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Inhalt

The EU Emissions Trading System (EU ETS) is intended to be the flagship instrument of EU climate policy. Key aspects in this cap-and-trade scheme are the target path as well as the market price for emission allowances which results from supply and demand for these allowances. The recent pronounced price movements on the market for emission allowances raise the question what causes these fluctuations and what could be the carbon price's role for stimulating and guiding the transformation of the EU economy towards the 2030 emission target, which aims at a reduction of greenhouse gases of at least 55 percent compared to 1990 levels. This research brief collects evidence about the market stringencies that result from demand and supply and that prevailed in the third trading period between 2013 and 2020 and discusses potential drivers for the carbon price in the current trading period up to 2030. We conclude that aligning the EU ETS with the "Fit for 55" framework, the expected radical innovation efforts needed in particular for the hard-to-abate industries together with changing market behaviour due to hedging and speculative trading will likely keep the EU ETS carbon price volatile.

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What is driving the EU ETS carbon price?

1. Do the recent price hikes of carbon allowances reflect the state of the EU Emissions Trading System?

In the EU Emissions Trading System (EU ETS), the flagship instrument of EU climate policy, the market price for emission allowances (EUA) traded at a record of 98 € per metric ton of CO_2 on 8 February 2022, thus tripling compared with the previous year and showing a twentyfold increase compared with five years ago. With the beginning of March 2022 this peak was broken when CO_2 traded at prices around 70 € per ton.

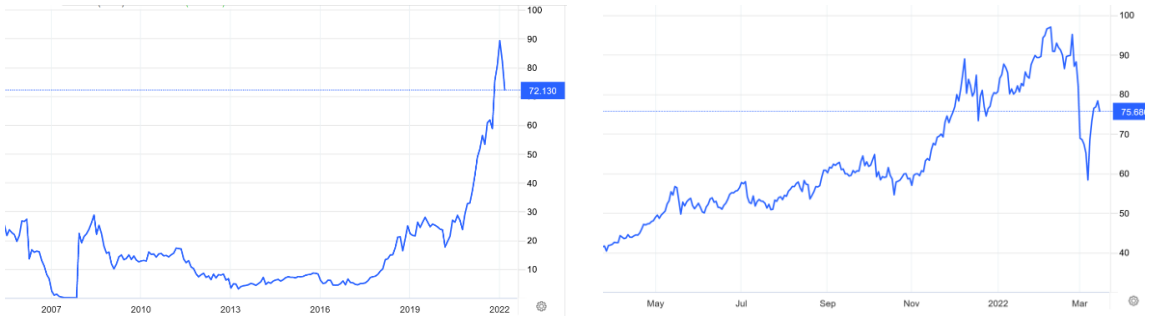
A closer look at the drivers for these price movements is motivated by the current discussions regarding a reform of the EU ETS in the Fit for 55 policy frameworks, the suggested complementary emission trading system for transport and buildings, and finally, the impacts of the EU ETS on innovation and inflation.

1.1 The history and (recent) price movements of EU ETS allowances

Over 11,000 installations EU-wide are included in the EU ETS cap-and-trade system. A target cap limits the annual total supply of allowances. These allowances can be traded on spot and futures markets or exchanged between trading partners. Their price movements, which reflect supply and demand of allowances on the stock market are depicted in Figure 1.

The price development for EU allowances has shown considerable fluctuations since the scheme was introduced in 2005 but stayed more or less below 30 €for one ton of CO_2 emissions until 2019. Then the price started climbing and peaked in February 2022 at 98 €. This is a tripling of the price over a year ago and a twentyfold increase compared to five years ago. Within a month, however, a pronounced price drop could be observed.

