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Interim report

Supply and demand in the ETS 2

Assessment of the new EU ETS for road transport, buildings and other sectors

by:
Jakob Graichen, Sylvie Ludig
Öko-Institut e.V., Berlin

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Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
buergerservice@uba.de
Internet: www.umweltbundesamt.de

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Öko-Institut e.V.
Borkumstr. 2
13189 Berlin
Germany

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Paula Müller

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Abstract: Supply and demand in the ETS 2

The study looks at the functioning of the new emission trading system for road transport, buildings, and small installations (ETS 2) in the EU. It explains the rules governing the supply of allowances including the functioning of the market stability reserve (MSR) and the price containment mechanisms. In the analytical part we assess the balance of supply and demand as well as auctioning revenues under different assumptions for the development of CO_2 emissions and CO_2 price. In the last part, we assess the interaction between the ETS 2 and national targets under the Effort Sharing Regulation (ESR), the relationship with the German national ETS and provide an outlook for the period until 2040.

We find that the sectors covered by the ETS 2 will need to reduce CO_2 emissions more than five times as fast than historic reduction rates to meet the cap. The different stability mechanisms are able to contain the difference between supply and demand to a politically set range if emissions reduce at least as fast as the cap. In scenarios where emission reductions are much slower than the cap, these mechanisms are too weak and too slow, very high CO_2 prices would be the result.

Concerning ESR targets, the ETS 2 will likely lead to an overachievement for poorer Member States whereas wealthy Member States will need to introduce more policies and measures or buy emission quantities. In relative terms, the German national ETS has a more ambitious target path than the ETS 2. Despite this, Germany is currently not on track to meet its national targets. If the ETS 2 replaces the national ETS without further national action, the gap is likely to increase even further.

Kurzbeschreibung: Angebot und Nachfrage im ETS 2

Die Studie untersucht die Funktionsweise des neuen EU Emissionshandelssystems (ETS 2) für den Straßenverkehr, Gebäude und kleine Anlagen. Sie erklärt die Regeln zur Festlegung und Steuerung des Angebots von Zertifikaten, einschließlich der Funktionsweise der Marktstabilitätsreserve (MSR) und der Preisdämpfungsmechanismen. Im analytischen Teil der Studie bewerten wir das Gleichgewicht von Angebot und Nachfrage sowie die Versteigerungserlöse unter verschiedenen Annahmen für die Entwicklung der CO_2-Emissionen und des CO_2-Preises. Im letzten Teil untersuchen wir die Wechselwirkung zwischen dem ETS 2 und den nationalen Zielen im Rahmen der EU Klimaschutzverordnung (Effort Sharing Regulation, ESR), das Verhältnis zum deutschen nationalen ETS (nEHS) und geben einen Ausblick auf den Zeitraum bis 2040.

Wir stellen fest, dass die vom ETS 2 erfassten Sektoren ihre CO_2-Emissionen im Vergleich zu den historischen Raten mehr als fünfmal so schnell senken müssen, um die Obergrenze (im Folgenden das „Cap“) einzuhalten. Die verschiedenen Stabilitätsmechanismen sind in der Lage, die Differenz zwischen Angebot und Nachfrage auf einen politisch festgelegten Bereich zu begrenzen, so lange die Emissionen mindestens so schnell sinken wie das Cap. In Szenarien, in denen die Emissionsreduktionen viel langsamer sind als das Cap, sind diese Mechanismen zu schwach und zu langsam, sehr hohe CO_2-Preise wären die Folge.

Hinsichtlich der ESR-Ziele wird das ETS 2 wahrscheinlich zu einer Übererfüllung für ärmere Mitgliedstaaten führen, während reiche Mitgliedstaaten mehr Politiken und Maßnahmen einführen oder Emissionsmengen zukaufen müssen. Der nEHS hat einen ehrgeizigeren relativen Minderungspfad als das ETS 2. Trotzdem ist Deutschland schon jetzt nicht auf dem Weg, seine nationalen Ziele zu erreichen. Wenn das ETS 2 das nationale ETS ohne weitere flankierende Maßnahmen ersetzt, könnte die Lücke noch größer werden.

