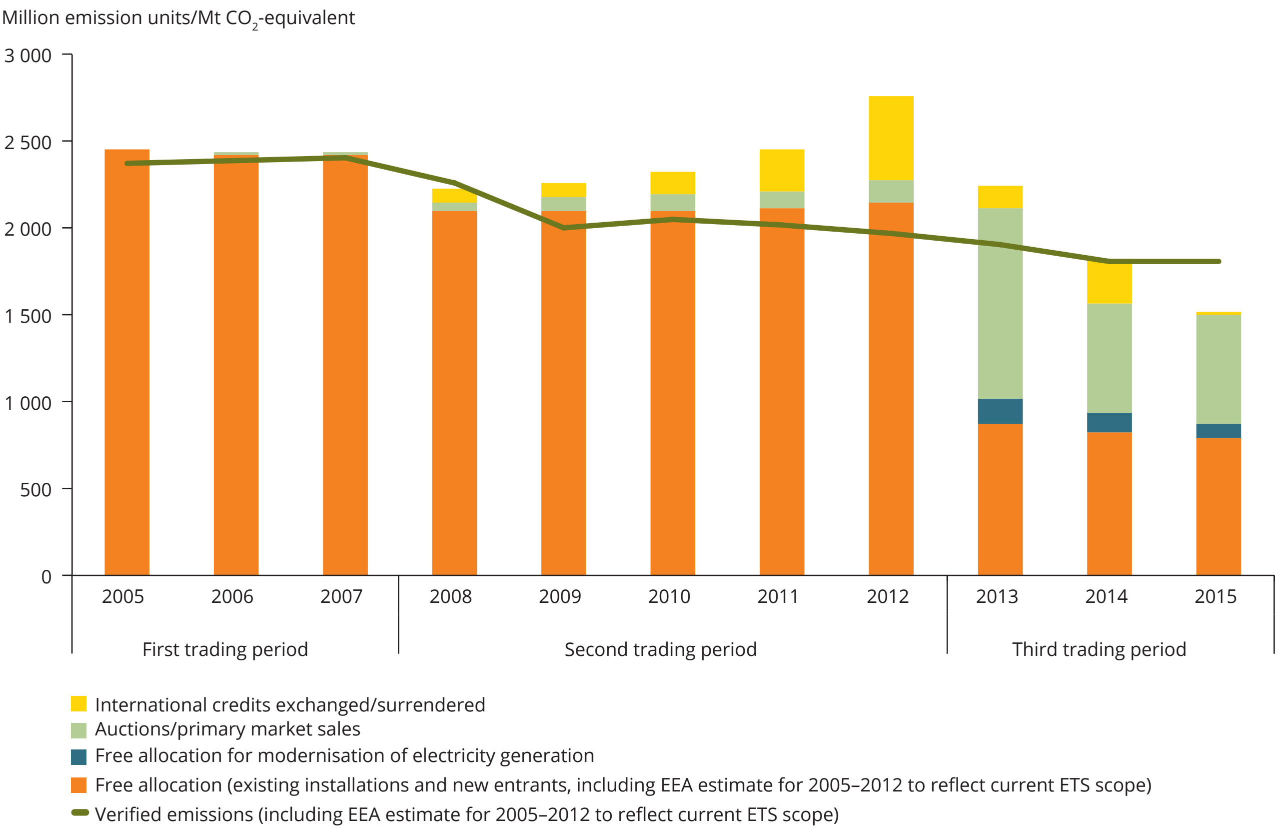
Auctioned allowances and price trends

Auctioning has so far been the default method of allocating allowances within the EU ETS during the third trading period. Firms have to purchase an increasing proportion of allowances (via auctions/primary market sales and the secondary market). The total amount to be auctioned between 2013 and 2020 is distributed among EU ETS countries in accordance with three criteria: historical emissions, income per capita and emissions performance (see Section A2.3 in Annex 2). Deductions are made from auctioned volumes to compensate for the transitional free allocation to modernise electricity generation in some eastern European Member States, under Article 10c of the ETS Directive. The quantities of allowances auctioned/sold by ETS countries (including NER300) in the third trading period are outlined in Table 2.1. The country auctioning the highest number of allowances between 2013 and 2015 was Germany, followed by the United Kingdom, Italy and Spain. This primarily reflects the fact that these EU ETS countries have higher historic verified emissions and are therefore entitled to a greater share of the auctioning rights. Member States where gross domestic product (GDP) is lower than the EU average ([21]) received more allowances than would be justified based on verified emissions alone.

The volume of allowances available for auction between 2014 and 2016 has been modified as a consequence of the back-loading decision, as a result of which the European Commission postponed the auctioning of 900 million allowances from 2014–2016 until 2019–2020 in order to help address the surplus of allowances in the short term (400 million allowances in 2014, 300 million in 2015 and 200 million in 2016) ([22]). As a consequence, the auctioning volumes were considerably higher in 2013, before back-loading commenced, than in the following years (Table 2.1). As fewer allowances were back-loaded in 2015 than in 2014, the total number of allowances auctioned by Member States in 2015 was higher than in 2014. The European Economic Area-EFTA States (Iceland, Liechtenstein and Norway) have not yet

([21]) Refer to Annex IIa of the ETS Directive, which lists 19 Member States that benefit from an increased auction share.
([22]) According to the MSR Decision (EU, 2015), back-loaded allowances will not come back to the market in 2019–2020.

Figure 2.10 Supply and demand balance for stationary installations, 2005–2015



Note: Both verified emissions and free allocation (existing installations and new entrants) include in the years 2005–2012 an estimate to reflect the current scope of the EU ETS (EEA, 2016a). As this addition is applied to both the supply of and demand for allowances, it does not affect the supply–demand balance.

The supply of allowances presented takes into account a redistribution by the EEA of annual volumes of allowances auctioned/sold on the primary market, from the year when they were released to the market to the years from which they arose. For example, the volumes of allowances relative to the second trading period (2008–2012) but sold/auctioned in the first months of 2013 are added here to the 2012 figures. Auctioned allowances that were 'back-loaded' are not shown in the graph. For more details, see Tables 2.1 and 2.2, and Section 2.1.2.

Source: EEA/EU ETS Data viewer, 2016.

started auctioning in the third phase. Once they start, the volumes withheld (19.47 million EUAs up to 2015) will be added to subsequent years.

For the Member States entitled to allocate transitional free allowances to certain installations in order to modernise their electricity generation (under Article 10c of the ETS Directive), these allowances are initially withdrawn from the auctioning volumes, thereby reducing the number of allowances to be auctioned. For example, the use of Article 10c allocation in 2014 strongly contributed to the disproportionate decline in the number of allowances auctioned by Poland and other states entitled to a transitional free allocation in accordance with Article 10c. However, given that any unused Article 10c allocations will be auctioned before the end of the third trading period, this may also lead to increases in auctioning volumes in later years. For example, Bulgaria, Lithuania and Romania auctioned allowances that could have been allocated for free under Article 10c of the ETS Directive in 2015, increasing overall volumes.

Table 2.1 Allowances auctioned/primary market sales in the third trading period

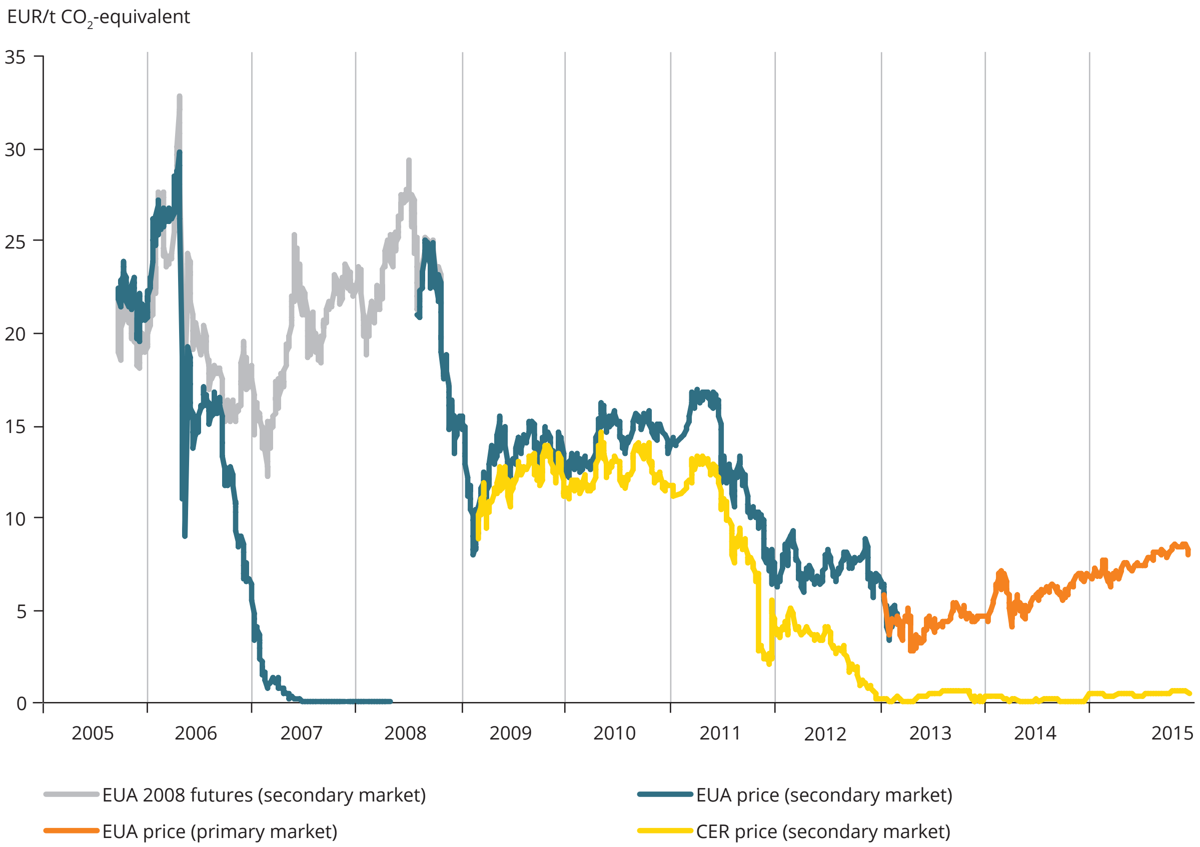
	Auctions/sales concluded (million EUAs)					Auctions/sales redistributed (million EUAs)				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Austria		1.6	12.7	8.8	10.0			14.3	8.8	10.0
Belgium			26.1	16.1	18.2			26.1	16.1	18.2
Bulgaria		3.3	12.0	6.1	15.9			15.3	6.1	15.9
Croatia					11.3			4.9	3.0	3.4
Cyprus		0.2	0.1	0.1				0.3	0.1	
Czech Republic			18.6	9.4	14.5			18.6	9.4	14.5
Denmark		0.2	12.7	8.0	9.0			12.9	8.0	9.0
Estonia			4.1	1.2	2.8			4.1	1.2	2.8
Finland		2.0	15.2	10.6	12.0			17.2	10.6	12.0
France		6.4	49.9	34.8	39.3			56.3	34.8	39.3
Germany		23.5	182.6	127.1	143.9			206.1	127.1	143.9
Greece		2.3	33.4	22.0	24.9			35.8	22.0	24.9
Hungary		0.6	7.8	9.5	10.8			8.4	9.5	10.8
Iceland										
Ireland			9.6	5.9	6.7			9.6	5.9	6.7
Italy		11.3	87.9	61.2	69.3			99.2	61.2	69.3
Latvia		0.3	2.5	1.7	1.9			2.8	1.7	1.9
Liechtenstein										
Lithuania		0.5	4.5	2.9	3.7			5.0	2.9	3.7
Luxembourg		0.1	1.1	0.8	0.9			1.2	0.8	0.9
Malta		0.0	1.0	0.6	0.7			1.1	0.6	0.7
Netherlands		3.9	30.6	21.3	24.1			34.5	21.3	24.1
Norway										
Poland			51.2	13.3	17.1			51.2	13.3	17.1
Portugal		1.6	16.5	11.2	12.6			18.1	11.2	12.6
Romania		5.9	27.9	16.5	25.4			33.8	16.5	25.4
Slovakia		1.8	14.0	9.7	11.1			15.9	9.7	11.1
Slovenia		0.5	4.0	2.8	3.2			4.6	2.8	3.2
Spain		10.1	78.8	54.8	62.1			88.9	54.8	62.1
Sweden		1.0	8.1	5.6	6.4			9.2	5.6	6.4
United Kingdom		12.3	95.1	66.2	75.0			107.4	66.2	75.0
NER300	12.0	188.0	27.4	72.7				200.0	100.0	
Total	**12.0**	**277.7**	**835.5**	**601.0**	**632.7**			**1 102.7**	**631.4**	**624.8**

Note: The table presents two sets of values concerning auctioned/sold allowances. The Section to the left ('Auctions/sales concluded') shows volumes attributed to the years when allowances were actually released to the market, whereas the Section to the right ('Auctions/sales redistributed) shows volumes redistributed in accordance with the years to which allowances correspond. Unless otherwise noted, the calculations and figures in this report refer to the redistributed amounts. For the third trading period, the redistribution concerned early auctions (2012) pertaining to the third trading period, Croatian auctions starting only in 2015 and NER sales (EEA, 2016b). The volumes of so-called 'early auctions' of the third trading period held in 2012 are added to 2013 auctioning volumes EUAs (90 million EUAs). Croatia started auctioning only in 2015: the volumes sold in 2015 but which in fact were allocated to 2013 and 2014 are attributed to the appropriate years (4.9 million EUAs to 2013 and 3.012 million EUAs to 2014). NER300 sales were carried out in two tranches; the first tranche of 200 million (sold in 2011 and 2012) is attributed to 2013, while the second tranche of 100 million EUAs (sold at the end of 2013/beginning of 2014) is attributed to 2014 (EIB, 2014b).

Source: EEA/EU ETS Data viewer, 2016.

Revenues from auctioning between 2013 and 2015 were highest in Germany, at EUR 2.6 billion, followed by the United Kingdom (EUR 1.4 billion) and Italy (EUR 1.3 billion). The level of auction revenue depends on a number of factors, including the number of allowances to be auctioned and the timing of auctions, which influence the auction price. The impact of the back-loading decision is particularly noticeable in 2014, with reduced auctioning revenues (Figure 2.12) in the EU ETS countries resulting from both lower volumes (Table 2.1) and lower EUA prices (Figure 2.11) relative to 2015. The auctioning of unused Article 10c allowances also contributed to an increase in revenues for several Eastern European countries (i.e. Bulgaria and Romania) in 2015 (Figure 2.12).

Figure 2.11 Price trends for EUAs and CERs

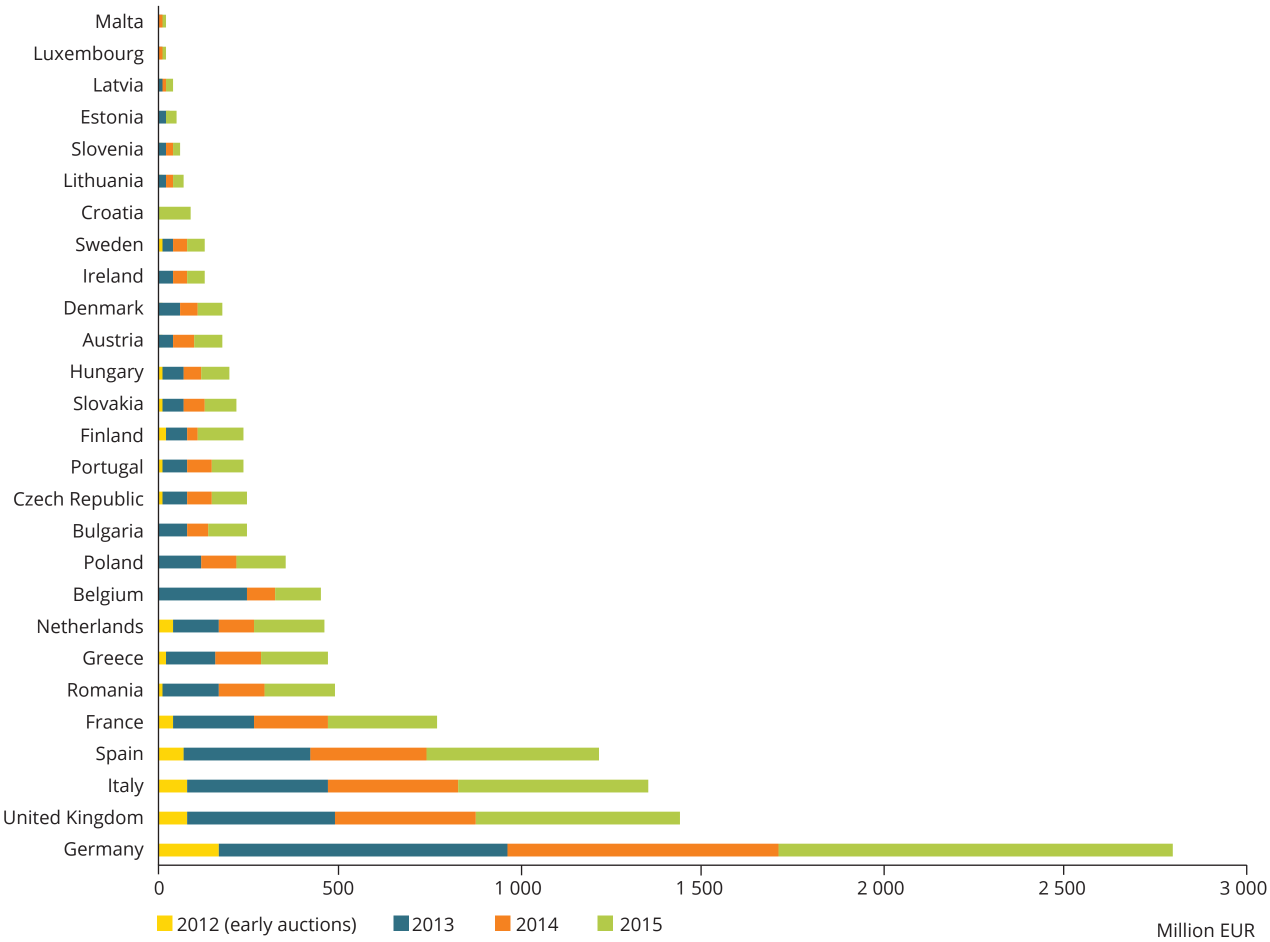


Note: The EUA price represents historic spot price data from the secondary market in the first and second trading periods. In the third trading period, the EUA price refers to auctioning data from the EEX and ICE trading platforms. The CER price up until the middle of 2014 is based on historic spot price data from Point Carbon. The more recent data up until the end of 2015 are based on future CER prices from the ICE trading platform.

The break in the EUA price between 2007 and 2008 reflects the lack of banking provisions between the first and second trading periods. However, trade in future EUA contracts did take place during this time period at a higher level.

Sources: Point Carbon, 2012; EEX, 2016; ICE, 2016.

Figure 2.12 Auction revenues, by Member State, in the third trading period



Sources: EEX, 2016; ICE, 2016.

Auctioning played a less important role in the first and second trading periods. The ETS Directive set a maximum on the proportion of the NAPs that could be auctioned of 5 % for the first trading period and 10 % for the second trading period. Furthermore, Member States did not auction the maximum allowed, some of them not making use of the ability to auction at all (see Table 2.2).

Free allocation to new entrants and capacity extensions

In order to support industrial growth within Europe, a reserve of 480 million EUAs (NER) was set aside at the start of the third trading period for:

- new installations (i.e. installations obtaining a permit for the first time after 30 June 2011 or any installation carrying out an activity included in the EU ETS for the first time);
- existing installations achieving a 'significant' increase in capacity ([23]).

In the period 2013–2015, refineries accounted for 32 % of the NER allowances allocated, followed by combustion installations (30 %), the iron and steel sector (13 %), the cement and lime sector (11 %) and the pulp and paper sector (5 %) (Figure 2.13).

([23]) Significant capacity extension means a significant increase in a sub-installation's initial installed capacity (not just merely replacing the existing production line) of at least 10 %, resulting in a significantly higher activity level (EU, 2011a).