Figure 1: **History and recent price movements of EU ETS allowances (in €/tCO_{2eq})**



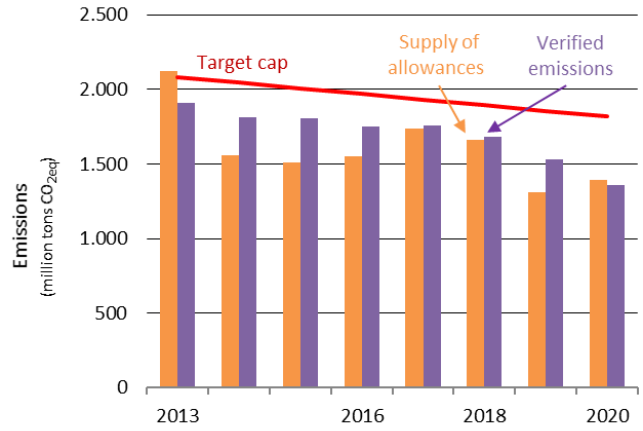
Source: Trading Economics.

1.2 Findings from the EU ETS in phase 3

The EU ETS represents a series of time-defined trading periods. It started in 2005 with phase 1 which served as a 3-year test period and in which free allocation of allowances to installations was the predominant allocation method. At the end of phase 1 prices dropped practically to zero as excess allowances could not be transferred to the next phase. Phase 2, running from 2008 to 2012, defined auctioning as basic principle for the allocation of allowances but still allocating approximately 90% of allowances were allocated for free. In phase 2 a big surplus of allowances accumulated largely driven by the economic crisis triggered by financial markets as well as the inflow of international carbon credits into the EU ETS. This again led to a decrease of allowances prices. With the start of phase 3 in 2013 corrective measures as described below were introduced by the EU Commission for reducing the vast accumulated surplus of allowances as well as the annual volume of freely allocated allowances. These measures are reflected in a reduction in the volume of the **Total Number of Allowances in Circulation (TNAC)**. Although so far there seems to be no scarcity of allowances to cover annual verified emissions of the regulated installations, we observe significant increases of the market price for allowances towards the end of phase 3 in 2020 and continuing since then. For phase 4, which will span from 2021 to 2030, further major reforms of the system are now under discussion for aligning the EU ETS to the new EU climate targets for 2030.

In the following some characteristics of the market for EU allowances in phase 3 are depicted, starting with the basic demand and supply relationships illustrated in Figure 2. The demand for allowances refers to the volume of verified emissions for which allowances need to be surrendered by the end of February of the following year. The supply of allowances is provided by free allocation and auctioning. The annual target cap limits total supply of new allowances into the system. It started from 2,084 million tons (mt) of CO_{2eq} emissions in 2013 and was reduced by a so-called Linear Reduction Factor (LRF) with 32 mt (1.74%) each year to 1,816 million tons in 2020. Figure 2 illustrates that since 2014 the annual allocation of EU allowances was lower than the verified emissions of regulated companies. Both annual supply of allowances and annual verified emissions were below the defined emissions cap of the EU ETS.

Figure 2: **The market for emission allowances in phase 3**



Evidence about the EU ETS market in phase 3:

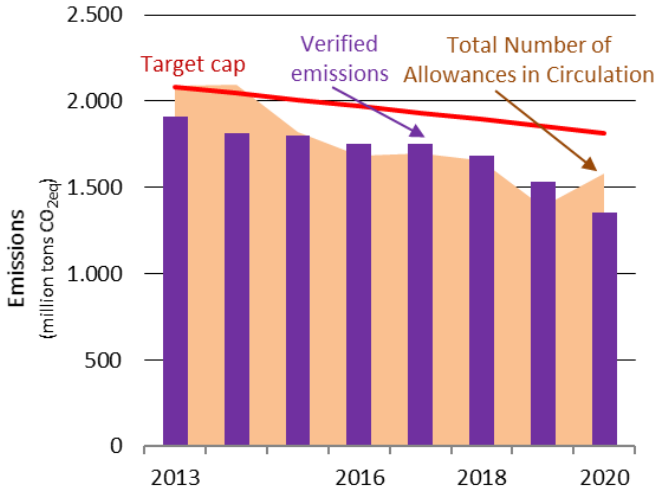
- Total supply of allowances was always below the target cap (except for 2013).
- Due to corrective measures the actual annual supply, i.e., the effective cap, was well below the initial target cap.
- Annual demand for allowances, defined by the verified emissions, was above the effective cap (except for two years).