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AEA	Assigned emission allocation (emission quantities under the ESR)
BAU	Business as usual
CRF	Common Reporting Format
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
ETS 1	ETS for large stationary installations and aviation
ETS 2	New ETS for road transport, buildings, and small installations
FF55	Fit-for-55
LRF	Linear Reduction Factor
MSR	Market Stability Reserve
SCF	Social Climate Fund
TNAC	Total Number of Allowances in Circulation

Summary

The new EU emission trading system (ETS 2) for road transport, buildings and small energy and industry installations will start on 1 January 2027. The ETS 2 complements the existing EU emission trading system for the energy, industry, aviation and maritime sectors (ETS 1) but has a different standing in the EU's climate architecture; it resides fully within the Climate Action Regulation (also known as the Effort Sharing Regulation, ESR) and is a measure to help achieve its targets. Compared to 2005, an emission reduction of only 11 % has been achieved in the ETS 2 sectors until 2021. At the same time, ambitious reductions in these sectors are required to meet the EU's ESR target of a 40 % reduction below 2005 by 2030. To comply with the ETS 2 cap development, covered sectors will need to reduce emissions by unprecedented velocities: Between 2005 and 2021, the annual average emission reduction in sectors covered by the ETS 2 was about 11 Mt CO_2. The ETS 2 cap will decrease by about 62 Mt CO_2 per year, more than five times as fast. Carbon pricing, together with other policies such as efficiency standards for buildings, an accelerated deployment of renewable energies and CO_2 emission limits for vehicles, will play a major role in ensuring these emission reductions.

The aim of this study is to explain the rules and mechanisms governing the new ETS 2 supply regime and assess the supply of and demand for allowances under different assumptions. In addition, it looks at the auction revenues by Member State and discusses the interaction with the ESR, the German national ETS and looks at the period up to 2040.

The new ETS 2

The ETS 2 will cover CO_2 emissions from road transport, buildings as well as small energy and industry installations outside the ETS 1. The ETS 2 itself will begin in 2027,[1] but the calculative cap path already starts in 2024. The initial value depends on the EU-wide ESR target for that year and the emissions from the ETS 2 sectors during the 2016-18 period. From then on, the cap decreases by 5.1% of the 2024 value per year. Once verified emission data for the ETS 2 are available, the cap will be recalculated.

All allowances are auctioned, there is no free allocation like in the ETS 1. To ensure some liquidity in the market, the quantity of allowances that will be auctioned in 2027 is increased by 30%; this frontloaded quantity is deducted again during the years 2029-2031.

The ETS 2 comes with flexibility instruments that react to the balance of supply and demand as well as to the CO_2 price development. A market stability reserve (MSR) withholds allowances if the supply of allowances exceeds emissions by over 440 Mt CO_2; if there is a difference of less than 210 Mt CO_2 between supply and demand, the reserve will issue additional allowances. The MSR will also issue allowances if the absolute price level or the speed at which the CO_2 price increases exceed specific limits. An important limitation is the availability of allowances in the MSR: it is initially filled with 600 million allowances. Under current legislation, these allowances are only valid until the end of 2030, i.e. both the quantity as well as the quality control mechanisms cease to function on 1 January 2031. Only allowances in the MSR which are withheld due to an oversupply will remain valid.

Supply and demand of allowances

The supply of allowances and the effect of the frontloading mechanism is shown in Table 1. The demand of allowances depends on the emission development. In this paper we use three scenarios: the **policy scenario** is based on the European Commission's impact assessment which accompanied the ETS 2 proposal. In this scenario, emissions decline at the same rate as the cap; supply and demand balance each other out. The **enhanced action scenario** assumes

[1] In case of exceptionally high energy prices, the start can be postponed by one year.

that emissions decline faster than in the policy scenario; total demand would be 7 % lower than in the policy case for the period 2027-2032. The **slow adoption scenario** is based on the assumption that annual emission reduction rates only double compared to the previous five-year period. In this scenario, total emissions would be 10 % higher than in the policy case until 2032. To put this into perspective: with an unchanged annual reduction rate, total emissions would be 20 % higher than in the policy case.

Table 1: Supply of allowances in the ETS 2

	2027	2028	2029	2030	2031	2032
ETS 2 cap	1 040	978	915	853	790	727
Frontloading	312		-104	-104	-104	
Total supply	1 352	978	811	749	686	727

Source: own calculation, Öko-Institut

In addition to the three demand scenarios, we also use four different applications of the price control mechanisms. These applications vary both in the quantity of additional allowance (zero to 160 million) as well as in the timing (once in 2028 or evenly from 2027 to 2030).