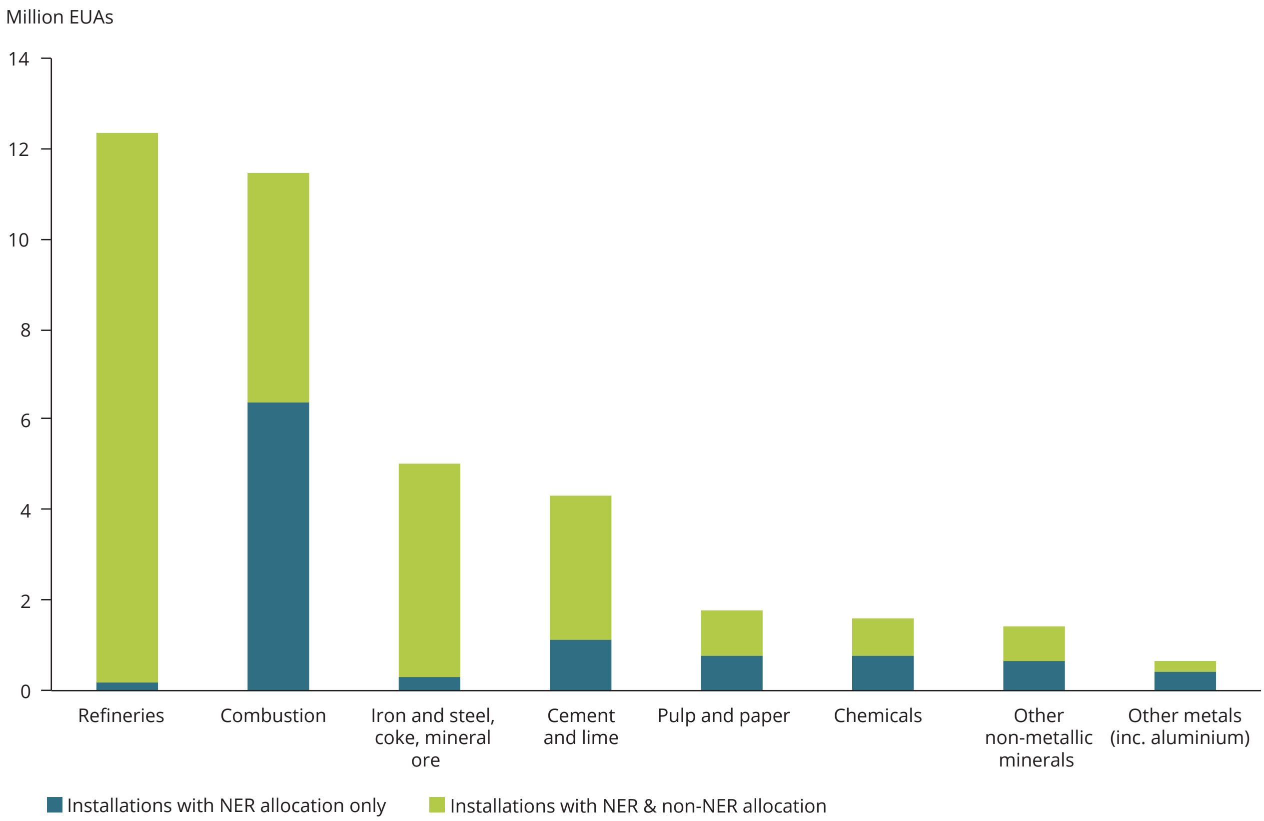
Table 2.2 Allowances auctioned/primary market sales in the first and second trading periods

	Auctions/primary market sales concluded (million EUAs)									Redistributed (million EUAs)	
	First trading period			Second trading period							
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2012	2013
Austria					0.4	0.4	0.2	1.0		1.0	
Belgium									9.6	9.6	
Bulgaria									0.1	0.1	
Cyprus											
Czech Republic								1.0	1.6	2.6	
Denmark		4.4							2.8	2.8	
Estonia											
Finland											
France											
Germany				49.1	41.1	41.1	40.7	48.1		48.1	
Greece							10.0	8.8		8.8	
Hungary		1.2	1.2					2.5	5.2	7.7	
Iceland											
Ireland		1.2			0.2	0.2	0.2				
Italy											
Latvia											
Liechtenstein											
Lithuania			0.6				0.9	1.7	0.8	2.5	
Luxembourg									0.0	0.0	
Malta											
Netherlands						8.0	4.0	4.0		4.0	
Norway					12.6	6.3	6.3	9.6	0.1	9.8	
Poland									0.2	0.2	
Portugal											
Romania									0.6	0.6	
Slovakia											
Slovenia											
Spain											
Sweden											
United Kingdom				4.0	25.0	35.8	30.7	27.3		27.3	
All countries		**6.8**	**1.7**	**53.1**	**79.3**	**91.9**	**92.9**	**104.0**	**21.0**	**125.0**	

Note: The table presents two sets of values concerning auctioned/sold allowances. The Section to the left ('Auctions/sales concluded') shows volumes attributed to the years when allowances were actually released to the market, whereas the Section to the right (redistributed) shows volumes redistributed by EEA in accordance with the years to which allowances correspond. The redistribution concerns specifically the auctions/sales by 10 countries (Belgium, Bulgaria, the Czech Republic, Denmark, Hungary, Lithuania, Luxembourg, Norway, Poland and Romania), in the first months of 2013, of allowances pertaining to the second trading period. These amounts were mainly EUAs remaining in the NER or unused EUAs set aside for UN-backed emission reduction projects (EEA, 2016b). Unless otherwise noted, the calculations and figures in this report refer to the redistributed amounts.

Source: EEA/EU ETS Data viewer, 2016.

Figure 2.13 Cumulative NER allocation (2013–2015) by sector and by eligibility type



Note: EUTL activity codes have been aggregated for certain sectors (see Table A1.1 for more information).

Source: EEA/EU ETS Data viewer, 2016.

Between 2013 and 2015, the majority of allowances (73 %) allocated from the NER went to installations also receiving non-NER allowances, which can be seen as an indication of capacity extensions. The proportion was higher for installations other than combustion only, with 85 % of the allocation going to industrial installations also receiving a non-NER allocation. In contrast, over half of the allowances received by the combustion sector ([24]) between 2013 and 2015 (i.e. 6.4 million EUAs) were distributed to installations receiving only an NER allocation ([25]).

The number of allowances allocated from the NER to installations in the third trading period can provide some indication of the economic situation of certain sectors of European industry:

- In the refinery sector, the high proportion of allowances primarily allocated to capacity extensions may reflect an increase in operating margins — primarily due to a fall in crude oil prices since the middle of 2014 (Fitzgibbon et al., 2015). Figure 2.14 shows that investments have predominantly occurred in Spain, Greece and Portugal.

- The allocation of NER allowances to installations producing iron, steel, cement or lime is somewhat limited, despite the fact that these installations account for a relatively high proportion of EU ETS emissions. The most significant investment in iron and steel capacity that was eligible for free allowances from the NER took place at the Port Talbot site in the United Kingdom. However,

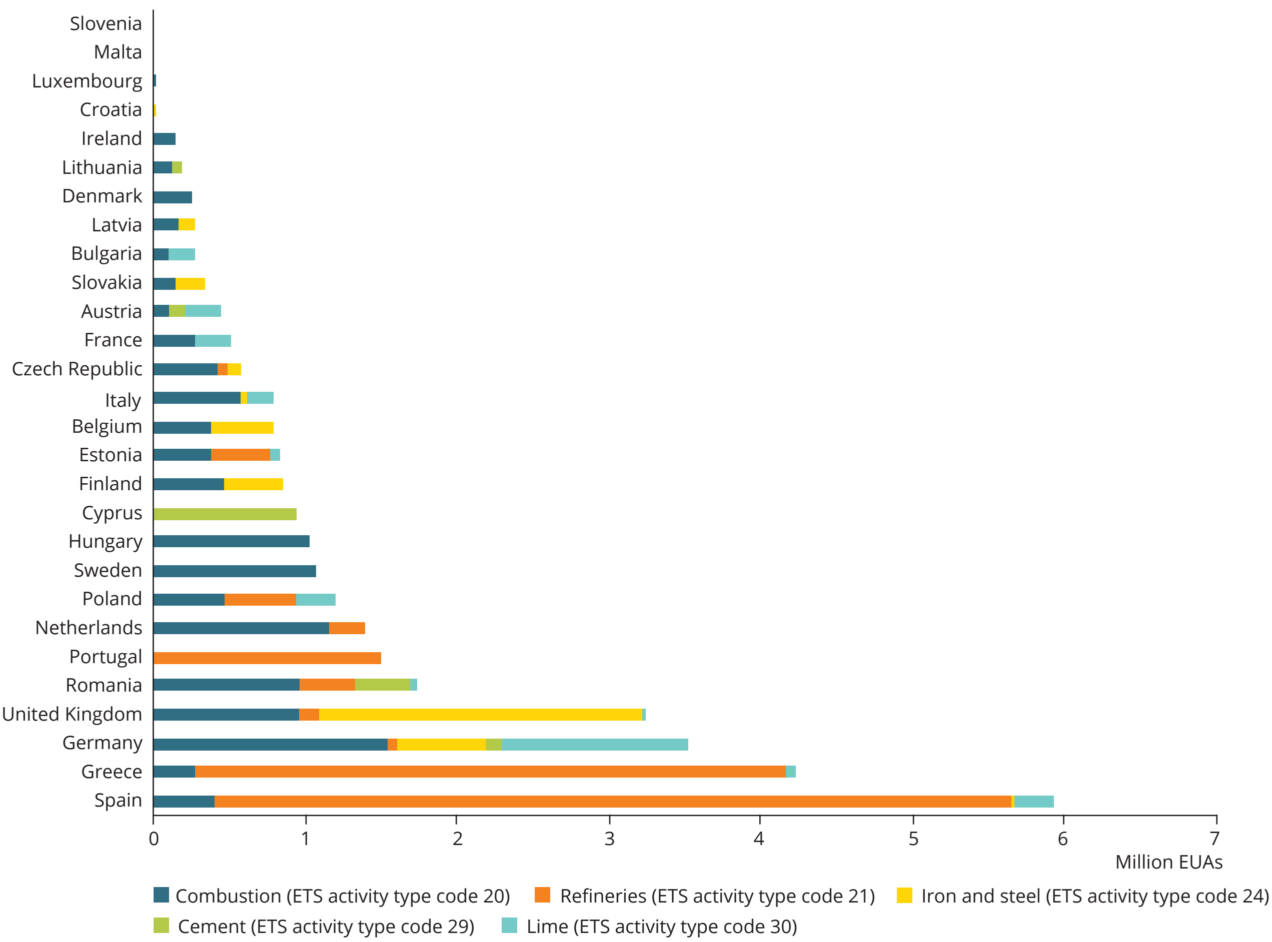
([24]) Only heat (not electricity) generation from combustion installations (transferred to district heating schemes and industrial processes) is eligible for NER allocation. In addition, there are also non-power plants in the combustion sector.

([25]) However, 3.5 million EUAs out of the NER were allocated to combustion installations not receiving other forms of allocation but having reported emissions in the second trading period.

recently Tata Steel announced that, despite recent investments, the United Kingdom plants are no longer economically viable because of the global oversupply of steel products (linked to the economic slowdown in China). Similar issues of global overcapacity have affected the cement and lime sector, with only a small number of plants increasing their capacity between 2013 and 2015.

As a consequence of the volatile and uncertain global economic outlook, the extent to which the allowances set aside in the NER will actually be used could remain low. Figure 2.15 shows that, between 2013 and 2015, only 20 % of the allowances in the NER were either used or reserved for future use as of January 2016 ([26]).

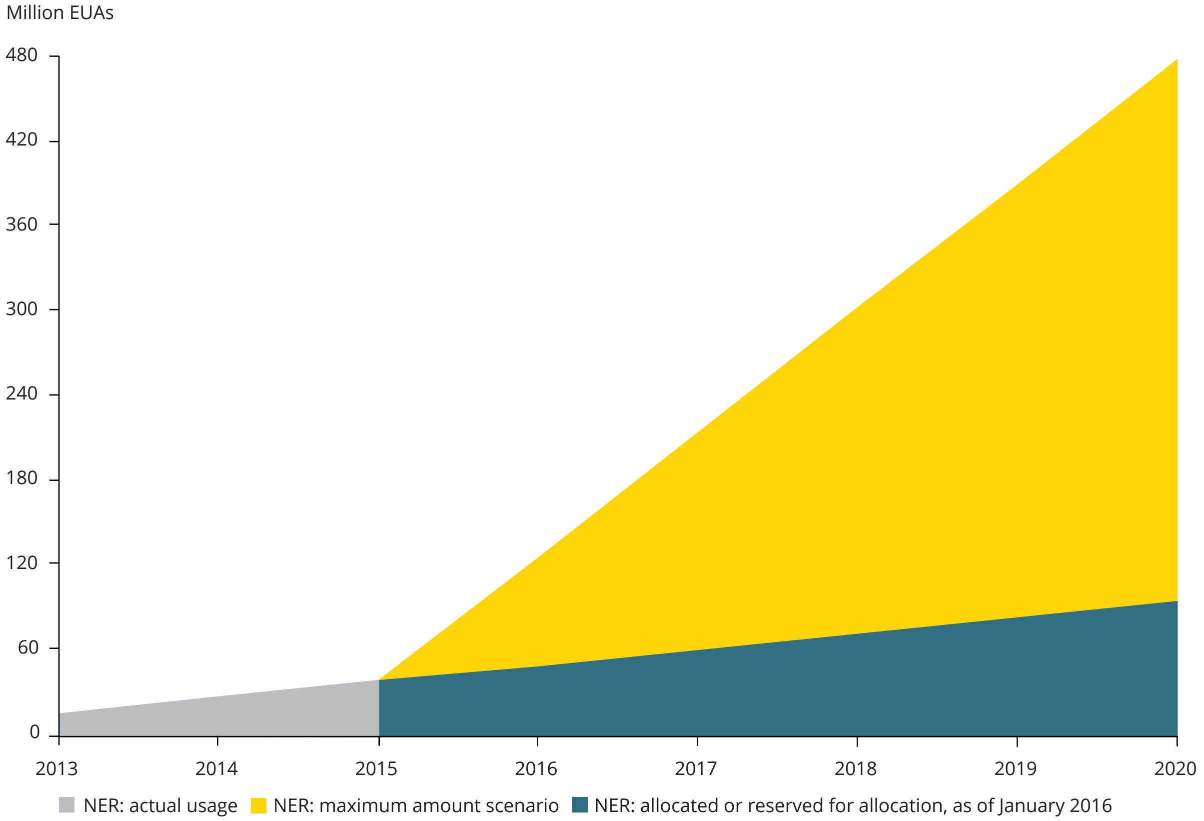
Figure 2.14 Cumulative NER allocation (third trading period) by sector and by country



Source: EEA/EU ETS Data viewer, 2016.

([26]) The European Commission has subsequently calculated an available budget of 77 % — taking also into account allowances that have either been used or reserved for future years until 15 July 2016 (see http://ec.europa.eu/clima/news/docs/2016071501_status_table_en.pdf).

Figure 2.15 Extrapolation of the cumulative use of the NER budget until 2020



Sources: EC, 2016a; EEA/EUETS Data viewer, 2016.

Transitional free allocation to modernise electricity generation

In eight Member States, some installations in the electricity generation sector receive a transitional free allocation under Article 10c of the ETS Directive (see Section A2.2 in Annex 2). The free allocation of up to 680 million allowances is contingent upon the value of these allowances being invested in efforts to modernise the electricity generation of the eligible Member States and diversify its fuel mix. The aggregate value of these corresponding investments into the diversification and modernisation of the electricity sector should amount to over EUR 12 billion, ranging from EUR 56 million for Hungary (EC, 2012b) to nearly EUR 7.5 billion for Poland (EC, 2014c). However, Member States can choose to reduce their transitional free allocation and auction the allowances instead, e.g. if investments to modernise electricity generation are not implemented.

In 2015, Poland was allowed to allocate 13.4 million free transitional allowances to the Bełchatów power plant (see Section 1.1.1). The national investment plan lists 13 investment measures for Bełchatów, 12 of which relate to the modernisation of existing lignite-fired blocks and one to investment in a new block, also fired by lignite (Ministerstwo Środowiska, 2013).

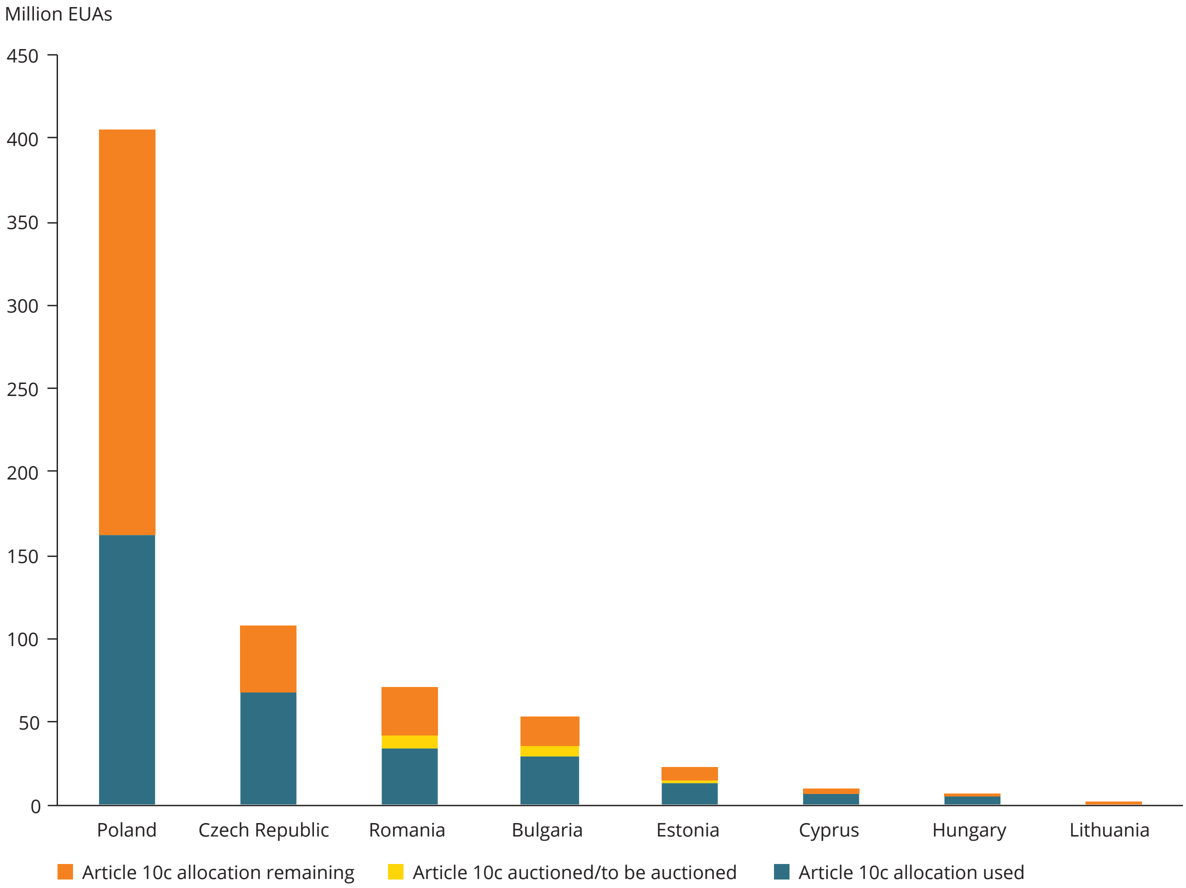
Just under half of the maximum budget (i.e. 49 %) for Article 10c allowances was used between 2013 and 2015 (Figure 2.16). Poland has the largest number of unused allowances: 60 % of its maximum Article 10c allocation. These could either be used by the power sector in future years (provided that a sufficient number of investment projects qualifying for Article 10c allocation are available) or auctioned before the end of the third trading period. To date, the majority of Article 10c allowances have been distributed to lignite-fired and hard coal-powered plants, mainly in Bulgaria, the Czech Republic, Poland and Romania (see Figure 2.17). The allowances that are not given out for free under Article 10c must be auctioned by Member States, for example if operators do not make the required investments or if the installations that were to receive the free allocation have closed. This has already occurred in Bulgaria and Romania, where unallocated Article 10c allowances led to increased auctioning volumes in 2015 and 2016.

The environmental benefits of such an allocation ultimately depend on the investments each of the Member States makes in modernising its electricity generation. Until now, the majority of the investments completed have not contributed to diversifying the energy mix away from fossil fuels (UBA, forthcoming). For example, fossil fuel capacity modernisation accounted for 82 % of the total investments outlined in the Polish National Plans under Article 10c (Carbon Market Watch, 2016).

Use of international credits for compliance

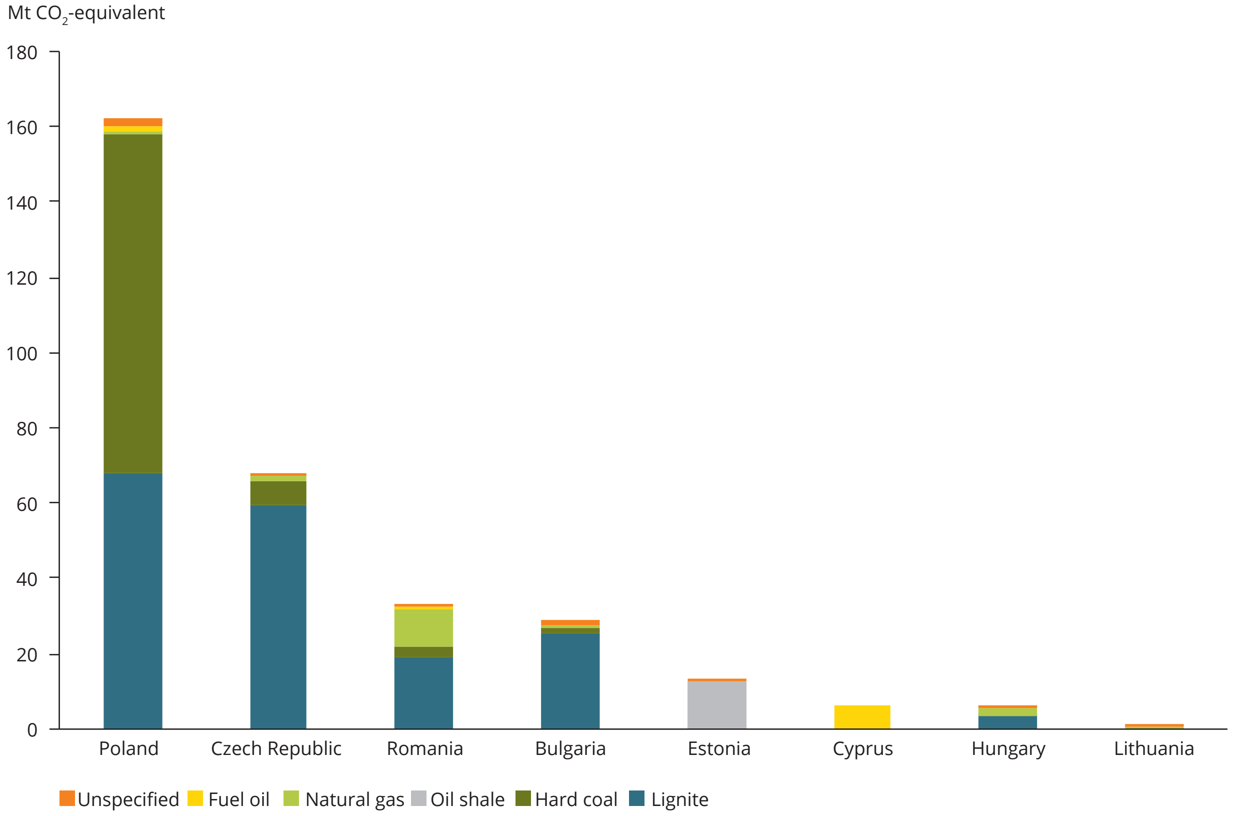
Operators under the EU ETS are allowed to use emission credits to comply with part of their legal obligation to surrender allowances equivalent to their verified emissions. These credits stem from flexible mechanisms set under the Kyoto Protocol: the Clean Development Mechanism (CDM) and Joint Implementation (JI). The international credits corresponding to these flexible mechanisms are CERs in the CDM and ERUs in JI. The overall use of credits is limited to 50 % of the community-wide reductions below the 2005 levels of the existing sectors over the

Figure 2.16 Use of Article 10c allowances between 2013 and 2015 by Member State



Sources: EU, 2012a, 2012b, 2012c, 2012d, 2012e, 2012f, 2012g, 2012h; EEA/EU ETS Data viewer 2016.