Source: Based on EC Carbon Market Reports and EUTL.

The focus on annual allocations as in Figure 2 does not fully reveal the market imbalances in the EU ETS. A considerable surplus of allowances was accumulated in phase 2 because of (1) bankability of allowances, (2) an oversupply due to the economic crisis that started in 2008 and (3) the inflow of international emission credits. The key indicator reflecting this surplus of allowances in the system is called the **Total Number of Allowances in Circulation (TNAC)**.

As can be seen from Figure 3, the TNAC at the beginning of phase 3 was equivalent to the value of the target cap and at the end of phase 3 in 2020 again surpassed the volume of verified emissions. Two mechanisms were introduced to reduce the substantial gap between the supply of allowances and the actual demand by verified emissions. In the years 2014 to 2016 900 million tons of allowances were withdrawn from the volume of allowances planned for auctioning by a mechanism called **Backloading**. In 2019 the **Market Stability Reserve (MSR)** was introduced with a mechanism that aims at stabilizing the number of TNAC between predefined target boundaries.

Figure 3: **Total Number of Allowances in Circulation (TNAC) in phase 3**



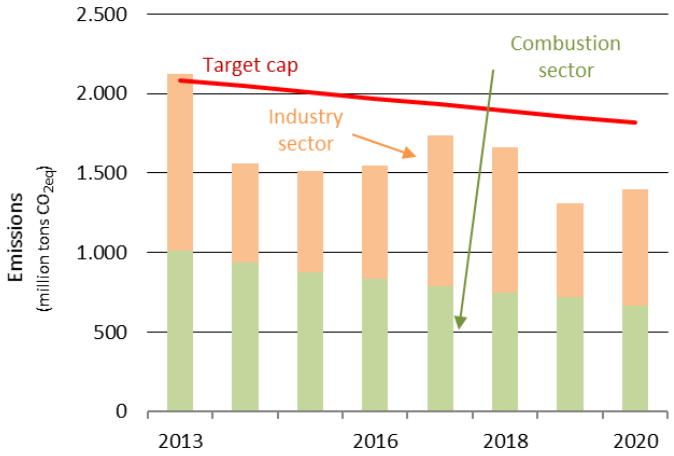
Total Number of Allowances in Circulation (TNAC) exceeded at the beginning of phase 3 the target cap and at the end the volume of verified emissions.

Source: EC Carbon Market Reports and own estimates.

Table 1 in the appendix shows details for the calculation of the volume of TNAC as published by the European Commission since 2017 and completed by own estimates for the period 2013 to 2016. We would like to point out that also the composition of TNAC is important to judge the real liquidity available to the market. This would require assessing the hedged allowances and the remaining part in the hands of other actors (industry, financial institutions).

The main drivers for scarcities in the EU ETS are the correspondence of the ex-ante cap with the actual supply of allowances and the actual emissions development. Figure 4 indicates the composition of total supply by distinguishing the amounts of free and auctioned allowances. Freely allocated allowances exhibit a continuous declining trend. The auctioned volume, however, shows fluctuations mirroring the Backloading procedure from 2014 to 2016 and the Market Stability Reserve mechanism that started in 2019.