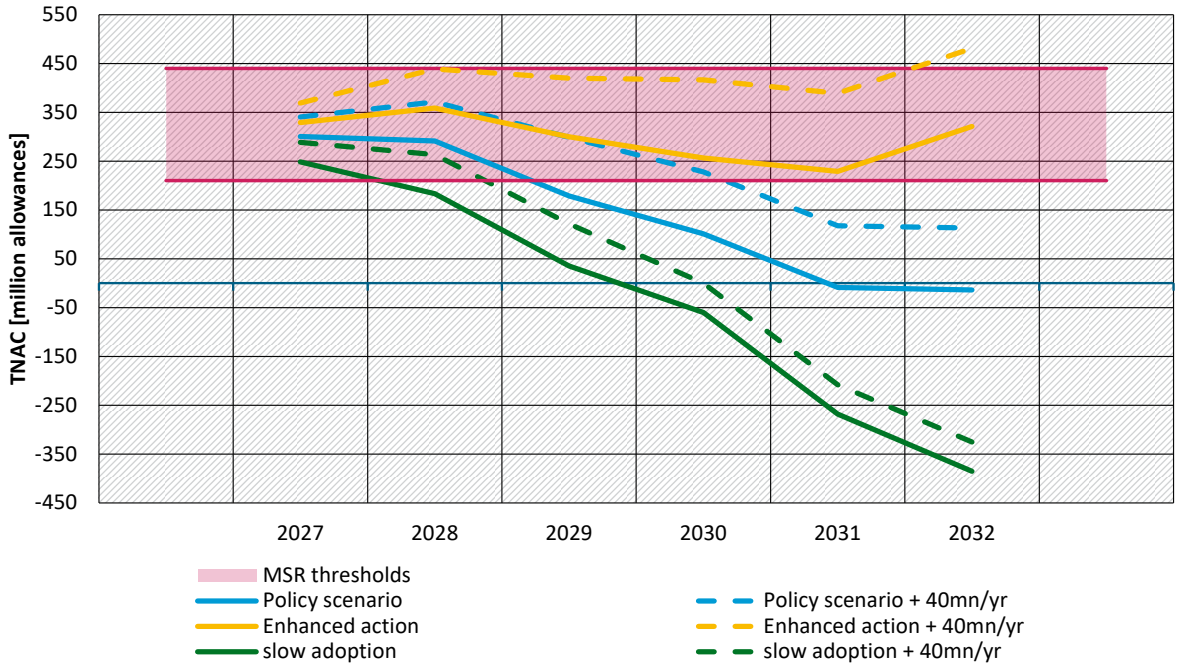
Performance of the MSR

In the policy scenario, the total number of allowances in circulation (TNAC, the difference between supply and demand) is a function of the frontloading mechanism, because emissions follow the cap. In 2027, TNAC is 300 million allowances; this value decreases to zero by 2031. The MSR is not able to keep the TNAC in the region between 210 and 440 million allowances which is assumed by the European Commission to be the optimal range of liquidity in the ETS 2 (Figure 1, blue line). This is because the activation of the MSR only starts after all allowances in the MSR have lost their validity, i.e. there are no certificates which could be issued. Even with the highest modelled price control mechanisms of 40 million additional allowances per year, the TNAC value only reaches 113 million allowances.

In the enhanced action scenario (yellow lines), the quickly declining emissions compensate for the frontloading effect, i.e. TNAC remains within the threshold for all years. Even in the maximum additional supply scenario TNAC stays within the range for all years but 2032. In 2033 the MSR would then start withholding the same supply.

In the slow adoption scenario (green lines), TNAC becomes negative in 2030 and decreases to minus 385 million allowances by 2032. Even with the additional supply TNAC would be minus 210 million in 2031 already and decline further. This is a counterfactual scenario: such a high negative TNAC value means that there are not enough allowances for all emissions, i.e. covered entities would not be able to fulfil their legal obligations. The MSR and the price containment mechanisms would not be strong enough to ensure a balance of supply and demand. In such a scenario, CO_2 prices would become extremely high until emissions decline sufficiently.

Figure 1: TNAC development 2027 – 2032 using different emission scenarios and different application of the price containment mechanism



Source: own illustration, Öko-Institut.