Figure 2.17 Free allowances for the modernisation of electricity generation by fuel type of the receiving power plants and by Member State, 2013–2015



Sources: Platts, 2014; EU, 2016; attribution of free allowances to fuel type by the Öko-Institut.

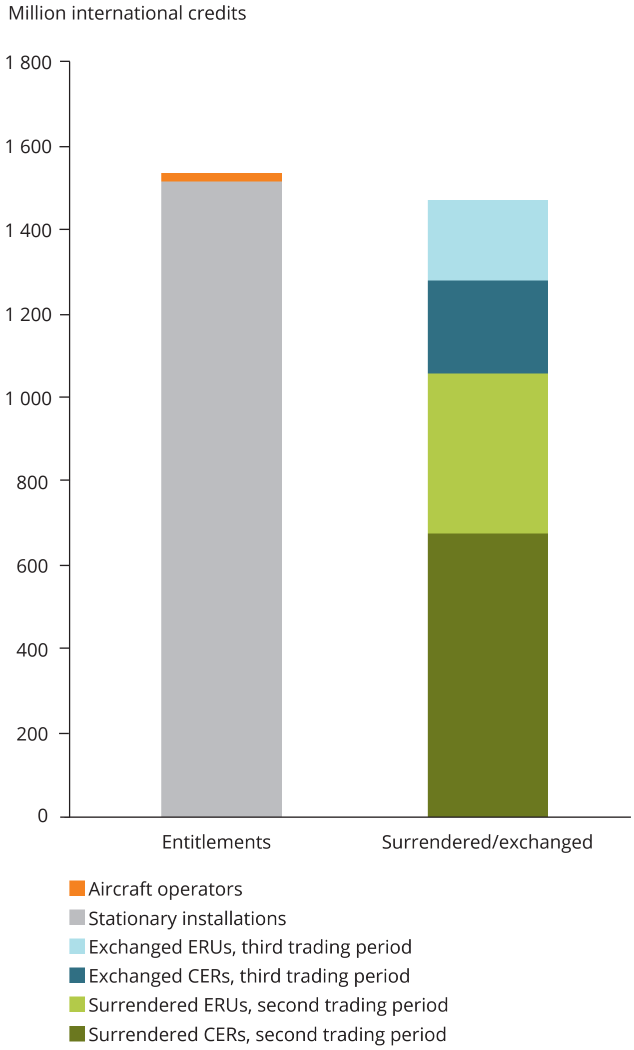
2008–2020 period. Additional limits are also set for new sectors and aviation (see Section A2.6 in Annex 2).

International credits from the CDM and JI projects can be used with certain qualitative restrictions. Excluded from the start of the scheme were nuclear energy projects and afforestation and reforestation projects; large hydroelectric projects (above 20 MW installed capacity) are accepted only under certain restrictions. Projects involving the destruction of industrial gases (HFC-23 and N_2O) in advanced developing countries (especially China) were the main project type surrendered by operators in the second trading period; since April 2013 they have been ineligible for compliance because of environmental concerns (EU, 2011b). Since April 2015, emission reductions that occurred in the first commitment period of the Kyoto Protocol (2008–2012) can no longer be exchanged ([27]).

By the end of 2015, almost the entire CER/ERU budget had been used up, with only 4 % of international credit entitlements remaining (Figure 2.18). In the third trading period, 53 % of the exchanged international credits originated from CDM projects (outside the EU) and 47 % from JI projects (EC, 2014g, 2015j, 2016c). However, the type of projects generating credits differed significantly. A third of all international credits stem from projects related to renewable electricity generation; the majority of these projects are based in China. In contrast, renewables played only a limited role in the JI project portfolio. Significantly, Figure 2.19 shows that the second largest project type is the dismantling of coal piles in Ukraine (UNFCCC, 2016a, 2016b, 2016c). Waste heaps from mines include considerable amounts of residual coal and are vulnerable to spontaneous ignition and slow combustion (UNFCCC Joint Implementation Supervisory

([27]) See http://ec.europa.eu/clima/policies/ets/credits/index_en.htm (accessed June 2016).

Figure 2.18 Allowed and existing use of international credits, 2008–2020



Note: International credit entitlements are published in the EUTL. If the amount was 'not set', but in 2008–2012 international credits were surrendered, the surrendered amounts were used for gap-filling.

Sources: EC, 2014g, 2015j, 2016c; EEA/EU ETS Data viewer, 2016.

Committee, 2011). Doubts have been raised concerning the environmental integrity of JI projects, especially those from Ukraine. Kollmuss et al. (2015) claim that the additionality is not plausible because most projects were implemented before registration and/or would be economically viable even without JI, meaning that overcrediting is likely ([28]).

2.2 Aviation

In the case of the aviation activities covered by the EU ETS, verified emissions surpassed the supply of allowances reserved for the aviation sector in the third trading period (Figure 2.20). This sector is thus a net buyer of allowances from the stationary sector. The emission difference between 2013 and 2012 is due to scope changes ([29]); however, aviation emissions are now slowly increasing. In response to the gradual increase in net demand, the EUAA price rose in 2015, although it remains lower than the EUA price ([30]).

Emission trends

For the period 2013 to 2016, only flights within the European Economic Area are covered under the EU ETS ([31]). Aviation emissions over the third trading period increased slightly, from 53.5 Mt CO_2-eq. in 2013 to 57.0 Mt CO_2-eq. in 2015.

The top 14 emitters in the aviation sector collectively accounted for 63 % of total aviation emissions in 2015 (Table 2.3). The relative increase in the emissions of low-budget air carriers (i.e. Ryanair, EasyJet, Vueling Airlines) between 2012 and 2015 is due primarily to increased levels of activity. As discussed in Section 1.2.1, the 'legacy' airlines have created their own low-cost subsidiaries in order to compete with the budget airlines. This is likely to provide part of the explanation for the declining emissions of Lufthansa between 2013 and 2015 and the coinciding increase in the emissions of Germanwings, for example.

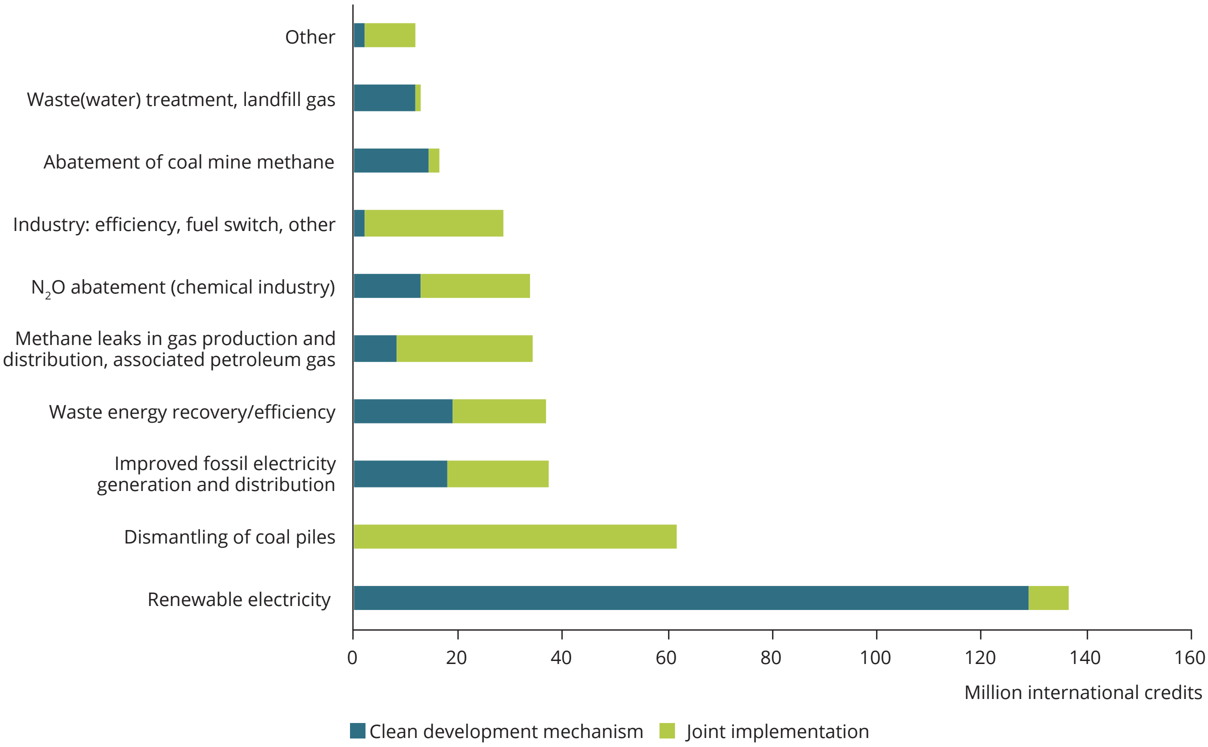
([28]) 'All coal waste pile JI projects together implicitly claim that they have produced around 30 % of all coal in Ukraine. This is a highly unrealistic scenario' (Kollmuss et al., 2015).

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

([30]) EUAAs can be expected to be priced in the range of EUA price — given that the two types of allowances can be used interchangeably by airlines for compliance — but at a slight discount.

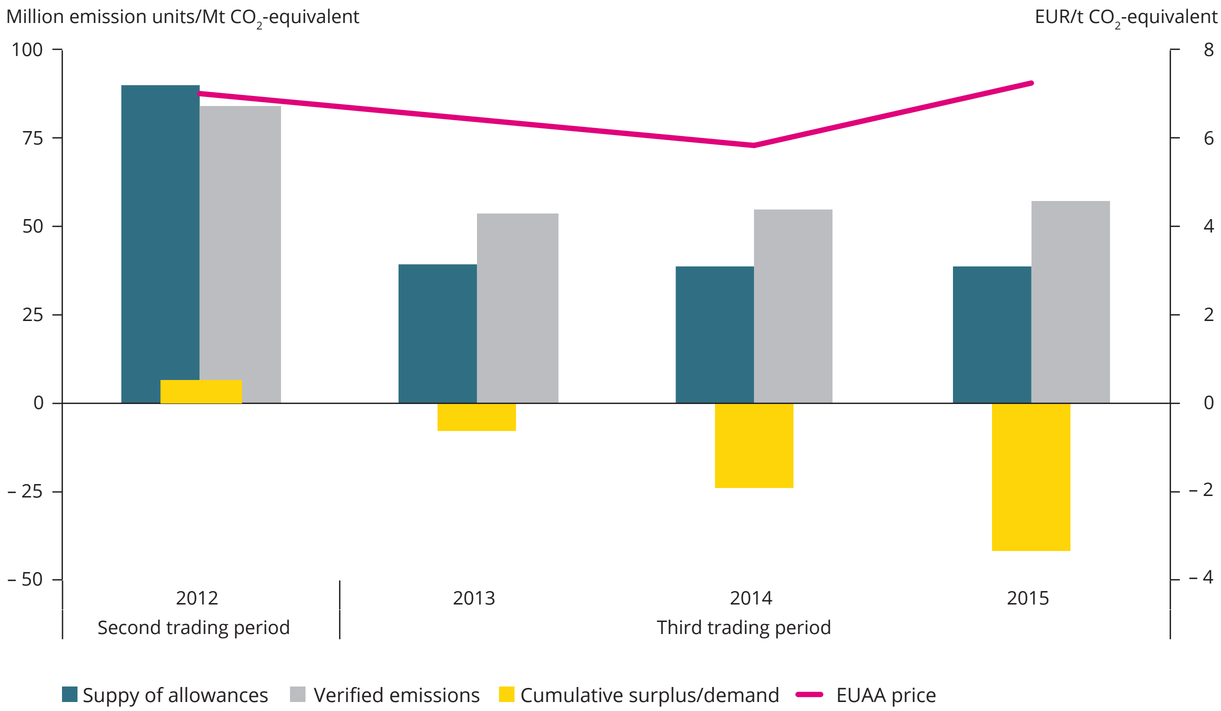
([31]) Flights between continental EEA and its outermost regions are also exempt, e.g. flights between mainland Europe and the Canary Islands (see Section A1.2 in Annex 1).

Figure 2.19 Total number of CERs and ERUs exchanged for allowances in the third trading period by EU ETS operators up to 30 April 2016



Sources: EC, 2014g, 2015j, 2016c; UNFCCC, 2016a, 2016b, 2016c; attribution of exchanged international credits to project types by the Öko-Institut.

Figure 2.20 Supply of allowances and verified emissions between 2012 and 2015, cumulative surplus/demand and EUAA price



Source: EEA/EU ETS Data viewer, 2016.

Table 2.3 Top 14 emitters in aviation

	Verified emissions (Mt CO_2-eq.)			
	2012	**2013**	**2014**	**2015**
Total aviation	**84.0**	**53.5**	**54.8**	**57.0**
Ryanair Limited	7.5	6.6	6.6	7.4
EasyJet Airline Company Ltd	4.6	4.3	4.4	4.7
Deutsche Lufthansa AG	4.9	4.4	4.0	3.8
British Airways PLC	2.5	2.5	2.5	2.6
Air France	3.8	2.6	2.4	2.4
Scandinavian Airlines System (SAS)	3.6	2.3	2.4	2.4
Norwegian Air Shuttle ASA	1.7	1.8	2.1	2.0
Vueling Airlines SA	1.3	1.3	1.6	1.8
Air Berlin PLC & Co. Luftverkehrs KG	2.5	1.8	1.9	1.7
Koninklijke Luchtvaart Maatschappij NV	1.9	1.5	1.6	1.6
Wizz Air Hungary LTD	1.1	1.1	1.3	1.5
Alitalia Società Aerea Italiana SpA	1.9	1.7	1.6	1.5
Germanwings GmbH	0.7	0.8	1.2	1.4
Transportes Aéreos Portugueses SA	1.3	1.1	1.1	1.2

Source: EEA/EU ETS Data viewer, 2016.

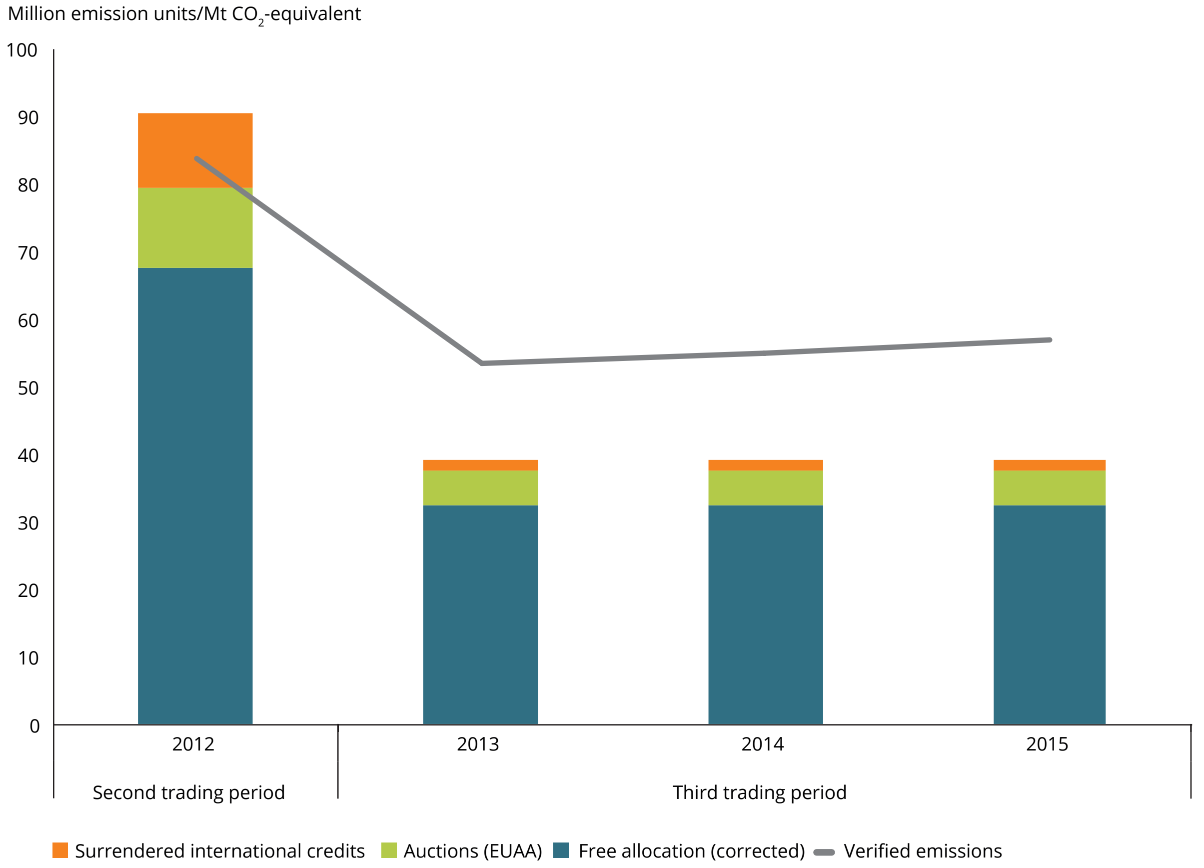
2.2.2 Supply of and demand for allowances

Since its inclusion in the EU ETS in 2012, the aviation sector has had to purchase EUAs from the stationary sector, in order to fully cover aviation emissions. Initially the scope of aviation covered all flights from, to and within the European Economic Area. However, in order to allow time for negotiations within the International Civil Aviation Organization (ICAO) on a global market-based measure for aviation, the requirements of the EU ETS were suspended for flights to and from non-European countries ([32]). With the reduction of the scope of covered aircraft operators, the amounts to be purchased from the stationary sector have declined. Furthermore, the balance between the supply of and demand for EUAAs changed considerably between 2012 and 2013–2015 (see Figure 2.21). The cumulated demand of the aviation sector over 2012–2015 amounts to 42 million EUAs ([33]).

([32]) The European Commission will report to the European Parliament and Council on the outcome of the 2016 ICAO Assembly and propose measures as appropriate to take international developments into account with effect from 2017.

([33]) The cumulated demand was actually slightly higher (i.e. 48 million EUAs) if only the 2013–2015 time period is considered with the same scope.

Figure 2.21 Demand and supply balance for EUAAs, 2012–2015



Source: EEA/EU ETS Data viewer, 2016.

Auctioned allowances and price trends

The original auctioning calendars were based on the full scope, and therefore had to be revised to reflect the reduced scope. Germany was the only country auctioning 2012 EUAAs in 2012: all other countries auctioned 2012 EUAAs in 2014, and EUAAs for the years 2013 to 2015 in 2015. The exception here is Poland, which decided to auction EUAAs pertaining to the years 2012 to 2015 in 2015 (EC, 2015a). It should be noted that the compliance deadlines for aviation emissions from 2013 and 2014 were also delayed. Given the number of auctioned allowances, Table 2.4 provides an overview of auctioning volumes that would have arisen if the total number for 2013–2015 had been distributed equally across 2013, 2014 and 2015 along with the volume of completed auctions.

The attribution of aviation emissions to countries for the purpose of determining the number of allowances to be auctioned under the EU ETS is fundamentally different to that applied in the national GHG inventories, where emissions from each flight are attributed to the country from which the flight leaves. Under the EU ETS, aviation emissions are primarily attributed to the country where the operators are registered (e.g. British Airways is registered in the United Kingdom), rather than the country of origination of flights. Table 2.4 shows that the United Kingdom auctioned the largest number of EUAAs between 2012 and 2015 (i.e. 5.2 million), followed by Germany (4.7 million) and then France (3.4 million) and Spain (3.4 million).

Revenues from auctioning between 2013 and 2015 were highest in Germany, at EUR 34 million, followed by the United Kingdom (EUR 33 million) and Spain (EUR 23 million). The level of auction revenue depends primarily on auction volumes and prices. It is evident from Figure 2.23 that the majority of the allowances were auctioned in 2015, which also coincided with an increase in the EUAA price (Figure 2.22). Revenues from auctioning aviation allowances (EUAAs) are considerably lower (in absolute value) than revenues from auctioning the allowances of stationary installations (EUAs), reflecting the aviation sector's minor share of the total emissions covered by the EU ETS.