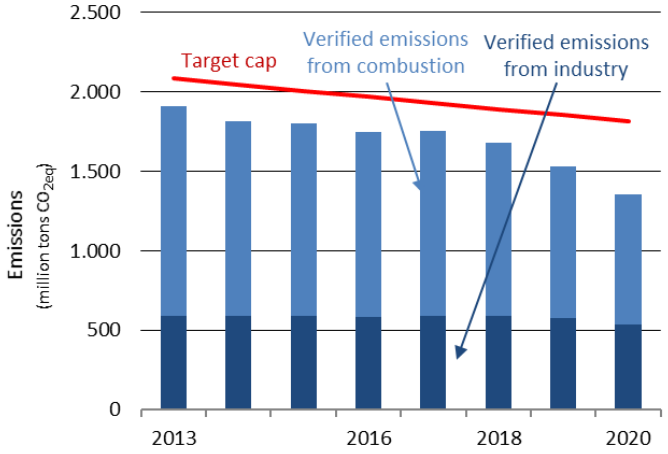
Figure 4: **The supply of emission allowances**



Regarding the supply of allowances, freely supplied allowances show a declining trend: The auctioned supply reflects the Backloading procedure and the MSR mechanism.

Source: EC Carbon Market Reports and own estimates.

Figure 5: **The demand for allowances by verified emissions**



The sharp decline of verified emissions is mainly due to the combustion sector which generates power and heat. The emissions from the industry sector remained almost stable.

Source: Based on EC Carbon Market Reports and EUTL.

Looking at the demand for allowances corresponding to verified emissions, we see in phase 3 a stronger decline in verified emissions than the target cap would suggest as depicted in Figure 5.

A decomposition of total demand into the sectors industry and combustion shows different dynamics: emissions from the industry sector remained almost stable over the whole trading period, compared to emissions from combustion for generating power and heat which sharply declined particularly towards the end of phase 3. This decline particularly reflects fuel switching to less emissions intensive or renewable energy sources and in addition the impacts related to the COVID-19 pandemic in 2020. The evidence so far suggests that emission reductions in industry will need more attention, above all the emissions from so-called hard-to-abate industries as steel, cement, refineries, and basic chemicals.

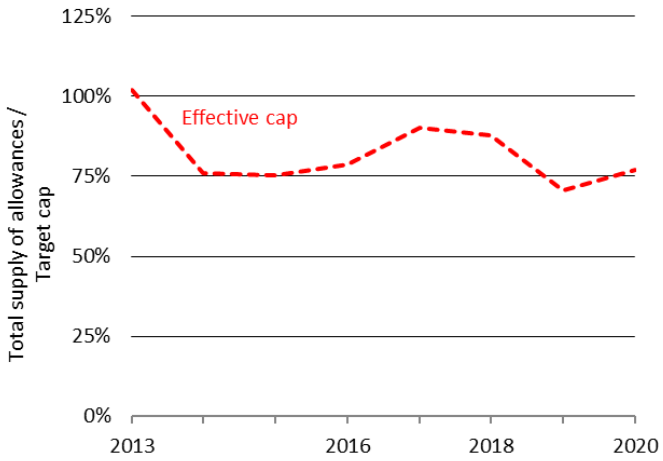
2. Do market stringencies correspond to the price of carbon in the EU ETS?

To explore the fundamentals of the EU ETS, which might be the drivers for the price movements of allowances, we identify a hierarchy of indicators that may be relevant to the evolution of the carbon price.

2.1 Overall market stringency: The effective cap was below the target cap

Actual supply resulting from freely allocated and auctioned allowances was always below the target cap. This is visible by the indicator effective cap from Figure **6** which depicts the deviation of actual supply – the effective cap – as a percentage from the target cap,

Figure 6: **Overall market stringency**



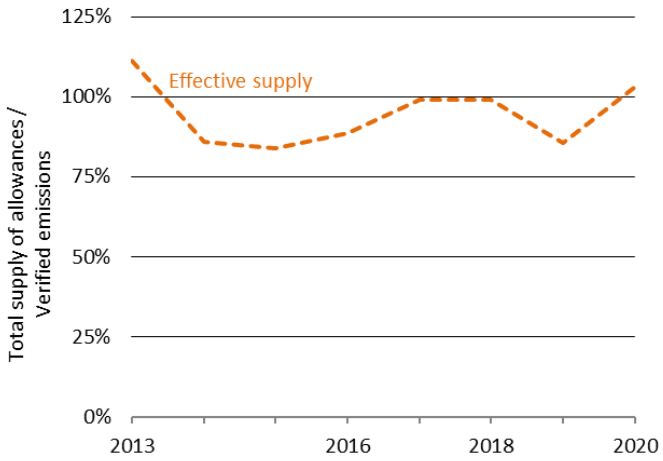
The effective cap measures the percentage deviation of actual annual supply of allowances from the target path.
This indicator illustrates the impact of measures for reducing the surplus of allowances.