Interaction with other climate policy

The ETS 2 applies homogeneously across all Member States, but resides within the differentiated ESR. National ESR targets are strongly differentiated between countries based on their wealth; Bulgaria as the country with the lowest GDP per capita has a 2030 reduction target of only 10 % below 2005. The richest countries including Germany will need to reduce emissions by 50 %. Because the ETS 2 covers over 60 % of the ESR emissions and the cap decreases to 44 % below 2005 by 2030, countries at the low end of the ESR target range will very likely overachieve their emission reduction targets. As a consequence, they will be able to sell excess emission quantities to richer Member States, for whom the ETS 2 is not strong enough to ensure ESR compliance. The over-/underachievement will likely be even higher: Consumers will react to the increased costs for energy consumption from fossil fuels due to the ETS 2 by a) changing behaviour (e.g. reducing room temperatures) and by b) investing in energy efficiency and non-fossil energy supply (e.g. better insulation and a heat pump). Behavioural changes can happen quickly whereas changes to the housing and vehicle stock will take some time and require sufficient economic resources. For this reason, we assume that in the short term the ETS 2 will reduce emissions the strongest in countries with lower purchasing power where increasing fuel prices will be felt the strongest. These are the countries that also have the lowest ESR target, i.e. they will be able to sell even more excess emission quantities.

Germany has introduced a national ETS (nETS) in 2021 with a slightly larger scope than the ETS 2. Most likely, the nETS will be transitioned into the ETS 2. This means that Germany would include the additional sectors into the ETS 2 but otherwise discontinue the nETS once the EU-wide trading starts. While there are economic benefits from participating in a larger ETS, this transition will exacerbate the current gap between national policies and targets. The nETS has a 2030 cap which is 46 % below 2016-18 levels, the ETS 2 of 38 %. Germany is already projecting to miss both its national GHG emissions targets as well as the ESR target. If the nETS is only replaced by the ETS 2 without further measures, these gaps could increase even more.

Zusammenfassung

Das neue EU-Emissionshandelssystem (ETS 2) für den Straßenverkehr, Gebäude und kleine Energie- und Industrieanlagen wird am 1. Januar 2027 starten. Das ETS 2 ergänzt den bestehenden europäischen Emissionshandel für Engie, Industrie sowie den Luft- und Seeverkehr (ETS 1), hat aber einen anderen Stellenwert in der EU-Klimaarchitektur; es ist vollständig in der Klimaschutzverordnung (auch bekannt als Effort-Sharing-Verordnung, ESR) verankert und ist eine Maßnahme, die zur Erreichung der ESR-Ziele der EU beitragen soll. Im Vergleich zu 2005 wurde bis 2021 eine Emissionsminderung von nur 11 % in den ETS 2 Sektoren erreicht. Gleichzeitig sind ehrgeizige Reduzierungen in diesen Sektoren erforderlich, um das EU-Ziel einer Reduzierung um 40 % gegenüber 2005 bis 2030 zu erreichen. Um die Obergrenzen (im Folgenden das „Cap“) des ETS 2 einzuhalten, müssen die betroffenen Sektoren ihre Emissionen in einem noch nie dagewesenen Tempo reduzieren: Zwischen 2005 und 2021 betrug die durchschnittliche jährliche Emissionsreduktion etwa 11 Mt CO_2. Die ETS 2-Obergrenze wird um etwa 62 Mt CO_2 pro Jahr sinken, also mehr als fünfmal so schnell. Die Bepreisung von Kohlendioxid wird zusammen mit anderen politischen Maßnahmen wie Effizienzstandards für Gebäude, einem beschleunigten Einsatz erneuerbarer Energien und CO_2-Emissionsgrenzwerten für Fahrzeuge eine wichtige Rolle bei der Sicherstellung dieser Emissionssenkungen spielen.

Ziel dieser Studie ist es, die Regeln und Mechanismen zur Angebotsteuerung des neuen ETS 2 zu erläutern und das Angebot an und die Nachfrage nach Zertifikaten unter verschiedenen Annahmen zu bewerten. Darüber hinaus werden die Versteigerungserlöse nach Mitgliedstaaten betrachtet und die Interaktion mit der ESR sowie dem deutschen nationalen ETS (nEHS) erörtert. Schließlich folgt noch ein Ausblick auf den Zeitraum bis 2040.