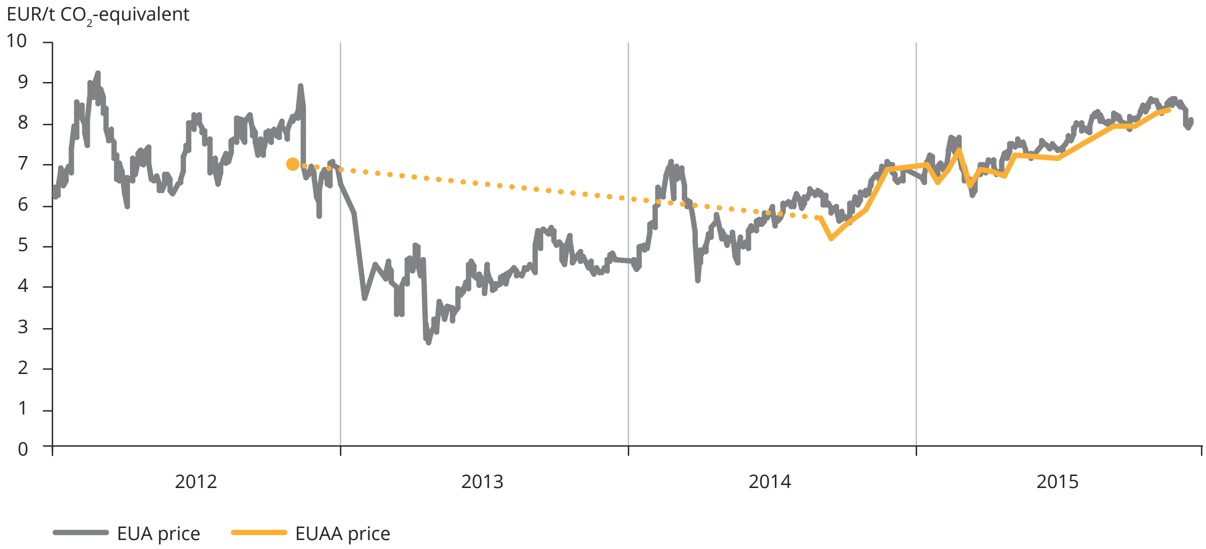
Table 2.4 Aviation allowances auctioned by Member State

	Auctions/sales concluded (million EUAAs)				Auctions/sales redistributed (million EUAAs)			
	2012	2013	2014	2015	2012	2013	2014	2015
Austria			0.196	0.336	0.196	0.112	0.112	0.112
Belgium			0.341	0.383	0.341	0.128	0.128	0.128
Bulgaria			0.037	0.130	0.037	0.043	0.043	0.043
Croatia				0.069		0.023	0.023	0.023
Cyprus			0.050	0.202	0.050	0.067	0.067	0.067
Czech Republic			0.078	0.170	0.078	0.057	0.057	0.057
Denmark			0.194	0.386	0.194	0.129	0.129	0.129
Estonia			0.007	0.022	0.007	0.007	0.007	0.007
Finland			0.136	0.303	0.136	0.101	0.101	0.101
France			1.674	1.731	1.674	0.577	0.577	0.577
Germany	2.500			2.229	2.500	0.743	0.743	0.743
Greece			0.183	0.710	0.183	0.237	0.237	0.237
Hungary			0.048	0.141	0.048	0.047	0.047	0.047
Iceland								
Ireland			0.145	0.305	0.145	0.102	0.102	0.102
Italy			0.873	2.049	0.873	0.683	0.683	0.683
Latvia			0.024	0.076	0.024	0.025	0.025	0.025
Liechtenstein								
Lithuania			0.010	0.041	0.010	0.014	0.014	0.014
Luxembourg			0.105	0.032	0.105	0.011	0.011	0.011
Malta			0.017	0.081	0.017	0.027	0.027	0.027
Netherlands			0.911	0.524	0.911	0.175	0.175	0.175
Norway								
Poland				0.434	0.108	0.108	0.108	0.108
Portugal			0.212	0.411	0.212	0.137	0.137	0.137
Romania			0.054	0.227	0.054	0.076	0.076	0.076
Slovakia			0.008	0.028	0.008	0.009	0.009	0.009
Slovenia			0.008	0.020	0.008	0.007	0.007	0.007
Spain			1.093	2.320	1.093	0.773	0.773	0.773
Sweden			0.171	0.517	0.171	0.172	0.172	0.172
United Kingdom			2.708	2.521	2.708	0.840	0.840	0.840
Total	**2.500**		**9.278**	**16.391**	**11.886**	**5.427**	**5.427**	**5.427**

Note: The table presents two sets of values concerning auctioned/sold allowances. The Section to the left ('Auctions/sales concluded') shows volumes according to the years when allowances were actually released to the market, whereas the Section to the right ('Auctions/sales redistributed) shows volumes redistributed by EEA in accordance with the years to which allowances correspond. Auctions of aviation allowances were suspended after the 'Stop the clock' decision taken in 2012. Germany was the only country auctioning EUAAs in 2012 (2.5 million EUAAs). All the other countries except Poland started auctioning EUAAs in 2014. For these countries, 2014 auctions of EUAAs relate to volumes for the year 2012, whereas 2015 auctions of EUAAs relate to volumes for the years from 2013 to 2015. Poland auctioned all EUAAs for 2012–2015 in 2015 (EC, 2015a). Unless otherwise noted, the calculations and figures presented in this report refer to the redistributed amounts.

Source: EEA/EU ETS Data viewer, 2016.

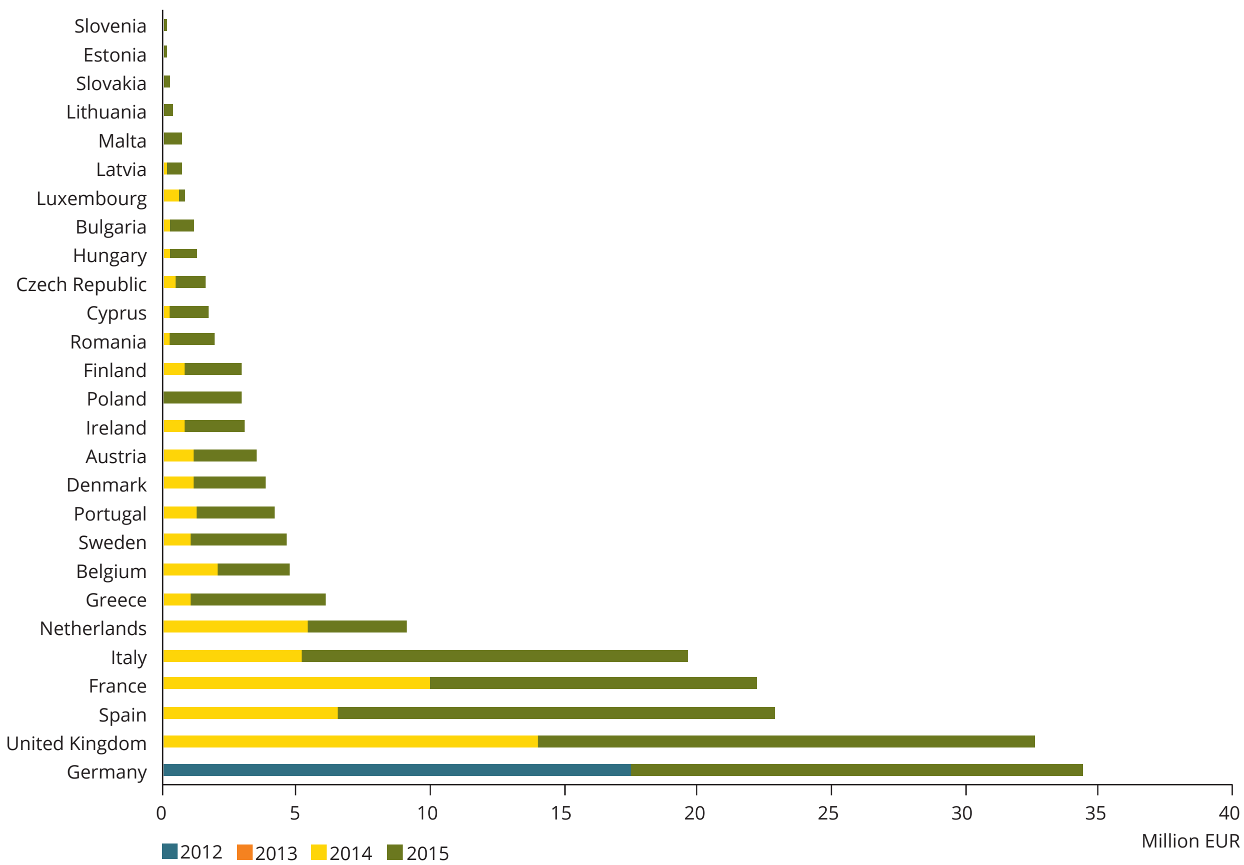
Figure 2.22 Price trends for EUAAs compared with EUAs, 2012–2015



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

Sources: Point Carbon, 2012; EEX, 2016; ICE, 2016.

Figure 2.23 EUAA auction revenues by Member State, 2012–2015



Sources: EEX, 2016; ICE, 2016.

3 Projected trends for stationary installations

3.1 Projected emission trend

In 2016, seven Member States (Austria, Cyprus, Denmark, France, Greece, Ireland and Luxembourg) provided updated projections compared with their 2015 submission under EU reporting requirements.

According to the figures reported by EU Member States in 2015 under EU legislation ([34]), EU ETS emissions are projected to further decrease with the current policies and measures in place ([35]). The projected reductions represent a 7 % decrease between 2015 and 2020, and a further 5 % decrease between 2020 and 2030, resulting in an overall decrease of 12 % by 2030 compared with 2015 levels.

Based on the current Member State projections, 2030 EU ETS emissions (from stationary installations) could be at least 30 % below 2005 levels, considering only existing policies and measures. If the additional measures planned by a number of Member States are taken into account, the total reduction of EU ETS emissions (stationary installations) is expected to be 34 % below 2005 levels ([36]). This remains less than the 43 % reduction below 2005 levels expected from the EU ETS sectors and which will contribute to the overall 40 % reduction target set for 2030. However, the dynamic effects of the market stability reserve (MSR) (see Section A2.4 in Annex 2), as well as other new policy proposals, which are currently being discussed at EU level (including a reform of the EU ETS, as well as measures to enhance energy efficiency), are still not included in national projections.

The projected decrease in EU ETS emissions between 2015 and 2030 is about twice as less than the decrease in EU ETS emissions that was actually achieved between 2005 and 2014. In fact, as many as 13 Member States project that EU ETS emissions will increase between 2015 and 2030. These national projections differ from the reference scenario used by the European Commission in its proposal for a 2030 framework for climate and energy policies (EC, 2013), which assumes that EU ETS emissions will decrease between 2015 and 2030 in all Member States except Latvia, Luxembourg, Malta and Slovenia (EC, 2016b).

Comparisons between projected and historic levels of EU ETS emissions should be considered with care, because recent trends have already been diverging from projected trends. This is mainly because most of the latest national projections available were elaborated in 2014, in order to be submitted to the European Commission, by 15 March 2015, which was the legal reporting deadline. With only 8 member States submitting updated projections in 2016 (Austria, Cyprus, Denmark, France, Greece, Hungary, Ireland and Luxembourg), most Member States prepared their projections on the basis of historic emission data for years until 2013 or before. Therefore, while projections were broadly consistent with 2013 levels, they have been diverging from observed trends since. For example, the difference between actual EU ETS emissions and projected emissions grew from 7 Mt in 2013 to 88 Mt in 2015 ([37]). Therefore 2020 or 2030 emissions are little comparable with actual 2015 historic

([34]) Article 14(1)(b) of the Monitoring Mechanism Regulation (MMR) (EU, 2013c).

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

([36]) Projections in the scenario 'with additional measures' (WAM) were reported by 18 Member States (Austria, Croatia, Cyprus, the Czech Republic, Estonia, Finland, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Portugal, Romania, Slovakia, Spain and the United Kingdom). For an aggregated EU-28 WAM scenario, Member States not reporting a WAM scenario have been gap-filled with the WEM scenario.

([37]) The projections reported by Member States and used in the report underwent QA/QC procedures by the EEA as described in 'Elements of the Union System for Policies and Measures and Projections and the Quality Assurance and Control (QA/QC) Programme as Required under Regulation (EU) No 525/2013' (EC, 2015b). The activities include the recalibration of projected trends on the basis of total GHG inventory data to a consistent reference year, when discrepancies between historic trends and projected trends are observed.

emissions. Member States are currently preparing new projections, taking into recent policy developments, in order to be able to submit them to the European Commission by 15 March 2017, under the Monitoring Mechanism Regulation.

Aggregated projections at EU level should also be considered with the care for the reason that Member States do not use fully harmonised methodologies and assumptions to prepare their projections. For example, most Member States use their own assumptions for fuel and gas prices (although the European Commission provides harmonised assumptions): while the European Commission projections assume that a carbon price of EUR 10 per EUA in 2020 and 35 EUR per EUA in 2030, national projections for the year 2020 use assumptions ranging from EUR 6 to EUR 18 per EUA, with an even wider spread in 2030 (EUR 6–35 EUR per EUA).

3.1.1 *Sectoral trends*

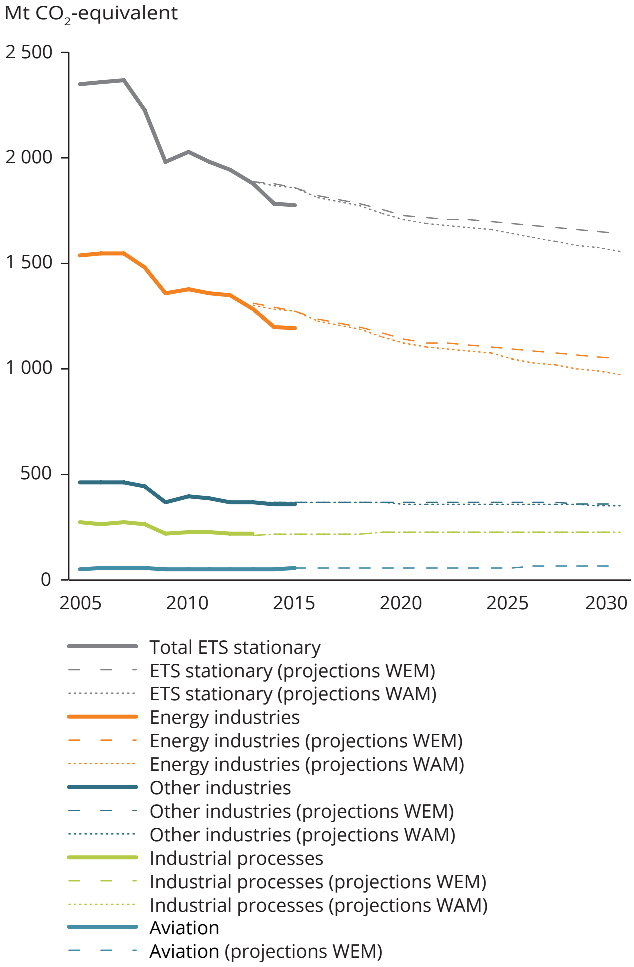
The decrease in EU ETS emissions within the EU-28 is projected to take place predominantly in the energy sector ([38]), whereas EU ETS emissions in other sectors are projected to remain stable until 2030 (see Figure 3.1). These projected trends contrast with historical trends, which show that decreases have been achieved in a number of industrial sectors, such as manufacturing and construction and industrial processes (which include emissions from production of cement as well as of iron and steel).

3.1.2 *National trends*

At the EU Member State level, different projected trends in emissions can be observed (see Figure 3.2). Overall, projections indicate that emissions will decrease more over the 5-year period from 2015 to 2020 than over the 10-year period from 2020 to 2030. Projections for the period from 2015 to 2020 show decreases in EU ETS emissions in 16 EU Member States; 16 EU Member States (but not always the same ones) also project emission reductions between 2020 and 2030.

Overall, for the period from 2015 to 2030, emissions are projected to decrease in 15 EU Member States, with reductions ranging from − 1 % (Austria) to − 62 % (Malta), and to increase in 13 EU Member States (Belgium, Croatia, France, Hungary, Ireland, Italy, Latvia, Lithuania, Romania, Slovakia, Slovenia, Spain and

Figure 3.1 Historic and projected EU emission trends in the ETS, by main source category



Note: Solid lines represent historic GHG emissions up to 2012. Dashed lines represent projections 'with existing measures' (WEM). Dotted lines represent projections under the 'with additional measures' (WAM) scenario.

Historic and projected emission trends are split by main source category ([39]). The allocation of EU ETS emissions to the sectors presented here is based on the assumption that a constant percentage of emissions from each relevant source category is covered under the EU ETS: 91 % of emissions from IPCC sectors 1.A.1, 1.B and 1.C, the Energy Industries; 74 % of emissions from IPCC sector 1.A.2, Manufacturing and Construction; 1 % of emissions from IPCC sectors 1.A.4 and 1.A.5, the Residential and Commercial sector; and 60 % of emissions from IPCC sector 2, Industrial Processes.

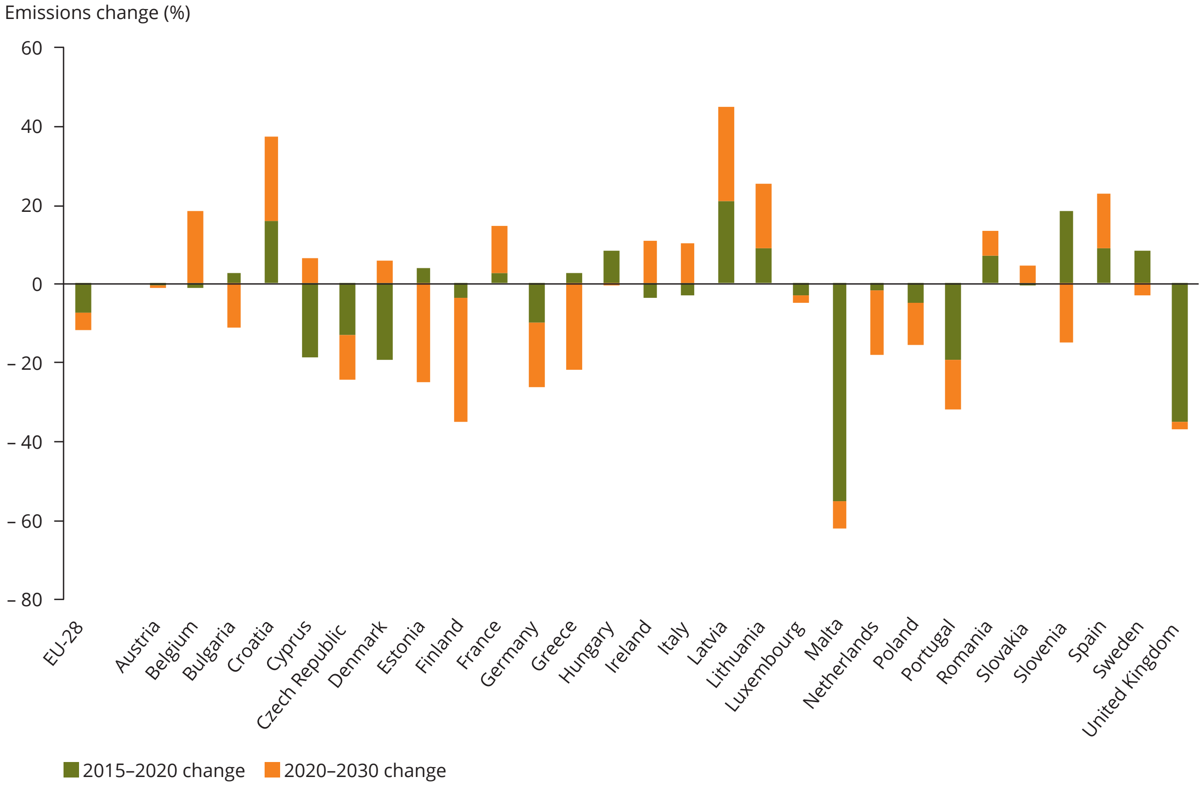
For Poland, the division of EU ETS emissions into source categories has partly been conducted by application of average sectoral percentages to total EU ETS emissions.

Sources: Deliveries for projections and national programmes by EU Member States (see http://cdr.eionet.europa.eu/ online), compiled by ETC/ACM as of 31 August 2015; EEA/EU ETS Data viewer, 2016.

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

([39]) These categories are consistent with the nomenclature of the IPCC used for reporting national GHG inventories. This nomenclature is used by Member States for reporting emission projections by sector. It differs from the typology of activities reported with verified emissions under ETS activities.

Figure 3.2 Changes in ETS emissions projected by EU Member States for 2015–2020 and 2020–2030 relative to 2015 emission levels



Note: Projections reported under the WEM scenario.

Sources: Deliveries for projections and national programmes by EU Member States (see http://cdr.eionet.europa.eu/ online), compiled by ETC/ACM as of 31 August 2015.

Sweden). For most of these countries, except France, Slovenia and Sweden, the projected increase in EU ETS emissions is in line with a projected increase in total (economy-wide) GHG emissions during this period. France and Sweden project considerable emission reductions of – 8 % and – 15 % in sectors outside the EU ETS (covered by the Effort Sharing Decision (ESD)) despite projected increases in EU ETS emissions. In Belgium and Italy, increases in EU ETS emissions drive the increase in total GHG emissions, despite projected reductions in emissions under the ESD. Croatia, Lithuania and Spain project larger increases in EU ETS emissions than in emissions under the ESD.

Explanations for the projected increases are limited:

- Croatia and Italy plan to reduce imports of electricity by increasing the capacity of their thermal power plants.
- Belgium and France anticipate a strong decrease in electricity generation from nuclear power plants.

When additional measures (at planning stage) are taken into consideration in projections, Croatia, Ireland, Italy, Lithuania and Slovakia project that such measures could result in emission reductions instead of increases. Spain did not account for any effects on the EU ETS sector from additional measures in its projections.

3.2 Supply of and demand for allowances

The surplus of allowances accumulated in the EU ETS stood at 1.8 billion by the end of 2015, mainly resulting from the economic crisis and extensive use of international credits. As this overall surplus was not expected to decline significantly by 2020, it risked undermining the proper function of the market and affecting the ability of the EU ETS to deliver on more ambitious reductions in future phases in a cost-effective manner. This is because a persistent surplus limits the EU ETS in delivering a carbon price that incentivises investments in GHG abatement.

To address the imbalance in the supply of and demand for allowances, the European Commission first postponed the auctioning of 900 million allowances. This back-loading of auction volumes has been implemented through an amendment to the EU ETS Auctioning Regulation (EU, 2014a). The auction volume for 2014 was reduced by 400 million allowances, while that for 2015 was reduced by 300 million and that for 2016 by 200 million. It was originally envisaged that these back-loaded EUAs would be returned to the market towards the end of the third trading period. The re-introduction of these back-loaded EUAs (and also any unallocated allowances accumulated during the third trading period) would have resulted in a significant increase in the surplus at the end of the third trading period.