Source: Own calculations.

2.2 Effective market stringency: Actual annual supply of allowances was close to verified emissions

Annual supply from freely allocated and auctioned allowances was at least equal to the demand by verified emissions in four out of eight years of phase 3 as can be seen from Figure 7. It shows the indicator effective supply, which is defined as the ratio of supplied allowances over the demand represented by verified emissions.

Figure 7: **Effective market stringency**

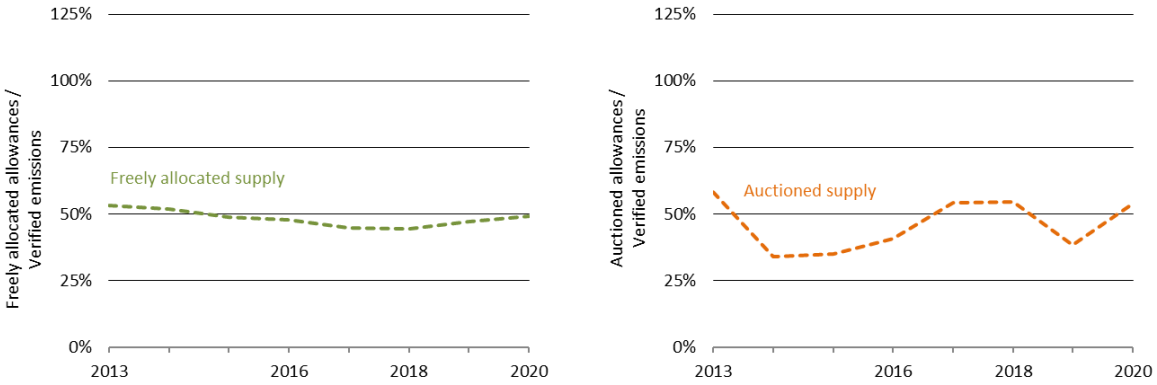


The effective supply measures the actual annual supply of allowances relative to the annual demand for allowances represented by verified emissions.
The development of this indicator also reflects measures for reducing the surplus of allowances but indicates otherwise that supply of allowances was close to verified emissions.

Source: Own calculations.

Additional evidence about the fluctuations of the effective market stringency can be obtained from Figure 8. The relation between freely allocated allowances and verified emissions shows a smooth pattern around half of the total supply volume whereas the other half provided via auctioning reflects the measures for reducing the market surplus.

Figure 8: **Impact of free allocations and auctioning on supply**



Source: Own calculations.

3. What might drive the prices for EU ETS allowances in phase 4 up to 2030

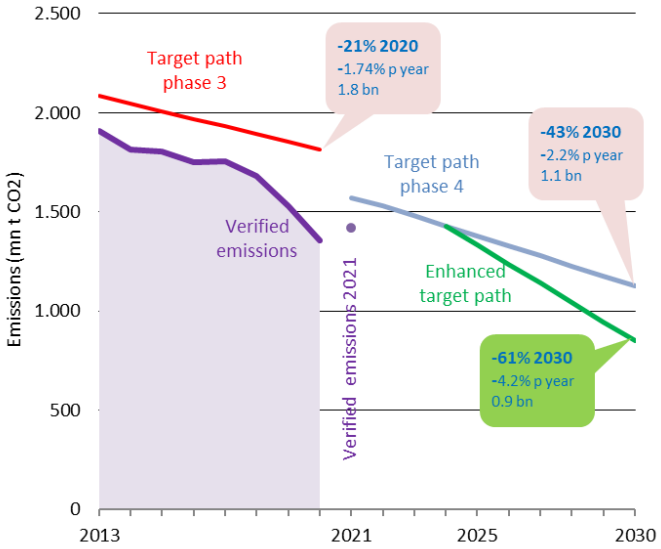
Market prices are supposed to reflect the relationship between supply and demand. Our analysis of phase 3, however, provided no clear evidence whether the price signal in the EU ETS delivers a reliable information about this relationship since a large volume of the Total Number of Allowances in Circulation (TNAC) was accompanied by high and low market prices for EU allowances. We summarize some arguments that might be relevant for price movements in phase 4. They are related to market stringencies, impacts of the EU ETS on innovation, and changing behavior of actors involved.