As back-loading is only a temporary measure, the second action taken by the European Commission was to propose establishing a market stability reserve (MSR), as a structural measure to address the imbalance between supply and demand. The reserve would both address the surplus of emission allowances that has built up and improve the system's resilience to major shocks, by adjusting the supply of allowances to be auctioned. Following its endorsement by the European Parliament, the MSR will be established in 2019 (EU, 2015). Back-loaded and certain unallocated allowances will be transferred to the MSR instead of returning to the market towards the end of the third trading period and beginning of the fourth. The MSR will operate entirely according to predefined rules that would leave no discretion to the European Commission or Member States in its implementation (EC, 2014e). See Section A2.4 in Annex 2 for further information on the MSR.

The projections reported by Member States indicate that emissions are expected to remain below the decreasing linear cap throughout the third trading period (see Section A2.5 in Annex 2). However, taking into account the back-loading of allowances, the surplus is expected to decline further in 2016 and again from 2019 onwards following the introduction of the MSR. The MSR is expected to play a significant role, in particular in 2019 and 2020, when back-loaded and unallocated allowances will be added to the reserve.

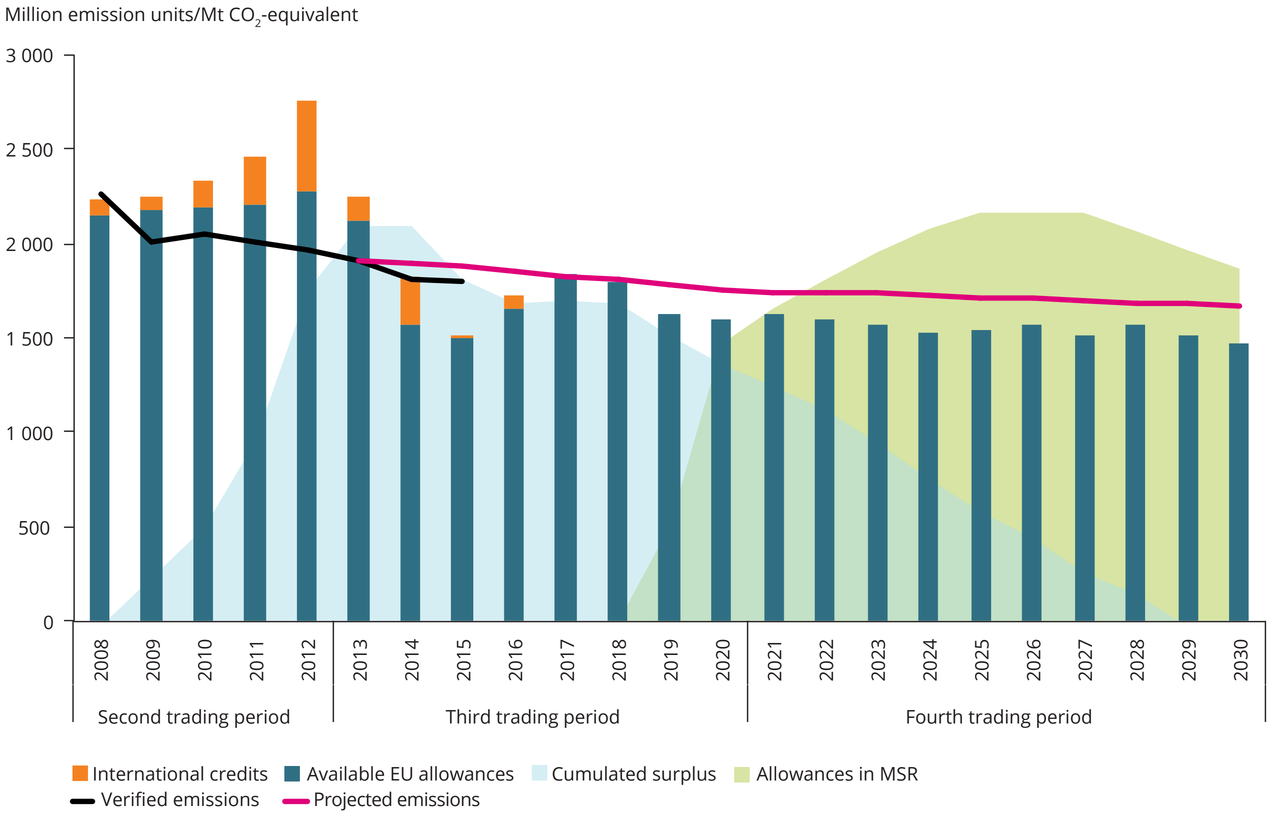
In October 2014, European leaders endorsed a binding EU target of at least a 40 % domestic reduction in GHG emissions by 2030 compared with 1990, with a contribution from the EU ETS amounting to a 43 % reduction compared with 2005. This reduction was to be achieved by changing the annual factor by which the cap is reduced from 1.74 % (third trading period) to 2.2 % from 2021 onwards (European Council, 2014). Taking this additional factor into account, and using the projections available from Member States with existing measures in place, the EU ETS surplus could be absorbed by the MSR in 2029 (see Figure 3.3). Based on the projections taking additional measures into account, the surplus would be absorbed 2 years later (2031).

The estimated dates for eliminating the surplus, that is 2029 or 2031, are based on Member State projections submitted by the end of August 2015 ([40]). These projections do not account for more recent policy developments, such as the agreement on the MSR, and it can be observed that the absolute level of projected EU ETS emissions is currently about 5 % higher than actual EU ETS numbers. Emissions may also be lower than currently projected as an effect of the MSR, which would reduce the speed at which the surplus is abolished. Given that a static baseline is applied in order to calculate the elimination of the surplus, the projected emissions from Member States are not responsive to the expected change in EUA prices ([41]) as a consequence of the MSR. The current estimate of the year of elimination of the surplus may therefore be conservative.

([40]) The projections reflect each Member State's expectation on how their energy mix will develop over the time period — this varies from one Member State to another.

([41]) Within the modelling exercise, future EUA prices are not estimated. Furthermore, the impact of the hedging of allowances is also not considered.

Figure 3.3 Outlook for the supply of and demand for allowances until 2030



Note: Between 2008 and 2013, the scope of the EU ETS increased in terms of both countries and activities. To make the time series comparable across the whole period considered, an estimate reflecting current EU ETS scope has been added to both EU ETS emission trends and allocated allowances, for the period from 2008 to 2012.

Projections used are those reported under the WEM scenario. See Section A2.4 in Annex 2 for the parameters of the MSR used in this calculation.

It is assumed that 300 million back-loaded EUAs will enter the MSR in 2019, followed by an additional 600 million back-loaded EUAs in 2020 (EU, 2015). An estimated 180 million unallocated EUAs from the NER from the third trading period will also enter the MSR in 2020 (EC, 2015d). Based on calculations made by the European Commission in its Impact Assessment (EC, 2015d) and in the proposal for a revised ETS Directive (EC, 2015e), it is assumed that 395 million unallocated EUAs of the third trading period are to be used towards the NER in the fourth trading period, and a further 50 million for an innovation fund in the fourth trading period.

It is further assumed that transitional free allocation for electricity generators (under Article 10c) continues at the average rate observed in 2013–2015, minus those allowances already reintroduced into auctioning amounts (see Section A2.4 in Annex 2). This would mean that 114 million allowances under Article 10c remain unallocated. These are then assumed to be auctioned in 2019 and 2020, with an equal amount being auctioned each year. The auctioning volumes currently withheld as auctions for EEA-EFTA States are still pending (26 million EUAs). These are assumed to be auctioned in the years 2017–2020 in equal tranches.

Net demand for aviation has been taken into account for historic years (2012–2015).

Sources: Authors' own calculation based on EEA/EU ETS Data viewer (2016); deliveries for projections and national programmes by EU Member States (see http://cdr.eionet.europa.eu/ online), compiled by ETC/ACM as of 31 August 2015.

References

Arlinghaus, J., 2015, *Impacts of carbon prices on indicators of competitiveness: A review of empirical findings*, OECD Environment Working Papers 87, OECD, Paris (http://www.oecd-ilibrary.org/environment/impacts-of-carbon-prices-on-indicators-of-competitiveness_5js37p21grzq-en) accessed 3 September 2015.

BBC News, 2016, 'Drax bid to convert plant from coal to biomass probed by EU', BBC News (http://www.bbc.co.uk/news/business-35232547) accessed 17 May 2016.

Carbon Market Watch, 2016, *Fossil fuel subsidies from Europe's carbon market*, Carbon Market Watch (http://carbonmarketwatch.org/wp-content/uploads/2016/04/Fossil-fuel-subsidies-from-Europes-carbon-market-final-web.pdf) accessed 17 May 2016.

Carbon Pulse, 2016, *EU should focus on current 2030 goals until 2018 UN stocktake, keep handing out free EUAs — Commission*, Carbon Pulse (http://carbon-pulse.com/16451) accessed 19 May 2016.

CEPI, 2016, *Preliminary statistics 2015*, Confederation of European Paper Industries (http://www.cepi.org/system/files/public/documents/publications/statistics/2016/Preliminary%20Statistics%202015.pdf) accessed 17 May 2016.

Cooper, R., 2010, *Europe's Emissions Trading System*, Discussion Paper 10-40, Harvard University (http://belfercenter.ksg.harvard.edu/files/CooperETSfinal.pdf) accessed 3 September 2015.

Cranfield University, 2008, *A report for the European Commission: Fuel and air transport*, Air Transport Department, Cranfield University (http://ec.europa.eu/transport/modes/air/doc/fuel_report_final.pdf) accessed 17 May 2016.

DECC, 2016, *Electricity production and availability from the public supply system*, DECC (https://www.gov.uk/government/statistics/electricity-section-5-energy-trends) accessed 17 May 2016.

EasyJet, 2015, *Annual report and accounts 2015*, EasyJet (http://corporate.easyjet.com/~/media/Files/E/Easyjet-Plc-V2/pdf/investors/result-center-investor/annual-report-2015.pdf) accessed 17 May 2016.

EC, 2005, Communication from the Commission, 'Further guidance on allocation plans for the 2008 to 2012 trading period of the EU Emission Trading Scheme' (Communication from the Commission 703 final, 22.12.2005, p. 1).

EC, 2006, Communication from the Commission to the Council and to the European Parliament on the assessment of national allocation plans for the allocation of greenhouse gas emission allowances in the second period of the EU Emissions Trading Scheme accompanying Commission Decisions of 29 November 2006 on the national allocation plans of Germany, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta, Slovakia, Sweden and the United Kingdom in accordance with Directive 2003/87/EC (Communication from the Commission 725 final, 29.11.2006, p. 1).

EC, 2011, Communication from the Commission — Guidance document on the optional application of Article 10c of Directive 2003/87/EC. C99, European Commission (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011XC0331%2801%29) accessed 27 October 2015.

EC, 2012a, Emissions trading: Commission rules on temporary free allowances for power plants in Poland, Memo, 13 July 2012 (http://europa.eu/rapid/press-release_MEMO-12-561_en.htm) accessed 22 June 2015.

EC, 2012b, State aid: Commission authorises transitional free allocation of greenhouse gas emission allowances for modernisation of Czech and Hungarian electricity sector, press release, 19 December 2012, European Commission (europa.eu/rapid/press-release_IP-12-1411_en.htm) accessed 17 June 2016.

EC, 2013, *EU energy, transport and GHG emissions Trends to 2050*, European Commission (http://ec.europa.eu/transport/media/publications/doc/trends-to-2050-update-2013.pdf) accessed 27 May 2015.

EC, 2014a, *Classification of installations in the EUTL Registry based on the NACE 4 Statistical Classification*, European Commission, Brussels (http://ec.europa.eu/clima/policies/ets/cap/leakage/docs/installation_nace_rev2_matching_en.xls) accessed 15 May 2015.

EC, 2014b, Communication from the Commission to the European Parliament and the Council: Energy efficiency and its contribution to energy security and the 2030 framework for climate and energy policy. COM (2014) 520 final, European Commission, Brussels (http://ec.europa.eu/energy/sites/ener/files/documents/2014_energy_efficiency_communication.pdf) accessed 25 August 2014.

EC, 2014c, Derogation of Article 10c of Directive 2003/87/EC on Emission Trading — Free allowances to power generators, European Commission (http://ec.europa.eu/competition/state_aid/cases/249823/249823_1531412_94_2.pdf) accessed 17 June 2016.

EC, 2014d, *Energy economic developments in Europe*, European Economy Series, European Commission (http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee1_en.pdf) accessed 26 August 2016.

EC, 2014e, Proposal for a Decision of the European Parliament and of the Council Concerning the establishment and operation of a market stability reserve for the Union greenhouse gas Emission Trading Scheme and amending Directive 2003/87/EC. COM (2014) 20 final, European Commission (http://ec.europa.eu/clima/policies/ets/reform/docs/com_2014_20_en.pdf) accessed 28 April 2015.

EC, 2014f, 'Status table on transitional free allocation to power generators for 2013', European Commission (http://ec.europa.eu/clima/policies/ets/cap/auctioning/docs/process_overview_10c_en.pdf) accessed 15 May 2015.

EC, 2014g, 'Updated information on exchange and international credit use in the EU ETS', European Commission (http://ec.europa.eu/clima/news/articles/news_2014110401_en.htm) accessed 11 April 2014.

EC, 2015a, *Auctions by the Transitional Common Auction Platform*, European Commission (http://ec.europa.eu/clima/policies/ets/cap/auctioning/docs/cap_report_201503_en.pdf) accessed 19 June 2015.

EC, 2015b, Elements of the Union System for Policies and Measures and Projections and the Quality Assurance and Control (QA/QC) Programme as Required under Regulation (EU) No 525/2013 (http://ec.europa.eu/clima/policies/strategies/progress/monitoring/docs/union_pams_projections_en.pdf) accessed 28 September 2016.

EC, 2015c, Estimated amount of general allowances (EUAs) to be auctioned in 2016, European Commission (http://ec.europa.eu/clima/news/articles/news_2015112701_en.htm) accessed 28 September 2016.

EC, 2015d, Impact Assessment Accompanying the Document Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC to Enhance Cost-effective Emission Reductions and Low-carbon Investments (SWD(2015) 135 final), European Commission (http://ec.europa.eu/clima/policies/ets/revision/docs/impact_assessment_en.pdf) accessed 28 July 2015.

EC, 2015e, Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC to Enhance cost-effective Emission reductions and Low-Carbon Investments (COM(2015) 337 final), European Commission (http://ec.europa.eu/clima/policies/ets/revision/docs/com_2015_337_en.pdf) accessed 28 July 2015.

EC, 2015f, *Quarterly report on European electricity markets*, DG ENER (https://ec.europa.eu/energy/sites/ener/files/documents/quarterly_report_on_european_electricity_markets_q3_2015.pdf) accessed 17 May 2016.

EC, 2015g, *Quarterly report on European electricity markets*, DG ENER (https://ec.europa.eu/energy/sites/ener/files/documents/quarterly_report_on_european_electricity_markets_q2_2015.pdf) accessed 17 May 2016.

EC, 2015h, *Quarterly report on European electricity markets*, DG ENER (https://ec.europa.eu/energy/sites/ener/files/documents/quarterly_report_on_european_electricity_markets_q1_2015.pdf) accessed 17 May 2016.

EC, 2015i, 'Status table on transitional free allocation to power generators for 2014' (updated on 23 April 2015), European Commission (http://ec.europa.eu/clima/policies/ets/cap/auctioning/docs/process_overview_10c_2014_en.pdf) accessed 24 April 2015.

EC, 2015j, 'Updated information on exchange and international credit use in the EU ETS', European Commission (http://ec.europa.eu/clima/news/docs/2015050402_credits_exchanged.xlsx) accessed 14 May 2015.

EC, 2016a, *Allocation of allowances from the New Entrants' Reserve 2013–2020, European Commission* (http://ec.europa.eu/clima/news/docs/2016011501_status_table_en.pdf) accessed 18 May 2016.

EC, 2016b, 'Energy modelling — Interactive graphs', European Commission (https://ec.europa.eu/energy/en/content/energy-modelling-interactive-graphs?type=msline&themes=s_56_total-ghg-emissions-excl-lulucf) accessed 26 August 2016.

EC, 2016c, 'Updated information on exchange and international credit use in the EU ETS', European Commission (http://ec.europa.eu/clima/news/articles/news_2016050201_en.htm) accessed 2 May 2016.

EC, 2016d, 'Status table on transitional free allocation to power generators for 2015', European Commission (http://ec.europa.eu/clima/policies/ets/cap/auctioning/docs/process_overview_10c_2015_en.pdf) accessed 13 May 2016.

EEA, 2013, *Trends and projections in Europe 2013 — Tracking progress towards Europe's climate and energy targets until 2020*, EEA Report No 10/2013, European Environment Agency (http://www.eea.europa.eu/publications/trends-and-projections-2013) accessed 1 January 2014.

EEA, 2014, *Why did greenhouse gas emissions decrease in the EU between 1990 and 2012?*, European Environment Agency (http://www.eea.europa.eu/publications/why-are-greenhouse-gases-decreasing) accessed 24 June 2015.

EEA, 2015a, *Application of the EU Emissions Trading Directive*, EEA Technical report No 3/2015, European Environment Agency (http://www.eea.europa.eu/publications/application-of-the-eu-emissions) accessed 15 May 2015.

EEA, 2015b, *EU ETS data viewer — User manual and background note*, European Environment Agency (http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer) accessed 14 May 2015.

EEA, 2015c, *Trends and projections in the EU ETS in 2015*, EEA Technical report No 14/2015, European Environment Agency (www.eea.europa.eu/publications/trends-and-projections-eu-ets-2015) accessed 20 October 2015.

EEA, 2016a, *Estimate of historical emissions for stationary installations to reflect the current scope of the EU ETS (2013–2020)*, ETC/ACM Technical Paper 2016/1, European Environment Agency (http://acm.eionet.europa.eu/reports/docs/ETCACM_TP_2016_1_estimates_reflect_current_scope_ETS.pdf) accessed 24 May 2016.

EEA, 2016b, *EU ETS data viewer user manual and background note*, European Environment Agency (http://www.eea.europa.eu/data-and-maps/data/european-union-emissions-trading-scheme-eu-ets-data-from-citl-8/eu-ets-data-viewer-manual/eu-ets-data-viewer-manual/at_download/file) accessed 11 May 2016.

EEA, 2016c, *Transforming the EU power sector: avoiding a carbon lock-in*, EEA Report No 22/2016, European Environment Agency (http://www.eea.europa.eu/data-and-maps/data/european-union-emissions-trading-scheme-eu-ets-data-from-citl-8/eu-ets-data-viewer-manual/eu-ets-data-viewer-manual/at_download/file) accessed 11 May 2016.

EEA/EU ETS Data viewer, 2016, 'EU Emissions Trading System (ETS) data viewer', European Environment Agency (http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer) accessed 3 June 2016.

EEX, 2016, 'Market data' (https://www.eex.com/en/market-data) accessed 13 May 2016.

Egenhofer, C., Alessi, M., Georgiev, A. and Fujiwara, J., 2011, *The EU Emissions Trading System and climate policy towards 2050: real incentives to reduce emissions and drive innovation?*, CEPS Special Reports, Centre for European Policy Studies (https://www.ceps.eu/publications/eu-emissions-trading-system-and-climate-policy-towards-2050-real-incentives-reduce) accessed 1 January 2016.

EIB, 2014a, 'Low carbon energy projects to benefit from EUR 2 billion funding', European Investment Bank (http://europa.eu/rapid/press-release_BEI-14-83_en.htm) accessed 30 June 2014.

EIB, 2014b, *Summary report on the monetisation of 300 million EU allowances (EUAs)*, European Investment Bank (http://www.eib.org/attachments/ner_summary_report_en.pdf) accessed 17 September 2015.

Ellerman, D. and Buchner, B., 2008, 'Over-allocation or abatement? a preliminary analysis of the EU ETS based on the 2005–06 emissions data', *Environmental and Resource Economics*, (41/2) 267–287.

ENTSO-E, 2016, 'Electricity generation per generation unit' (https://transparency.entsoe.eu/generation/r2/actualGenerationPerGenerationUnit/show) accessed 23 June 2016.

EU, 2003, Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending

Council Directive 96/61/EC (OJ L 275, 13.10.2003, p. 32) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003L0087&from=EN) accessed 30 June 2014.

EU, 2004, Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms (OJ L 338, 27.10.2004, p. 18).

EU, 2006, Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services repealing Council Directive 93/76/EEC (OJ L 114, 27.04.2006, p. 64) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006L0032&from=EN) accessed 15 August 2014.

EU, 2009a, Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (OJ L 140, 2009, p. 63) (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0063:0087:en:PDF) accessed 15 August 2014.

EU, 2009b, Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJ L 140, 05.06.2009, p. 16) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN) accessed 15 August 2014.

EU, 2011a, Commission Decision of 27 April 2011 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (OJ L 130, 27.04.2011, p. 1).

EU, 2011b, Commission Regulation (EU) No 550/2011 of 7 June 2011 on determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, certain restrictions applicable to the use of international credits from projects involving industrial gases (OJ L 149, 08.06.2011, p. 1) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0550&from=EN) accessed 1 February 2016.

EU, 2012a, Commission Decision of 13.7.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Poland (Commission Decision C(2012) 4609 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_4609_en.pdf) accessed 24 May 2016.

EU, 2012b, Commission Decision of 23.5.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Cyprus (Commission Decision C(2012) 3260 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_3260_en.pdf) accessed 24 May 2016.

EU, 2012c, Commission Decision of 23.5.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Estonia (Commission Decision C(2012) 3271 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_3271_en.pdf) accessed 24 May 2016.

EU, 2012d, Commission Decision of 23.5.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Lithuania (Commission Decision C(2012) 3237 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_3237_en.pdf) accessed 24 May 2016.

EU, 2012e, Commission Decision of 30.11.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Hungary (Commission Decision C(2012) 8675 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/hungary_com_en.pdf) accessed 15 August 2014.

EU, 2012f, Commission Decision of 6.7.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Bulgaria (Commission Decision C(2012) 4560 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_4560_en.pdf) accessed 24 May 2016.

EU, 2012g, Commission Decision of 6.7.2012 concerning the application pursuant to Article 10c (5) of Directive

2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by Romania (Commission Decision C(2012) 4564 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_4564_en.pdf) accessed 24 May 2016.

EU, 2012h, Commission Decision of 6.7.2012 concerning the application pursuant to Article 10c (5) of Directive 2003/87/EC of the European Parliament and of the Council to give transitional free allocation for the modernisation of electricity generation notified by the Czech Republic (Commission Decision C(2012) 4576 final, 2012) (http://ec.europa.eu/clima/policies/ets/allowances/electricity/docs/c_2012_4576_en.pdf) accessed 24 May 2016.

EU, 2013a, Commission Decision of 5 September 2013 concerning national implementation measures for the transitional free allocation of greenhouse gas emission allowances in accordance with Article 11(3) of Directive 2003/87/EC of the European Parliament and of the Council (notified under document C(2013) 5666) (2013/448/EU) (OJ L 240, 2013, p. 27) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0448&from=EN) accessed 15 August 2014.

EU, 2013b, Decision No 377/2013/EU of the European Parliament and of the Council of 24 April 2013 derogating temporarily from Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community (OJ L 113, 25.04.2013, p. 1) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013D0377&from=EN) accessed 19 August 2014.

EU, 2013c, Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (2013/162/EU) (OJ L 165, 18.06.2013, p. 13) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0525&from=EN) accessed 14 August 2014.

EU, 2014a, Commission Regulation (EU) No 176/2014 of 25 February 2014 amending Regulation (EU) No 1031/2010 in particular to determine the volumes of greenhouse gas emission allowances to be auctioned in 2013-20 (OJ L 56, 26.02.2014, p. 11) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0176&from=EN) accessed 15 August 2014.

EU, 2014b, Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in view of the implementation by 2020 of an international agreement applying a single global market-based measure to international aviation emissions (OJ L 129, 30.04.2014, p. 1) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0421&from=EN) accessed 25 June 2014.

EU, 2014c, Commission implementing regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council (OJ L 203, 11.07.2014, p. 23) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0749&from=EN) accessed 18 August 2014.

EU, 2014d, Commission Decision of 27 October 2014 determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage, for the period 2015 to 2019 — (notified under document C(2014) 7809) — (2014/746/EU) (OJ L 308, 29.10.2014, p. 114).

EU, 2015, Decision of the European Parliament and of the Council of concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC (OJ L 264/1, 2015) (http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015D1814&from=EN) accessed 5 August 2015.

EU, 2016, 'European Union Transaction Log (EUTL)' (http://ec.europa.eu/environment/ets/) accessed 1 July 2016.

European Council, 2007, *Brussels European Council 8/9 March 2007. Presidency conclusions*, 7224/1/07, Council of the European Union (http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf) accessed 29 September 2014.

European Council, 2014, *Conclusions on 2030 Climate and Energy Policy Framework*, Brussels (http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf) accessed 9 September 2015.

Eurostat, 2016, 'Supply, transformation and consumption of electricity — annual data (dataset: nrg_105a)' (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_105a&lang=en) accessed 1 July 2016.

Fitzgibbon, T., Kloskowska, A. and Martin, A., 2015, *Impact of low crude prices on refining*, McKinsey & Company (http://www.mckinsey.com/industries/oil-and-gas/our-insights/impact-of-low-crude-prices-on-refining) accessed 18 May 2016.

Gloaguen, O. and Alberola, E., 2013, *Assessing the factors behind CO_2 emissions changes over the phases 1 and 2 of the EU ETS: An econometric analysis*, CDC Climate Research Working Paper 2013-15 (http://www.cdcclimat.com/IMG/pdf/13-10_cdc_climat_r_wp_13-15_assessing_the_factors_behing_co2_emissions_changes.pdf) accessed 1 June 2016.

ICE, 2016, 'Market data' (https://www.theice.com/marketdata/reports) accessed 1 June 2016.

International Council for Clean Transportation, 2015, *Transatlantic airline fuel efficiency ranking, 2014*, International Council for Clean Transportation (http://www.theicct.org/sites/default/files/publications/ICCT_transatlantic-airline-ranking-2014.pdf) accessed 17 May 2016.

Kollmuss, A., Schneider, L. and Zhezherin, V., 2015, *Has Joint Implementation reduced GHG emissions? Lessons learned for the design of carbon market mechanisms*, Stockholm Environment Institute (https://www.sei-international.org/mediamanager/documents/Publications/Climate/SEI-WP-2015-07-JI-lessons-for-carbon-mechs.pdf) accessed 18 May 2016.

Lufthansa News, 2015, *Lufthansa and Germanwings successfully complete transfer of decentralized routes*, Lufthansa Group (http://www.lufthansa.com/mediapool/pdf/51/media_1676646151.pdf) accessed 17 May 2016.

Macalister, T., 2016, 'Longannet power station closes ending coal power use in Scotland', *The Guardian* (https://www.theguardian.com/environment/2016/mar/24/longannet-power-station-closes-coal-power-scotland) accessed 17 May 2016.

McGuinness, M. and Ellerman, D., 2008, *CO_2 abatement evidence from the EU ETS trial period*, CEEPR Working Paper 08-010, MIT (https://dspace.mit.edu/bitstream/handle/1721.1/45654/2008-010.pdf?sequence=1) accessed 28 November 2014.

Ministerstwo Środowiska, 2013, 'Krajowy Plan Inwestycyjny' (https://mobi.mos.gov.pl/g2/big/2013_11/d7b19b82c44955b69ac88a1adc0f14cd.pdf) accessed 23 June 2016.

Norwegian Air Shuttle ASA, 2015, Annual report 2015, *Norwegian Air Shuttle ASA* (https://www.norwegian.com/globalassets/documents/annual-report/nas_annualreport_2015.pdf) accessed 17 May 2016.

Ofgem, 2015, *Wholesale energy markets in 2015*, Ofgem (https://www.ofgem.gov.uk/sites/default/files/docs/2015/09/wholesale_energy_markets_in_2015_final_0.pdf) accessed 17 May 2016.

Ofgem, 2016, 'Spark and dark spreads (GB)' (https://www.ofgem.gov.uk/chart/spark-and-dark-spreads-gb) accessed 17 May 2016.

Ottery, C., 2015, 'Italian energy giant Enel commits to coal investment phase-out', Greenpeace (http://energydesk.greenpeace.org/2015/03/17/enel-commits-coal-investment-phase/) accessed 17 May 2016.

Petrosyan, K., 2016, *Recent developments in refining and in the supply and trade of petroleum products*, Brussels.

Platts, 2014, 'World Electric Power Plants Database' (http://www.platts.com/products/world-electric-power-plants-database) accessed 1 June 2016.

Point Carbon, 2012, 'Historic prices from Carbon Market Daily' (http://www.pointcarbon.com/) accessed 1 June 2016.

Rudd, A., 2015, *Amber Rudd's speech on a new direction for UK energy policy — Speeches — GOV*, DECC (https://www.gov.ukgovernment/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy) accessed 17 May 2016.

Ryanair, 2015, *Annual report 2015*, Ryanair (https://investor.ryanair.com/wp-content/uploads/2015/07/Annual-Report-2015.pdf) accessed 17 May 2016.

S&P Global Platts, 2015, *European utilization refinery rates elevated on stronger cracking margins*, S&P Global Platts (http://www.platts.com/latest-news/oil/london/european-utilization-refinery-rates-elevated-26159441) accessed 17 May 2016.

Tighe, C. and Pooler, M., 2015, 'SSI suspends production at Teesside iron and steel plant', *The Financial Times* (http://www.ft.com/) accessed 17 May 2016.

Timera Energy, 201, 'European gas pricing dynamics', Timera Energy (http://www.timera-energy.com/european-gas-pricing-dynamics/) accessed 17 May 2016.

UBA, forthcoming, *Analyse der kostenlosen Zuteilung nach Artikel 10c. Weiterentwicklung der Regelung in der vierten handelsperiode*., Dessau-Roßlau.

UNFCCC, 2015, *Adoption of the Paris Agreement* (http://unfccc.int/documentation/documents/advanced_search/items/6911.php?priref=600008831) accessed 20 January 2016.

UNFCCC, 2016a, 'CDM methodologies' (http://cdm.unfccc.int/methodologies/index.html) accessed 22 June 2016.

UNFCCC, 2016b, 'CDM project database' (http://cdm.unfccc.int/Projects/projsearch.html) accessed 22 June 2016.

UNFCCC, 2016c, 'JI project database' (http://ji.unfccc.int/JI_Projects/ProjectInfo.html) accessed 22 June 2016.

UNFCCC Joint Implementation Supervisory Committee, 2011, *Project 0246: Processing of waste heaps at Monolith-Ukraine*. (http://ji.unfccc.int/UserManagement/FileStorage/TYI023CELK17ORZN95BF6PVSHWJGUA) accessed 23 June 2016.

Annex 1 Background information on the EU ETS

A1.1 Introduction to the EU ETS

The EU ETS is one of the key climate policy instruments in the EU to reduce GHG emissions. It was established by the Emissions Trading Directive (Directive 2003/87/EC establishing a scheme for GHG emission allowance trading within the Community and amending Council Directive 96/61/EC) (EU, 2003) and entered into force on 1 January 2005, in the context of international mitigation commitments by the EU under the Kyoto Protocol.

The EU ETS is based upon a 'cap and trade' approach, whereby a total limit (i.e. cap) on covered GHG emissions, in the form of a quantity of emission allowances, is set for the regulated entities. The EU ETS is designed to achieve cost-efficient reductions (that correspond to the cap) by equalising the marginal cost of abatement for all participating entities through the trading of emission allowances on the market.

By setting a cap on emissions, the EU ETS creates a price signal that encourages operators with high abatement costs to purchase additional allowances, and operators with low abatement costs to reduce emissions and sell their allowances or buy fewer. As the EU ETS cap declines, it is expected that the price of allowances will increase to reflect the greater level of emission reductions required. As a consequence, more expensive abatement measures will become financially viable over time, and it is expected that investments in low-carbon technology, driven by the price signal, will also lower abatement costs. In order to lower the cost of compliance, the EU ETS also allows operators, under certain conditions, to implement cost containment measures (i.e. the purchase of international offsets/banking or limited borrowing of allowances ([42])).

In March 2007, the European Council committed the EU to becoming a highly energy-efficient, low-carbon economy by reducing its GHG emissions by 20 % from 1990 levels, raising to 20 % the share of renewable energy sources (RES) in the EU's gross final energy consumption and improving the EU's energy efficiency by 20 % by 2020 (European Council, 2007).

To achieve these domestic commitments, in 2009 the EU adopted the climate and energy package ([43]), legally binding legislation related to the GHG and renewable energy targets. The package introduced a clear approach to achieving the 20 % reduction of total GHG emissions from 1990 levels, which is equivalent to a 14 % reduction compared to 2005 levels. This reduction objective was divided between two subtargets: a 21 % reduction target compared with 2005 for emissions covered by the EU ETS (equivalent to about 45 % of total EU GHG emissions); and a 10 % reduction target compared with 2005 for the remaining non-ETS emissions (shared between the 28 Member States through differentiated national GHG targets). This was equivalent to a split of the reduction effort between ETS and non-ETS sectors of two-thirds versus one-third (EU, 2009a).

As part of the climate and energy package adopted in 2009, the 2003 Emissions Trading Directive was revised (Directive 2009/29/EC) (EU, 2009a), in order to help the EU achieve its 2020 GHG reduction commitment and to contribute to emission reductions after 2020.

Under the revised ETS Directive, one single EU ETS cap covers the EU Member States and the three European Free Trade Association (EFTA) countries (Iceland, Liechtenstein and Norway), i.e. there are no further differentiated caps by country. For allowances allocated free of charge to the EU ETS participants, annual caps were set for the period 2013 to 2020; these caps decrease each year by a quantity equivalent to about 1.74 % of the average emissions during the second trading period (2008–2012). Auctioning is now the default method of allocation; however, a substantial share of free allocation remains until 2020. The EU ETS also has a wider scope than in the first (2005–2007) and second (2008–2012) trading periods, as additional

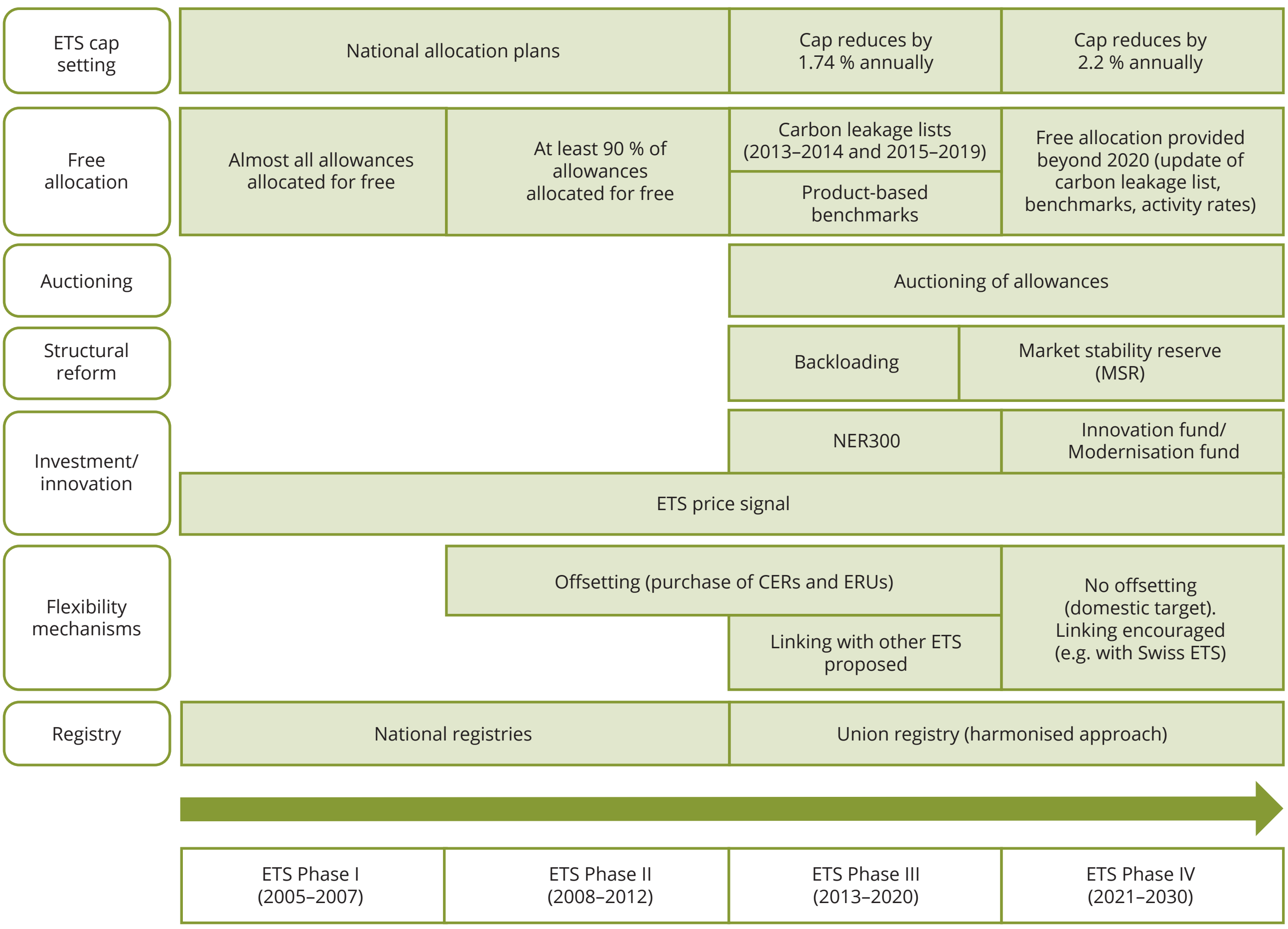
([42]) Borrowing is formally not allowed, but operators receive allocation for the ongoing year in February, i.e. before the date of surrender for the previous year (the following April). They can therefore use the 'new' allocations for covering the previous year's emissions.
([43]) See http://ec.europa.eu/clima/policies/package/index_en.htm for more details.

countries, gases and sectors have entered the system. These changes were implemented in 2013, when the EU ETS entered its third trading period (2013–2020).

In July 2015, the European Commission (EC, 2015e) put forward a legislative proposal for a revision to the EU ETS for the post-2020 period The reform to the EU ETS is the first step towards the delivery of the 2030 framework (EC, 2014b), which includes a GHG reduction target of at least 40 % domestically relative to 1990 levels that is part of the EU's contribution to the new global climate deal agreed at the COP 21 meeting in Paris in December 2015 (UNFCCC, 2015). Given the ambitious outcome of the negotiation, the aspiration to limit global warming to well below 2°C may lead to the upward revision of the GHG target following a UN global stock-take in 2018; however, this will be considered by the European Commission only after 2018, with many believing that it will be difficult to subsequently adjust the target (Carbon Pulse, 2016).

Nevertheless, based upon current levels of ambition, the domestic GHG target for 2030 will be split between the ETS and non-ETS sectors on the basis of cost efficiency (EC, 2014d). The EU ETS is expected to deliver a reduction of 43 % below 2005 emission levels in 2030 by increasing the annual linear reduction factor applying to the EU ETS cap to 2.2 % from 2021 onwards. Meanwhile, the non-ETS sector aims to achieve a 30 % reduction below 2005 emission

Figure A1.1 Overview of the development of the key design elements of the EU ETS



Note: The column related to the fourth trading period is based on a European Commission proposal, since the Council and Parliament have not yet formally adopted the post-2020 rules.

The provision of free allocation is expected to continue beyond 2020, to provide appropriate levels of support for sectors at risk of losing international competitiveness.

An additional key design element of the EU ETS that is not illustrated above is the banking of allowances between periods, which was not allowed from the first to second trading period, but has been allowed since the beginning of the second trading period.

Source: Authors, 2016.

levels in 2030 by setting non-ETS targets for Member States. In addition to the downward adjustment of the EU ETS cap, reforms will also be made regarding the allocation of free allowances under carbon leakage rules (i.e. priority for sectors at highest risk) and a better alignment of production with allocation and an update of benchmark values to reflect technological progress. To assist the power and industrial sectors in their efforts to decarbonise, an innovation fund (i.e. extending existing support for innovative technologies) and a modernisation fund (i.e. improving energy systems in 10 lower-income Member States) will also be established in Phase IV of the EU ETS.

The legislative proposal to reform the EU ETS has been submitted to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions for further consideration under the ordinary legislative procedure.

A1.2 Scope of the EU ETS

Participating countries

The EU ETS began with the 25 Member States of the EU in 2005. There are now 31 participating countries. Bulgaria and Romania joined the EU ETS in 2007. The three EFTA countries participating in the European Economic Area (Iceland ([44]), Liechtenstein and Norway) joined in 2008; Croatia joined the EU and, as a result, the EU ETS in 2013.

Activities covered by the EU ETS

The EU ETS covered 11 401 stationary installations in most industrial sectors in 2015 ([45]). The scope of the EU ETS includes all combustion installations with a capacity (rated thermal input) exceeding 20 MW and all installations where activities listed in Annex I of the ETS Directive are carried out (EU, 2003). The total emissions of all stationary installations covered by the EU ETS in 2015 were equal to 1 800 Mt CO_2-eq. (EEA/EU ETS Data viewer, 2016).

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

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

The majority (61 %) of the stationary installations in the EU ETS are fuel combustion plants, and together they account for an even higher proportion (i.e. 68 %) of total verified emissions from stationary installations (see Figure A1.2). In terms of emissions, the cement, clinker and lime production sector is the second largest sector, accounting for about 8 % of total verified emissions from stationary installations, even though it ranks fourth in terms of the number of installations. The iron, steel and coke sector and the refinery sector each account for 7 % of emissions from stationary installations, followed by the chemicals sector, responsible for 4 % of emissions. The remaining activities account for 26 % of the stationary installations covered by the EU ETS, but produce only 6 % of the total verified emissions for stationary installations.

In fact, emissions in the EU ETS are dominated by a small subset of large emitters. Of the 9 000 installations that were reported in relation to Article 21 of the ETS Directive (EEA, 2015a), 72 % emit less than 50 000 Mt CO_2-eq. and are together responsible for only 10 % of overall emissions.

([44]) Stationary installations in Iceland have participated since 2013.
([45]) This number includes all stationary installations whose verified emissions and/or allocation were reported in the EUTL in 2015.

Figure A1.2 Share of stationary installations and verified emissions in the EU ETS, 2015

Note: Number of installations based on installations with verified emissions in 2015.

Source: EEA/EU ETS Data viewer, 2016.

Aviation

The EU ETS covered 776 aircraft operators in 2015. The total emissions of aviation covered by the EU ETS in 2015 were equal to 57 Mt CO_2-eq. The aviation sector has been included in the EU ETS since 2012 (EU, 2009a). In principle, the EU ETS should cover all flights departing from and/or arriving at airports in all EU Member States, as well as Iceland, Liechtenstein and Norway and closely related territories. However, since 2012, only flights departing from and arriving at aerodromes located in these countries (and Switzerland in 2012) have been included in the EU ETS. This exclusion, first resulting from the 'Stop the clock' decision (EU, 2013b), was taken in order to facilitate negotiation of a global agreement to address aviation emissions in the forum of the International Civil Aviation Organization (ICAO). The ICAO assembly agreed in 2013 to develop a global market-based mechanism (MBM) to be adopted in 2016 and implemented in 2020. The EU has decided to continue with a reduced, intra-EU scope in the 2013–2016 period (EU, 2014b).

Emissions for 2012 are not comparable to 2013 and 2014 emissions, as operators could choose whether to report 2012 emissions from the full scope (including international flights) or from the reduced scope — in the latter case, they had to return the allocation received for their international flights ([46]). It can be expected that those operators receiving a large proportion of emissions for free would choose the original scope, whereas those operators needing to buy a substantial number of allowances to cover for their emissions would choose the reduced scope.