3.1 The Fit for 55 frameworks propose an increased stringency for the EU ETS

In July 2021 the European Commission published in the Fit for 55 frameworks a comprehensive package of legislative proposals for achieving climate neutrality by 2050 and meeting the intermediate target of at least 55% net reduction of greenhouse gas emissions by 2030 over 1990. The proposed revisions of the EU ETS Directive are intended to tighten the stringencies in the system as indicated in Figure 9. The main elements of the proposed reform which impact expectations about increased stringencies in phase 4 are:

- **A more ambitious emissions target** path for the EU ETS should reduce emissions by 61% compared to 2005 with an enhanced annual Linear Reduction Factor (LRF) of 4.2%.
- **A more responsive Market Stability Reserve (MSR)** mechanism should react faster to the Total Number of Allowances in Circulation (TNAC) in the system by increasing the feeding rate and allowing for canceling of allowances.
- **A gradual phaseout of free allowances** in accordance with the intended Carbon Border Adjustment Mechanism (CBAM) which is supposed to put a levy on the embedded carbon content of high carbon imports.

Figure 9: **Suggested target paths for the EU ETS up to 2030**



The current target path up to 2030 is suggested to be tightened for meeting a 61% reduction compared to 2005 of the EU ETS emissions in line with the overall emissions target of minus 55% over 1990. The discontinuity in 2021 reflects the BREXIT adjustment.

Source: Based on EC Market Reports.

3.2 A focus on innovation

In phase 4 of the EU ETS there should be a stronger focus on innovation. This will be above all an issue for the industrial sector, which showed only slight declines in emissions in phase 3 in contrast to the combustion sector, which benefitted from policies targeted to renewable energy sources. A stronger focus on innovation, which was not incentivized so far due to the too low prices and the continued free allocation, could impact the stringencies in the EU ETS in opposite directions. On the one hand, carbon saving innovations that reduce the carbon intensity in industry will, depending on economic activity, lower the annual demand for allowances, thus relieving potential market shortages. On the other hand, a larger number of allowances will be used in phase 4 to ensure financing of the Innovation, Transition, and Modernization funds. The dedicated volume of allowances for these funds is part of the overall number of allowances and will thus lower the auctioning volume. This then would add stringencies to the market for allowances.

The need for innovation is huge, considering that about two thirds of emissions from the industrial sector originate from so-called hard-to-abate-industries as steel and cement. So far there are only vague visions about the disruptive changes needed for these industries but the volume of financial support from the Modernization Fund could act as a key driver.

3.3 Changing market behavior of actors

Two possible explanations can be used for the observed lack of correlations between surpluses on the market and market prices.

One possible explanation refers to the Market Stability Reserve, which is intended to keep the liquidity of the market for allowances in the range between 400 to 833 million tons of CO_2. This numbers reflect assumptions about the behavior of actors in the market, most importantly the managing of risk via hedging.

Hedging as risk management tool is applied by utilities in order to reduce risk in long-term commodities contracts like coal, gas, but also carbon allowance (see Eurelectric, 2009). Currently, hedging over three years is typical in the EU. With a continuously increasing share of renewable energy sources in the energy sector hedging demand from the power sector is likely to decrease in the coming years but it might be that hedging will increase in the industry sector, which needs to be accommodated by the market. Because of hedging, the market balance has to show a surplus all the time, which allows this hedging activity to be sustainable.