([46]) The devolution of allowances is not yet recorded for all cases in the EUTL. Based on information from the European Commission, the ETC/ACM adjusted EUTL information on allocation to aircraft operators to reflect the 'Stop the clock' scope (see detailed description of the approach in EEA, 2015b.

Table A1.1 Activities and sectors covered by the EU ETS in 2015

Activity type	Sectors	Number of entities	Verified emissions (Mt CO_2-eq.)
20 Combustion of fuels	Combustion	6 921	1 225
21 Refining of mineral oil	Refineries	142	130
22 Production of coke	Iron and steel, coke, metal ore	22	16
23 Metal ore roasting or sintering		10	3
24 Production of pig iron or steel		253	106
25 Production or processing of ferrous metals	Other metals (incl. aluminium)	239	12
26 Production of primary aluminium		30	7
27 Production of secondary aluminium		34	8
28 Production or processing of non-ferrous metals		87	7
29 Production of cement clinker	Cement and lime	262	114
30 Production of lime, or calcination of dolomite/magnesite		314	32
31 Manufacture of glass	Other non-metallic minerals	370	18
32 Manufacture of ceramics		1 059	16
33 Manufacture of mineral wool		47	2
34 Production or processing of gypsum or plasterboard		40	1
35 Production of pulp	Pulp and paper	148	5
36 Production of paper or cardboard		600	22
37 Production of carbon black	Chemicals	11	1
38 Production of nitric acid		33	4
39 Production of adipic acid		2	0
40 Production of glyoxal and glyoxylic acid		1	0
41 Production of ammonia		29	23
42 Production of bulk chemicals		335	35
43 Production of hydrogen and synthesis gas		45	9
44 Production of soda ash and sodium bicarbonate		13	3
45 Capture of greenhouse gases under Directive 2009/31/EC	Other	0	0
99 Other activity opted-in under Art. 24		354	3
Sum of all stationary installations		**11 401**	**1 800**
10 Aviation		776	57

Note: Number of entities based on installations with verified emissions and/or allocation in 2015.

Source: EEA/EU ETS Data viewer, 2016.

Moreover, from 2013 until 2020, the EU Regulation (EU) No 421/2014 (EU, 2014b) introduced a temporary exemption for flights by non-commercial aircraft operators with total annual emissions lower than 1 000 t CO_2-eq. per year (based on the full scope).

Aircraft operators are allocated EUAAs, which can be used for compliance for aviation emissions only and not by stationary installations. Furthermore, EUAAs are auctioned at the same auctioning platforms that auction EUAs; these are the EEX and the ICE. Finally, aircraft operators are entitled to use international credits beyond those allowed in 2012, up to a maximum of 1.5 % of their verified emissions in the third trading period, and to purchase EUAs from the stationary sector (unlimited).

Annex 2 The EU ETS cap and its composition

A2.1 Overall cap

The emission target of the EU ETS — the cap — represents the maximum volume of GHG emissions that can be emitted by all the participating installations ([47]). It consists of a quantity of emission allowances that are available to the regulated entities, through either free allocation or auctions.

In the first and second trading periods, emission caps were determined at national level by all participating countries in their national allocation plans (NAPs). These NAPs had to be set up in accordance with guidance published by the European Commission (EC, 2005). After submission, they were reviewed by the European Commission for approval. The review process of the national emission caps for the second trading period by the European Commission is documented in Communication COM(2006) 725 (EC, 2006). In essence, the NAPs were checked against Member States' emission projections — based on GDP growth and reduced carbon intensity taken from the PRIMES 2005 modelling. This was to make sure that they were in line with Member States' Kyoto or burden-sharing targets for the first commitment period (which corresponds to the second trading period in the EU ETS). The sum of all individual caps in the Member States formed an EU-wide cap.

In 2013, the EU ETS entered its third trading period. For this trading period and the subsequent ones, a single EU ETSwide cap is set to govern the supply of allowances under the EU ETS. The cap level is determined on the basis of the expected contribution of the EU ETS towards achieving the EU's 20 % emissions reduction target for 2020 compared with 1990, which amounts to a 21 % reduction compared with 2005 levels in the EU ETS sectors. From 2013 onwards, the cap is equal to a trajectory that decreases every year by an amount equivalent to 1.74 % of the average emissions between 2008 and 2012, starting in 2010 — and taking into account additional emissions from the installations that joined the EU ETS in 2013 (EU, 2009a). From 2021 onwards, the linear reduction factor will be increased to 2.2 %, in order to deliver GHG emission reductions of 43 % by 2030, in line with a cost-efficient achievement of the agreed target to reduce the EU's domestic GHG emissions by 40 % in 2030 compared with 2005 (European Council, 2014).

In addition, until 2020, operators can use a certain number of international credits, subject to certain conditions. In practice, this flexibility increases the overall amount of emissions allowable under the system.

A2.2 Free allocation

Community-wide and harmonised free allocation

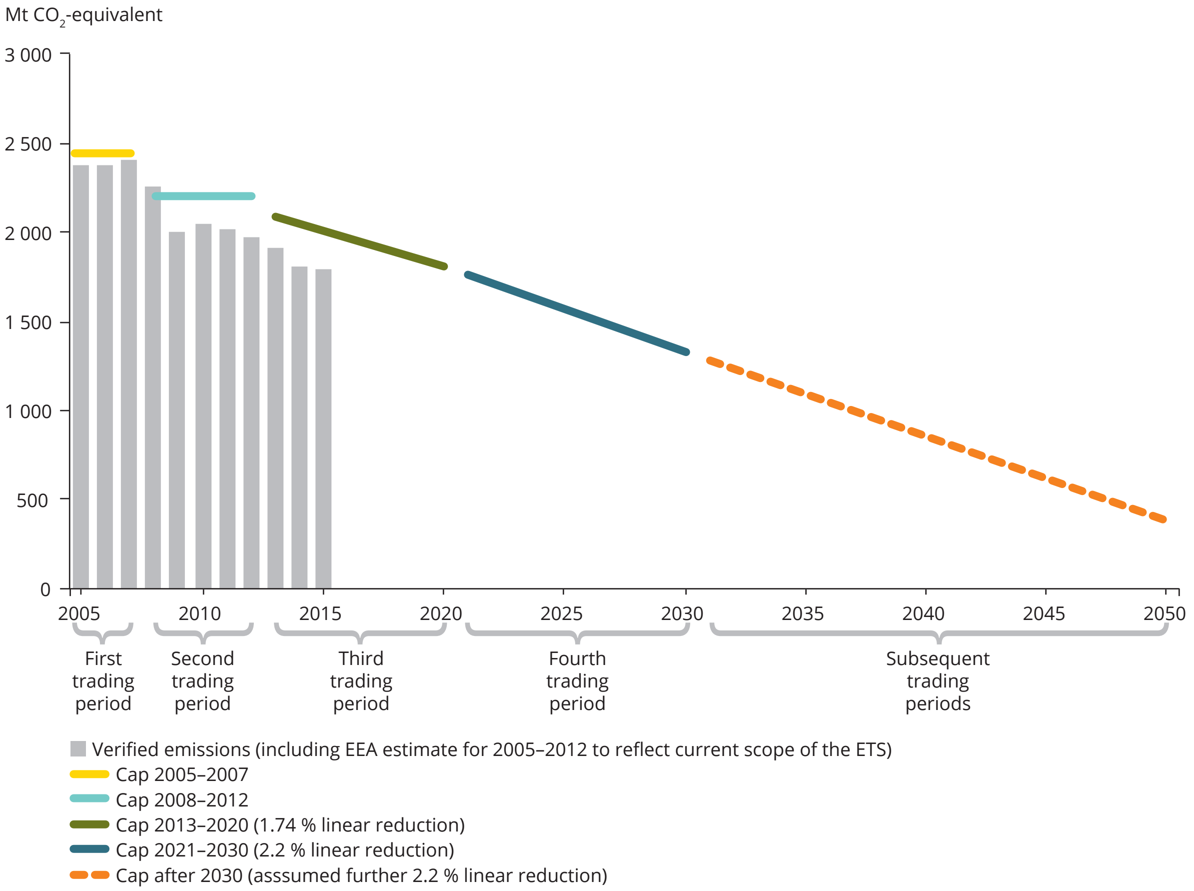
During the first trading period (2005–2007), almost all allowances were allocated free of charge (less than 1 % were auctioned or sold). The allocation level for individual installations was mainly based on historical emissions ('grandfathering'). The rules for allocation of allowances to individual installations in the first and second trading periods were determined in the NAPs (EU, 2003).

In the second trading period (2008–2012), 95 % of emission allowances were still allocated free of charge (EEA, 2013). In many countries (e.g. Denmark, Germany and the United Kingdom), benchmarks were used to calculate an allocation of allowances to electricity generators, while allocation for industrial sectors was still largely based on historical emissions. As a result, free allocation (relative to emissions) tended to be higher for industrial sectors than for combustion installations (a large proportion of which generate electricity).

The number of allowances allocated free of charge follows a decreasing path over the third trading period (EU, 2009a). The provision of free allowances limits the cost of compliance with the main objective of

([47]) There is a cap on aviation emissions as well, but as the scope of aviation emissions to be covered and the resulting cap is expected to change from 2017, aviation is not included in the figures in this annex.

Figure A2.1 EU ETS cap, 2005–2050



Note: The data presented do not include the aviation sector.

Sources: EU, 2013a; EEA/EU ETS Data viewer, 2016.

protecting industry against the risk of carbon leakage (i.e. firms relocating production and associated emissions to jurisdictions with lower environmental standards). Most of these free allowances are therefore allocated to industrial sectors, although installations producing electricity receive an allocation for heat production, free of charge.

Free allocation to the manufacturing sector follows harmonised allocation rules from the third trading period onwards: it is based on EU ETS-wide benchmarks and historical production levels from the years 2005–2008 or 2009–2010 (EU, 2011a). Benchmarks are largely product based, and correspond to the average GHG emission performance of the 10 % most efficient installations in the EU producing that product in the years from 2007 and 2008. For sectors not deemed at 'risk of carbon leakage', the share of allowances provided free of charge will decrease from 80 % in 2013 to 30 % in 2020; but sectors or subsectors deemed to be at 'risk of carbon leakage' are allocated 100 % of allowances free — as applied to EU-wide benchmarks and historical production values.

On the basis of these harmonised allocation rules, governments submitted to the European Commission preliminary calculations (national implementation measures (NIMs)) of the number of free allowances to be allocated to each installation in their jurisdiction. As the preliminary allocation through the NIMs exceeded the maximum number of allowances laid down in Article 10a (5) of the ETS Directive (EU, 2013a), a cross-sectoral correction factor — equal to 5.73 % in 2013 and rising to 17.56 % in 2020 — is applied to non-electricity generators, in order to comply with these rules. Allocations for heat production by electricity generators, in accordance with Article 10a (4) of the ETS Directive, are not subject to the above-mentioned maximum amount, and are instead reduced by the linear reduction factor of 1.74 %. After applying those factors, the final allocations to installations in each country were calculated, inscribed in the national allocation tables (NATs) and published on the EU Transaction Log (EUTL).

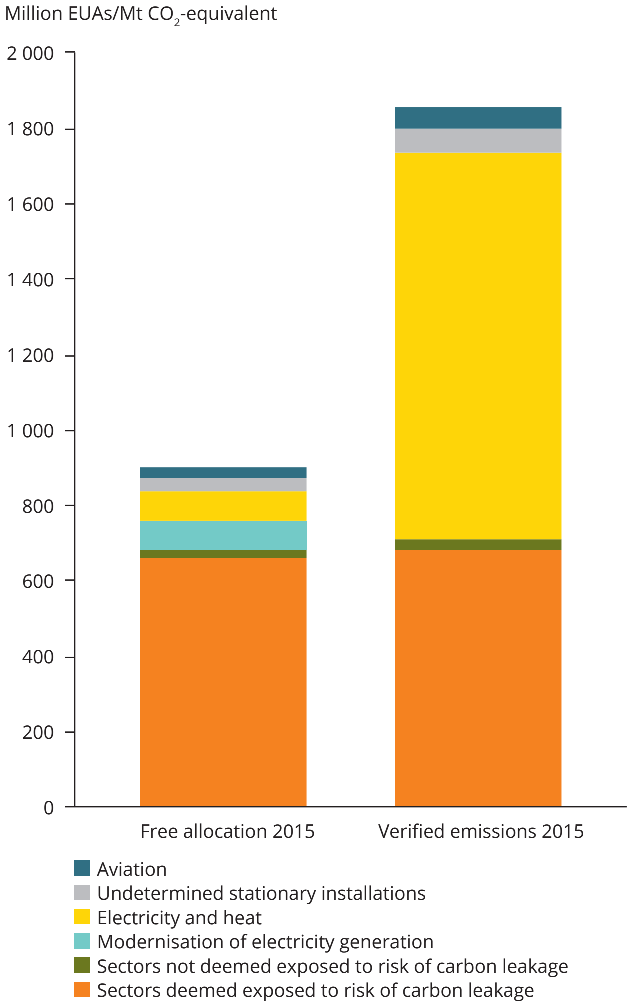
The European Commission is responsible for producing a carbon leakage list of exposed sectors or subsectors, which is primarily based on both carbon cost (i.e. direct and indirect carbon costs/gross value added (GVA)) and trade intensity (i.e. imports and exports/production and imports). These indicators are updated every 5 years. The second carbon leakage list ([48]), which applies for the years 2015–2019, was adopted by the European Commission in October 2014 (EU, 2014d). Since a carbon price of EUR 30 per tonne CO_2-eq. was assumed for the assessment of the risk of carbon leakage, more sectors and subsectors were included in this second carbon leakage list than would have been had current carbon prices been considered. The European Commission justifies the choice of a higher carbon price by the expectation that introducing an MSR will increase carbon prices in the medium and long term by managing the supply of allowances in circulation (EU, 2014d).

Free allocation differs significantly across the different categories of allocation considered (see Figure A2.2). Industrial installations emit 38 % of total emissions covered by the EU ETS; 55 % are emitted by power plants and 3 % by aircraft operators ([49]). Operators of industrial installations as a group receive free of charge certificates worth 100 % of their 2014 emissions. The vast majority of industrial installations host an activity considered to be at risk of carbon leakage — only 2 % of industrial emissions are caused by installations whose activity is not deemed at risk of carbon leakage.

Electricity and heat installations have to purchase the majority of allowances needed to cover for their emissions. They receive, on average, 9 % of their emissions as free allocation for heat (74 million EUAs ([50])) and an additional 78 million EUAs as transitional free allocation, which is available to power plant operators only in a number of eastern European countries.

Finally, aircraft operators also have to purchase allowances to cover their verified emissions. In 2015, aircraft operators were allocated 32 million EUAAs free of charge — this corresponds to 57 % of their emissions.

Figure A2.2 Verified emissions and free allocation, according to allocation rules, 2015



Note: Electricity and heat refers to electricity generators. 'Carbon leakage sectors' and 'non-carbon leakage sectors' both refer to non-electricity generators (industry installations). Verified emissions data for installations producing electricity and heat are only available at an aggregate level.

Sources: Sector classification based on EC, 2014a; EC, 2015i; EEA/EU ETS Data viewer, 2016.

Transitional free allocation

In eight Member States, some installations in the electricity generation sector continue to receive transitional free allocation over and above this allocation for heat, in order to help modernise electricity generation

([48]) The first carbon leakage list applied from 2013 to 2014.

([49]) Attribution to sectors is based on NACE codes published by the European Commission in the process of determining the carbon leakage list (EC, 2014a). The remaining 4 % are emitted by stationary installations that cannot be attributed to a specific sector, e.g. because no NACE code is available.

([50]) Estimate based on the quantity of allowances allocated free of charge (Article 10a(1)) to installations whose NACE code corresponds to heat and electricity production. It is assumed that these installations were producing only heat, since installations producing electricity are covered by Article 10c and therefore available separately in the EUTL. It is also possible that certain free allowances were dedicated to installations with undefined activity, but their share is assumed to be very low.

under Article 10c of the ETS Directive (EU, 2009a) ([51]). The total maximum number of allowances that can be allocated free by Member States under these rules was published in three decisions of the European Commission (EC, 2014f, 2015i, 2016d). Power plant operators benefiting from such free allocation can use it to finance retrofitting or upgrading infrastructure, to install clean technology or for the diversification of energy mix or sources of supply. If investments to modernise electricity generation are not implemented as planned, the amount of free allocation is reduced and the allowances auctioned instead (EC, 2011). In 2016, four Member States plan to auction unused Article 10c allowances: Bulgaria (1.5 million EUAs), the Czech Republic (0.1 million EUAs), Estonia (0.2 million. EUAs) and Romania (6.7 million EUAs) (EC, 2015c).

In 2013, a total of 138.6 million allowances were allocated free of charge to installations under Article 10c, which corresponds to 91 % of the maximum allowed amounts (EC, 2014f; EU, 2016). In 2014, a total of 103.5 million allowances were allocated to installations, which corresponds to 80 % of the maximum allowed amount (EC, 2015i; EU, 2016). In 2015, a total of 78.1 million allowances were allocated to installations, which corresponds to 68 % of the maximum allowed amount (EC, 2016d; EU, 2016). Notably in Hungary, transitional free allocation was restricted to 2013 only, while in all other countries the allowed amounts will continue but will reduce steadily until they reach zero in 2020 (see Table A2.1).

Summary of planned free allocation

A summary of the planned allocation of free allowances up until 2020 is provided in Figure A2.3, which is disaggregated according to the different types of allocation.

The majority of free allowances between 2013 and 2020 are to be allocated to non-electricity generators, mainly in industrial sectors, in accordance with Article 10a(5) of the ETS Directive. On average, this corresponds to about 78 % of free allocation during the third trading period (EU, 2013a).

In general, electricity generators receive a free allocation only for heat produced under Article 10a(4) of the ETS Directive. The free allocation decreases over time, from 80 % of the benchmark in 2013 to 30 % in 2020, for plants that are not considered to be exposed to the risk of carbon leakage. Overall, it is planned that about 8 % of the total free allocation during the third trading period will go towards heat production (EU, 2013a).

The transitional free allocation for power generators in eight Member States will decline to zero by 2020, in accordance with Article 10c of the ETS Directive. The share of the maximum allowed amount of transitional free allocation in total free allocation averages 9 % during the third trading period (EU, 2013a). If the maximum allowed amount is not allocated free of charge, it will be auctioned by the relevant Member States.

Furthermore, for new entrants, there will be maximum free allocation of about 480 million EUAs ([52]), which have been placed into the NER, as stipulated in Article 10a(7) of the ETS Directive. New entrants will receive about 6 % of the total free allocation.

It can already be projected that not all of the planned allocation of free allowances will indeed be allocated (EC, 2015d). According to the MSR decision, any amounts not given out under Article 10a(4) and (5) owing to closures of plants (Article 10a(19)) or partial cessation of activities (Article 10a(20)), as well as allowances from the NER that are not allocated, are placed in the MSR (EU, 2015). However, the proposal for a revised ETS Directive (EC, 2015e) suggests that 250 million of these allowances should go towards an NER for the fourth trading period, and a further 50 million towards an innovation fund (NER400). There may be further 'de facto' unallocated allowances as a result of the application of a carbon leakage factor for sectors not on the carbon leakage list, estimated at 145 million EUAs (EC, 2015d). These amounts are also suggested to go towards an NER for the fourth trading period (EC, 2015e).

([51]) Under Article 10c, paragraph 1, Member States are permitted to allocate free allowances to electricity generation (a) when the national electricity network is not connected to the Union for the Co-ordination of Transmission of Electricity (UCTE); (b) when the national electricity network is connected to the UCTE only through a line with a capacity of less than 400 MW; and (c) when the GDP per capita of the Member State does not exceed 50 % of the average and more than 30 % of electricity is produced from a single fossil fuel.

([52]) The overall size of the NER is 780 million EUAs (5 % of the cap in the period from 2013 to 2020). In order to generate financial support for CCS and innovative renewable energy projects, 300 million EUAs are taken out of this reserve and auctioned ('NER300').

Table A2.1 Maximum and allocated transitional free allocation for the modernisation of electricity generation under Article 10c of the ETS Directive

		Number of free allowances available for the modernisation of the electricity system (million EUAs)										
		2013	2014	2015	2016	2017	2018	2019	2020	Remainder 2013–2015	Amounts for auctioning	Remaining budget up to 2020
Bulgaria	Maximum allowed amount	13.5	11.6	9.7	7.7	5.8	3.9	1.9	0.0	5.8	– 6.9	32.0
	Allocated allowances	11.2	9.8	8.1								
Cyprus	Maximum allowed amount	2.5	2.2	1.9	1.6	1.3	0.9	0.6	0.0	0.0	0.0	4.4
	Allocated allowances	2.5	2.2	1.9								
Czech Republic	Maximum allowed amount	26.9	23.1	19.2	15.4	11.5	7.7	3.8	0.0	0.9	– 0.1	39.4
	Allocated allowances	26.8	23.0	18.5								
Estonia	Maximum allowed amount	5.3	4.5	3.8	3.0	2.3	1.5	0.8	0.0	0.4	– 0.2	8.2
	Allocated allowances	5.1	4.4	3.7								
Hungary	Maximum allowed amount	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.9
	Allocated allowances	6.1	0.0	0.0								
Lithuania	Maximum allowed amount	0.6	0.5	0.5	0.4	0.4	0.3	0.2	0.0	0.7	0.0	2.0
	Allocated allowances	0.3	0.3	0.3								
Poland	Maximum allowed amount	77.8	72.3	66.7	60.0	52.2	43.4	32.2	0.0	54.4	0.0	242.2
	Allocated allowances	70.7	55.2	36.5								
Romania	Maximum allowed amount	17.9	15.3	12.8	10.2	7.7	5.1	2.6	0.0	12.4	– 8.8	46.9
	Allocated allowances	15.7	8.6	9.2								
Total	**Maximum allowed amount**	**151.5**	**129.5**	**114.5**	**98.3**	**81.2**	**62.8**	**42.1**	**0.0**	**75.4**	**– 16.0**	**375.8**
	Allocated allowances	**138.6**	**103.5**	**78.1**								

Sources: EC, 2012a, 2014f, 2015c, 2016d; EU, 2012e, 2015i, 2016.

Therefore, the allocation of allowances up until 2020 may not necessarily correspond to that originally planned and shown in Figure A2.8. There are four possible reasons for this:

(a) closure of plants or partial cessation of activities (Article 10a(19) and (20) of the ETS Directive);

(b) failure to completely use up allowances in the NER;

(c) de facto unallocated allowances due to a carbon leakage factor having been applied to sectors not on the carbon leakage list; and

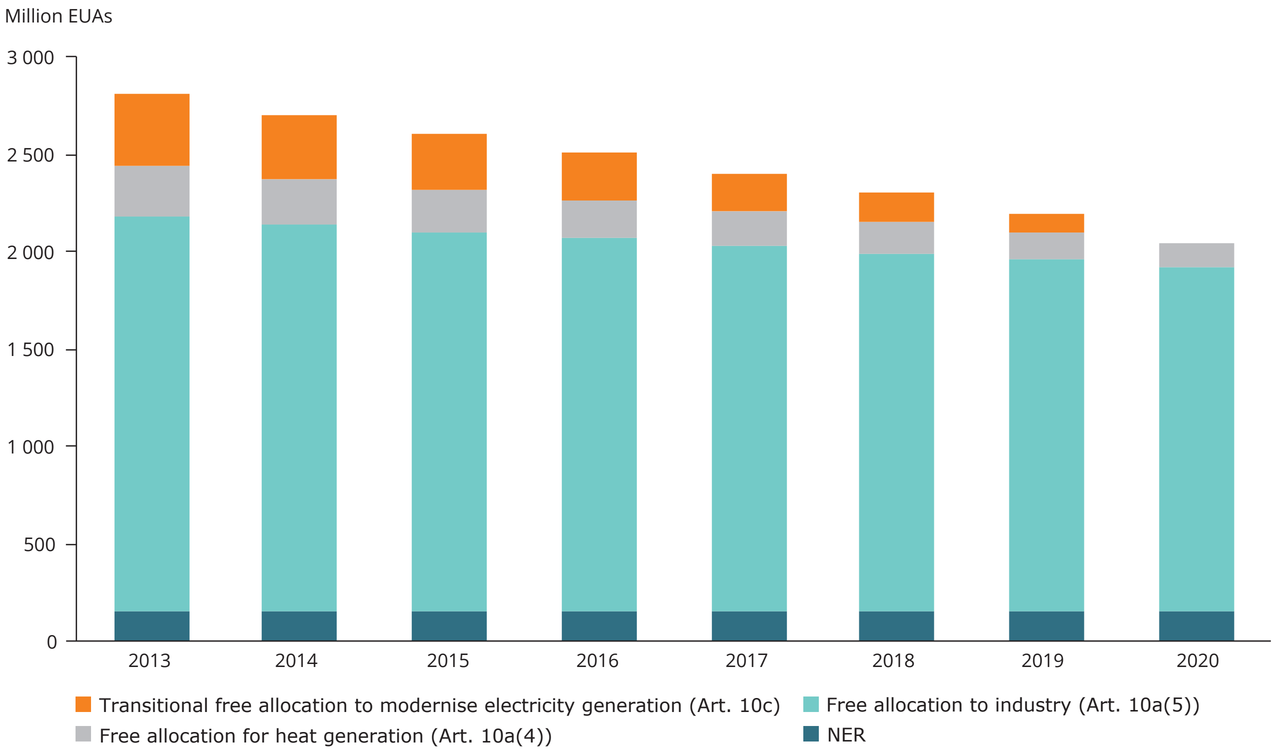
(d) less than the maximum amount of free allocation under Article 10c of the Directive being allocated to electricity generators.

A2.3 Auctions

Since the start of the third trading period, auctioning has become the default method of allocating EUAs ([53]). At the start of the third trading period, a surplus of almost 2 billion allowances had accumulated, mainly as a result of lower demand for EUAs owing to the economic crisis, an inflexible supply of allowances and high imports of international credits.

As a short-term measure to rebalance supply and demand and reduce price volatility, it was decided that the auctioning of 900 million allowances would be postponed through an amendment to the EU ETS Auctioning Regulation. Through this mechanism, the auctioning quantities were reduced by 400 million EUAs in 2014, by 300 million EUAs in 2015 and by 200 million

Figure A2.3 Planned allocation of free allowances, 2013–2020



Note: The maximum number of allowances planned for the NER are equally distributed over the 8 years of the third trading period. Maximum amounts for Article 10c allocation are shown. No potentially unallocated allowances due to partial cessations or closures or further unallocated allowances due to the application of a carbon leakage factor are taken into account.

Sources: EU, 2009a, 2012e, 2013a; EC, 2012a.

([53]) The EU jointly auctions allowances for all Member States (under the Common Auction Platform), except three which have opted out of this common auctioning platform: Germany, Poland and the United Kingdom. The EEX carries out Common Auction Platform auctions, German auctions and Polish auctions. ICE carries out auctions for the United Kingdom.

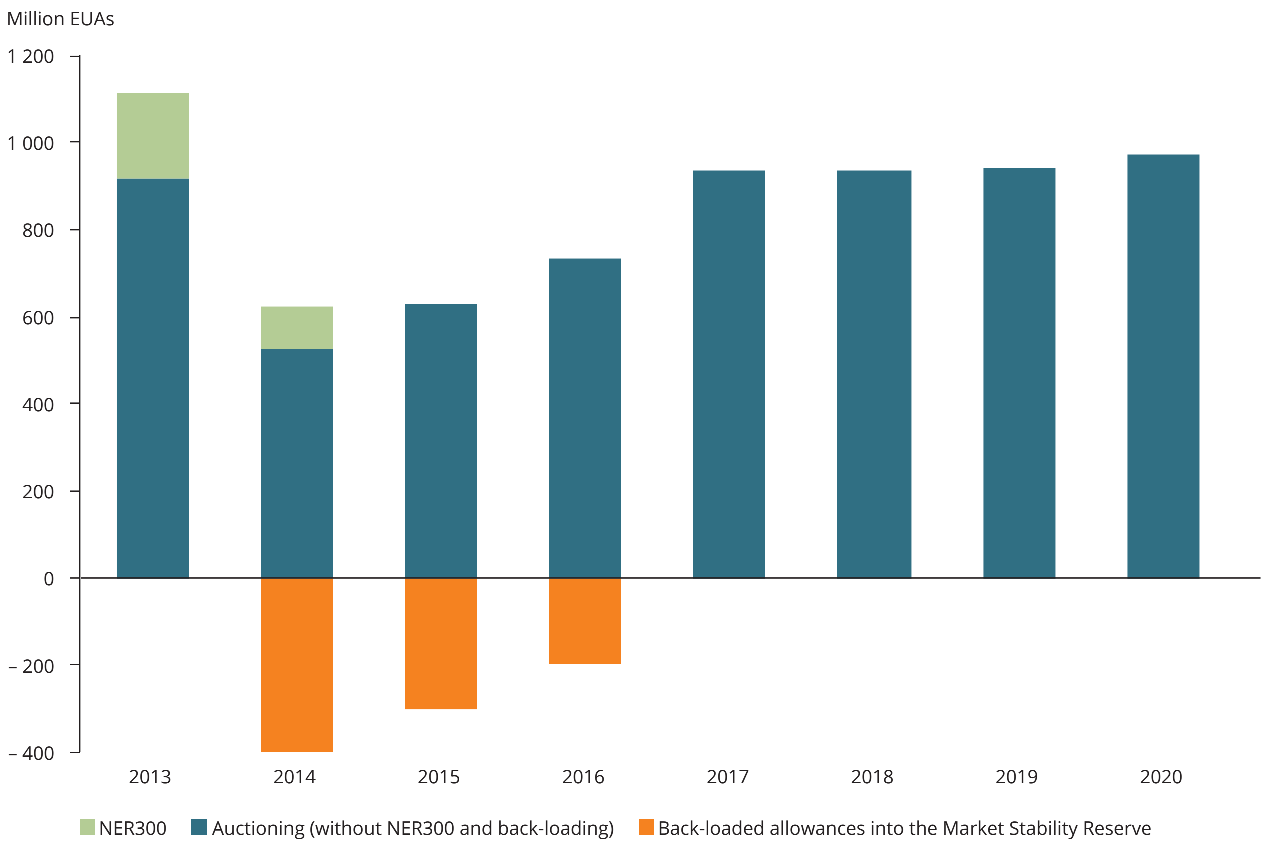
EUAs in 2016. It is intended to reintroduce these back-loaded amounts in 2019 and 2020 (300 million EUAs and 600 million EUAs, respectively) (EU, 2014a). As back-loading is only a temporary measure, the European Council and the European Parliament have agreed to set up an MSR. Back-loaded allowances will be directly transferred to the MSR in 2020 (EU, 2015). Figure A2.4 also includes sales of some 300 million EUAs that have been taken from the NER (NER300) (EIB, 2014a) ([54]). These EUAs were sold in order to generate financial support for carbon capture and storage (CCS) and for innovative renewable energy projects.

Similarly to the numbers of allowances allocated free of charge, actual numbers auctioned will differ from planned numbers— both year on year and overall. First, yearly differences may be attributable to different starting dates of auctioning: certain countries started auctioning later than planned because administrative matters have to be resolved with the auction platform; the European Economic Area–EFTA States have still not started auctioning ([55]). Second, as noted above, a number of unallocated allowances will be auctioned rather than given out free of charge, including those allowances that are placed into the MSR. In fact, the MSR is expected to further reduce auctioned amounts in 2019 and 2020, after it starts operating.

A2.4 The Market Stability Reserve (MSR)

The MSR proposal was adopted by the Council on 18 September 2015 (EU, 2015). It indicates that the MSR should be set up in 2018, with the first adjustment

Figure A2.4 Planned primary market sales of allowances, without MSR, 2013–2020



Note: The numbers of allowances sold from the NER300 for 2013 and 2014 are based upon assumptions on the timing of the delivery of these allowances, which differs slightly from the timing as stated in EIB (2014b), i.e. 211 million EUAs in 2013 and 89 million EUAs in 2014. Some of these allowances were auctioned, whereas others were sold OTC and others still sold via exchanges.

Sources: EC, 2012a; EU, 2012e, 2013a; EIB, 2014a.

([54]) A first tranche of 200 million EUAs had already been sold by October 2012. However, they are attributed to the auctions and sales in 2013, as it was only possible to use these allowances from 2013 onwards. A second tranche of 100 million EUAs was sold between November 2013 and April 2014. The second tranche is allocated to the year 2014.

([55]) http://ec.europa.eu/clima/policies/ets/cap/auctioning/faq_en.htm to auctions starting in January 2019. Starting on 15 May 2017, the European Commission will publish each year (year x) a report on the total number of allowances in circulation (TAiC), which corresponds to the sum of EUAs issued and international credits used/exchanged, minus the sum of verified emissions under the EU ETS (both since 2008), minus any allowances in the MSR, minus any allowances cancelled on behalf of the account holders. The TAiC is counted in each year to 31 December of the year in question (year x – 1).

Should the TAiC be greater than 833 million, 12 % of this TAiC will be deducted from auctioned amounts (by adjusting auction calendars between September of the year when the TAiC calculation was released by the Commission and August of the following year) and placed in the reserve. In the first year, i.e. between January and August 2019, only 8 % of the TAiC will be deducted from the number of auctioned allowances (representing 1 % for each month between January and August 2019). If the TAiC is determined to be less than 400 million, 100 million allowances will be released into the market via auctioning.

Furthermore, the MSR decision states that back-loaded allowances will be placed into the reserve, as will allowances that are unused as a result of the NER not being fully used up (Article 10a(7)), and that allowances may be returned by operators due to cessations and closures (Article 10a(19) and (20)). These will be placed into the reserve in 2020, with possible alternatives to be set out in a proposal by the European Commission for the fourth trading period, if appropriate. Any other unused allowances under Article 10a or unallocated allowances under Article 10c should be auctioned by the relevant Member States.

In its proposal for a revised ETS Directive, the European Commission suggests that 250 million unallocated allowances placed in the MSR should instead be used towards an NER for the fourth trading period. It further proposes that even before 2021 a further 50 million allowances should be allocated to an innovation fund, also operational during the fourth trading period (NER400) (EC, 2015e). See Table A2.2 for a summary on the design parameters of the MSR.

A2.5 Summary of the total supply of allowances

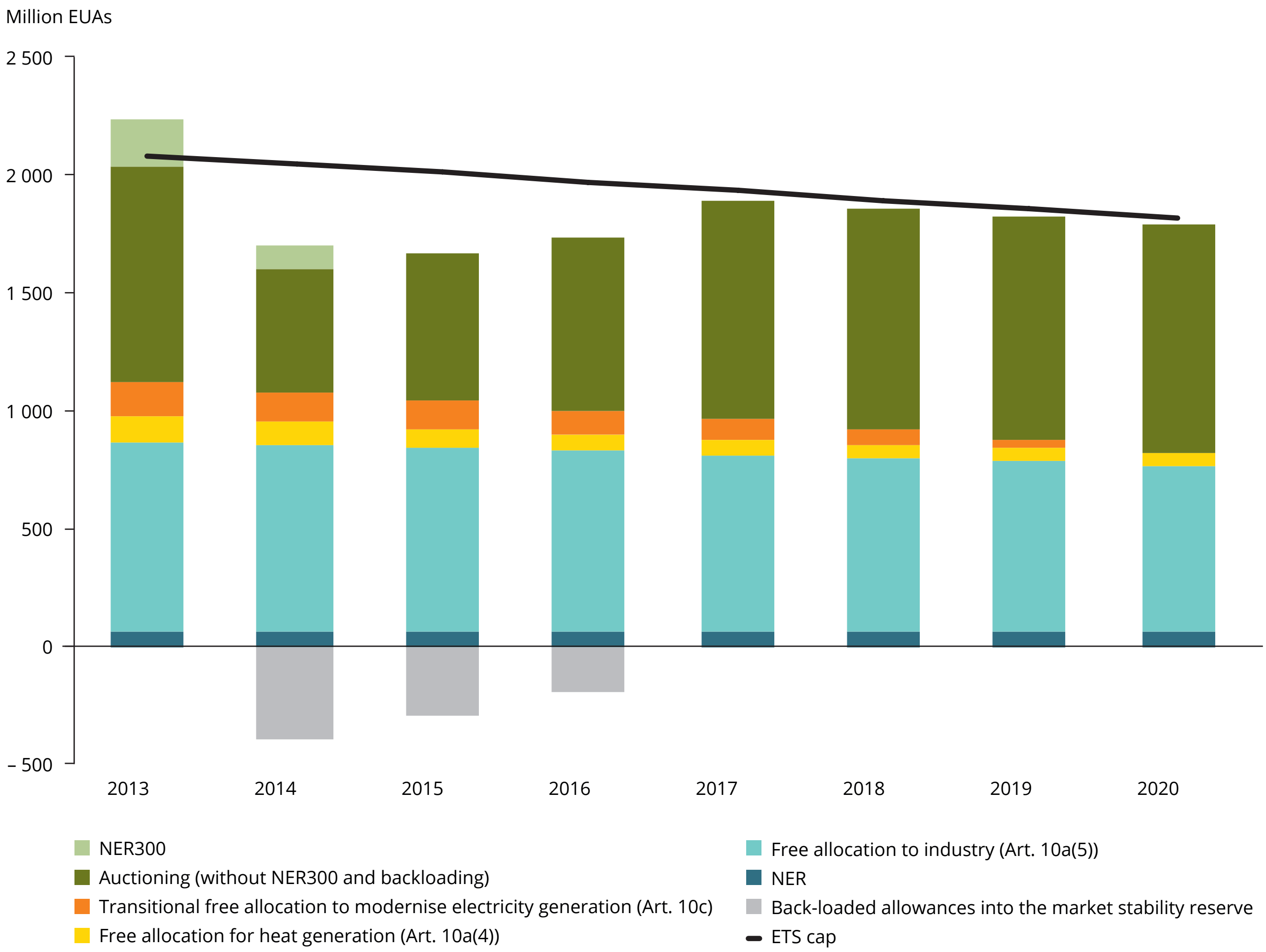
The total supply of planned allowances for the third trading period is illustrated in Figure A2.5, which shows the proportions of allowances that are planned to be either allocated free of charge or sold in the primary market (mostly via auctions). As noted above, the actual numbers of allowances allocated free of charge or sold in the primary market will differ — both year on year and in aggregate. This is because of, among other reasons, unallocated allowances, the MSR or yearly effects such as changes to the auction calendars.

Table A2.2 Proposed design parameters of the MSR

Established	2018
Start date	January 2019
Publication of TAiC in year 'x – 1'	15 May of year 'x' (starting on 15 May 2017)
Thresholds	< 400 million → release; > 833 million → build-up
% put in MSR if TAiC > 833 million	12 % of TAiC
Release from MSR if TAiC < 400 million	100 million
900 million back-loaded allowances	Placed into reserve
Unallocated allowances under Article 10a(7), Article 10a(19) and Article 10a(20)	Placed into reserve
of which 250 million	to be used towards NER in fourth trading period
of which 50 million	to be used towards NER400 before 2021
Remaining unallocated allowances under Article 10a(4) and Article 10a(5) estimated at 145 million	To be used towards NER in fourth trading period
Unallocated allowances under Article 10c	Auctioned by relevant Member States

Sources: EC, 2015e; EU, 2015.

Figure A2.5 Planned supply of allowances (2013–2020) without MSR



Sources: EC, 2012a; EU, 2012e, 2013a; EIB, 2014a.

A2.6 International credits

Operators liable under the EU ETS are allowed to use emission credits to comply with part of their legal obligation. These credits stem from flexible mechanisms set up under the Kyoto Protocol: the Clean Development Mechanism (CDM) and Joint Implementation (JI). According to the Linking Directive (EU, 2004), CERs from the CDM were allowed from 2005, and ERUs from JI were allowed from 2008. Before 2006, only a small number of CERs had been issued ([56]), and in 2006, EUA prices decreased significantly. Therefore, no CERs and ERUs were surrendered during the first trading period of the EU ETS. The use of CDM and JI credits gained increasing importance during the second trading period.

For the second trading period of the EU ETS, entitlement limits were set in the NAPs. These defined the entitlements as a percentage of the free allocation to each installation in the 2008–2012 period. The national average percentages vary from 4 % in Estonia ([57]) to 22 % in Germany. In total, they add up to an upper limit of 1.4 billion CERs or ERUs that could be used in the second trading period. This corresponds to 14 % of the total free allocation in the second trading period. Overall, 76 % of this maximum limit was used in the second trading period.

In the third trading period, operators of stationary installations are entitled either to use up the remainder of their international credit entitlement specified in the NAPs or to use 11 % of the free allocation of EUAs

([56]) See http://cdmpipeline.org.
([57]) Estonia allowed 10 % starting in 2011, which amounts to an average of 4 % over the whole second trading period.

granted to them in that period (if higher than the gross entitlement). This leads to an additional allowance of 90 million units for existing generators.

Operators of stationary installations newly included in the scope of the EU ETS in the third trading period, which did not receive free allocations or entitlements for international credit use during the second trading period are able to use international credits up to a maximum of 4.5 % of their verified emissions during the third trading period, adding another estimated 40 million units. The same holds for operators of installations that are new entrants to the EU ETS, the total effect of which will be known only once the total emissions of these installations are confirmed at the end of the third trading period.

A2.7 Cumulative surplus

The data underlying the calculation of the cumulative surplus are summarised in Table A2.3.

Table A2.3 Verified emissions and allowance data for stationary installations and aviation carriers between 2008 and 2015

	Unit	2008	2009	2010	2011	2012	2013	2014	2015
Stationary installations									
Emissions	Mt CO_2-eq.	2 259	2 004	2 052	2 010	1 969	1 908	1 814	1 800
Verified emissions	Mt CO_2-eq.	2 120	1 880	1 939	1 904	1 867	1 908	1 814	1 800
EEA estimate to reflect current ETS scope	Mt CO_2-eq.	139	124	113	106	102	0	0	0
Allocation	Million EUAs	2 097	2 094	2 102	2 114	2 146	875	831	793
Allocated allowances	Million EUAs	1 958	1 970	1 989	2 008	2 044	875	831	793
EEA estimate to reflect current ETS scope	Million EUAs	139	124	113	106	102	0	0	0
Transitional allocation	Million EUAs						139	103	78
Auction/primary sales	Million EUAs	53	79	92	93	125	1 103	631	625
International credits	Million credits	84	81	137	254	493	132	256	22
Verified emissions	Mt CO_2-eq.					84	53	55	57
Aviation									
Allocation, aviation	Million EUAAs					68	32	32	32
Auction/primary sales	Million EUAAs					12	5	5	5
International credits	Million credits					11	1	1	1
All EU ETS									
Balance stationary installations	Million allowances	– 25	251	279	450	795	339	8	– 283
Net demand (aviation)	Million allowances					6	– 14	– 16	– 18
Cumulative surplus (including aviation)	Million allowances	– 25	225	505	955	1 756	2 081	2 073	1 773

Note: The annual volumes of allowances auctioned/sold on the primary market presented in this table were attributed by the EEA to the years from which they arose. Therefore, the total volumes presented do not correspond to the volumes that were effectively released to the market each year, or to the numbers produced by the auctioning platforms. For more details, see Sections 2.1.2 and 2.2.2.

The cumulative surplus refers to the build-up of unused allowances (including net demand from aviation). It is important to acknowledge that this differs from the TAiC, which also takes into account the additional surplus held back in the MSR (i.e. back-loaded allowances that will now not automatically return to the market).

Source: EEA/EU ETS Data viewer, 2016.

European Environment Agency

Trends and projections in the EU ETS in 2016
The EU Emissions Trading System in numbers

2016 — 77 pp. — 21 x 29.7 cm

ISBN 978-92-9213-817-2
doi:10.2800/71685

TH-AL-16-023-EN-N
doi:10.2800/71685

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Publications Office

European Environment Agency