The second explanation points at increased interest and activity in the carbon allowance market from financial institutions (see also Quermin and Pahle (2021)). As a result, a stronger short-term and speculative trading behaviour could shape the market for carbon allowances in the future. This line of arguments could explain the most recent price hikes and the subsequent price drops in the EU ETS market.

3.4 Final remarks

The history of the EU ETS shows a series of reforms and further developments of the original system. Major changes mainly targeted at reducing the cumulated allowance surpluses and at sustaining market stability were implemented in phase 3. These reforms already show some effect. The reform requirements, however, do not end here. The challenge for the pending reform

in phase 4 is to align the current ETS target path with the tightened emissions target agreed on in the Fit for 55 package.

A key objective of an emissions trading system is the price of allowances as a signal of market stringency. However, the extent to which the price can be seen as a signal for the available supply and the demand of allowances is limited. Expectations about future stringencies resulting from the proposed new targets for phase 4 will be one relevant aspect. The high price increase in 2021 and the most recent decline in prices in the beginning of March 2022 need additional explanations which point to trading of allowances on the financial markets.

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Trading Economics. https://tradingeconomics.com/commodity/carbon

Appendix

Table 1: **Total Number of Allowances in Circulation**

Total number of allowances in circulation [million t]	2013	2014	2015	2016	2017	2018	2019	2020
Supply	**5.873,959**	**7.587,824**	**9.091,613**	**10.643,041**	**12.397,278**	**13.956,283**	**16.439,231**	**18.402,494**
Banking from Phase 2	1.749,541	1.749,541	1.749,541	1.749,541	1.749,541	1.749,541	1.749,541	1.749,541
Free allowances from 2013	1.006,370	1.939,293	2.811,697	3.639,022	4.419,671	5.162,023	5.850,263	6.588,904
annual change		*932,923*	*872,404*	*827,325*	*780,649*	*742,352*	*688,240*	*738,641*
unallocated allowances Article 10a(7)								301,801
Allowances deducted for the Innovation Fund								-50,000
Allowances auctioned from 2013	2.458,998	3.224,940	3.841,325	4.550,428	5.509,016	4.641,208	5.229,748	6.008,253
annual change		*765,942*	*616,385*	*709,103*	*958,588*	*-867,808*	*588,540*	*778,505*
Allowances deducted from auctioning 2014-2016 (backloading)		400,000	700,000	900,000			900,000	900,000
Allowances deducted from auctioning in 2019 and 2020							397,125	772,750
Allowances monetised by the EIB for the NER300	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
International credit entitlements exercised by installations	359,050	374,050	389,050	404,050	419,050	434,050	450,222	478,845
Demand	**3.788,959**	**5.494,824**	**7.273,613**	**8.958,041**	**10.703,374**	**12.301,373**	**13.756,610**	**14.899,170**
Verified emissions from 2013	1.894,454	3.694,589	5.484,026	7.220,934	8.962,029	10.631,597	12.193,929	13.546,329
annual change	*1.894,454*	*1.800,135*	*1.789,437*	*1.736,908*	*1.741,095*	*1.669,461*	*1.562,332*	*1.352,400*
Allowances cancelled	0,050	0,100	0,150	0,200	0,250	0,315	0,349	0,441
MSR holdings	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**1.297,125**	**1.924,552**
MSR feed							1.297,125	627,427
TNAC response							*264,000*	*397,000*
Backloading							*900,000*	*0,000*
Unallocated allowances							*133,125*	*230,427*
Total number of allowances in circulation (TNAC)	**2.085,000**	**2.093,000**	**1.818,000**	**1.685,000**	**1.693,904**	**1.654,910**	**1.385,496**	**1.578,772**

Source: European Commission documents.