Das neue ETS 2

Das ETS 2 wird die CO_2-Emissionen aus dem Straßenverkehr, aus Gebäuden sowie aus kleinen Energie- und Industrieanlagen außerhalb des ETS 1 abdecken. Das ETS 2 selbst wird 2027 beginnen,[2] aber der Pfad zur Berechnung der Emissionsobergrenze („Cap“) beginnt bereits 2024. Der Anfangswert hängt vom EU-weiten ESR-Ziel für dieses Jahr und den Emissionen aus den ETS 2-Sektoren im Zeitraum 2016-18 ab. Von da an sinkt das Cap jährlich um 5,1 % des 2024er Wertes. Sobald geprüfte Emissionsdaten für das ETS 2 verfügbar sind, wird die Obergrenze neu berechnet.

Alle Zertifikate werden versteigert, es gibt keine kostenlose Zuteilung wie im ETS 1. Um eine gewisse Liquidität auf dem Markt zu gewährleisten, wird die Menge der im Jahr 2027 zu versteigernden Zertifikate um 30 % erhöht; diese Menge wird in den Jahren 2029 bis 2031 wieder abgezogen.

Das ETS 2 verfügt über Flexibilitätsinstrumente, die auf das Gleichgewicht von Angebot und Nachfrage sowie auf die CO_2-Preisentwicklung reagieren. Eine Marktstabilitätsreserve (MSR) hält Zertifikate zurück, wenn das Angebot an Zertifikaten die Emissionen um mehr als 440 Mt CO_2 übersteigt. Ist die Differenz zwischen Angebot und Nachfrage geringer als 210 Mt CO_2 gibt die Reserve zusätzliche Zertifikate aus. Die MSR vergibt auch dann Zertifikate, wenn das absolute Preisniveau oder die Geschwindigkeit, mit der der CO_2-Preis steigt, bestimmte Grenzen überschreitet. Eine wichtige Einschränkung ist die Verfügbarkeit von Zertifikaten in der MSR: Sie wird zunächst mit 600 Millionen Zertifikaten gefüllt. Diese Zertifikate sind unter dem aktuellen Rechtsrahmen nur bis Ende 2030 gültig, d.h. sowohl die Mengen- als auch die Preiskontrollmechanismen laufen am 1. Januar 2031 aus. Nur Zertifikate in

[2] Im Falle außergewöhnlich hoher Energiepreise könnte das ETS 2 auch erst im Jahr 2028 starten.

der MSR, die aufgrund eines Überangebots einbehalten werden, bleiben gültig und könnten dann noch ausgeschüttet werden.

Angebot und Nachfrage von Zertifikaten

Das Angebot an Zertifikaten und die Auswirkungen des Frontloading-Mechanismus sind in Tabelle 2 dargestellt. Die Nachfrage nach Zertifikaten hängt von der Entwicklung der Emissionen ab. In diesem Papier verwenden wir drei Szenarien: Das **Zielszenario** basiert auf der Folgenabschätzung der Europäischen Kommission, das den ETS 2-Vorschlag begleitete. In diesem Szenario sinken die Emissionen mit der gleichen Geschwindigkeit wie das Cap, Angebot und Nachfrage gleichen sich aus. Beim **Szenario mit verstärkten Maßnahmen** wird davon ausgegangen, dass die Emissionen schneller zurückgehen als beim Zielszenario. Die Gesamtnachfrage wäre im Zeitraum 2027 bis 2032 um 7 % niedriger als im Zielszenario. Das **Hochemissionsszenario** basiert auf der Annahme, dass sich die jährlichen Emissionsminderungsraten im Vergleich zum vorangegangenen Fünfjahreszeitraum nur verdoppeln. In diesem Szenario wären die Gesamtemissionen bis 2032 um 10 % höher als im Zielszenario. Zum Vergleich: Bei einer unveränderten jährlichen Reduktionsrate wären die Gesamtemissionen um 20 % höher als im Zielszenario.

Tabelle 2: Angebot von ETS 2 Zertifikaten

	2027	2028	2029	2030	2031	2032
ETS 2 Obergrenze	1 040	978	915	853	790	727
Frontloading	312		-104	-104	-104	
Gesamtangebot	1 352	978	811	749	686	727

Quelle: Eigene Berechnungen, Öko-Institut

Zusätzlich zu den drei Nachfrageszenarien verwenden wir auch vier verschiedene Optionen zur Anwendung der Preiskontrollmechanismen. Diese Optionen unterscheiden sich sowohl in der Menge der zusätzlichen Zertifikate (null bis 160 Millionen) als auch im Zeitpunkt (einmalig im Jahr 2028 oder gleichmäßig von 2027 bis 2030).

Die Marktstabilitätsreserve

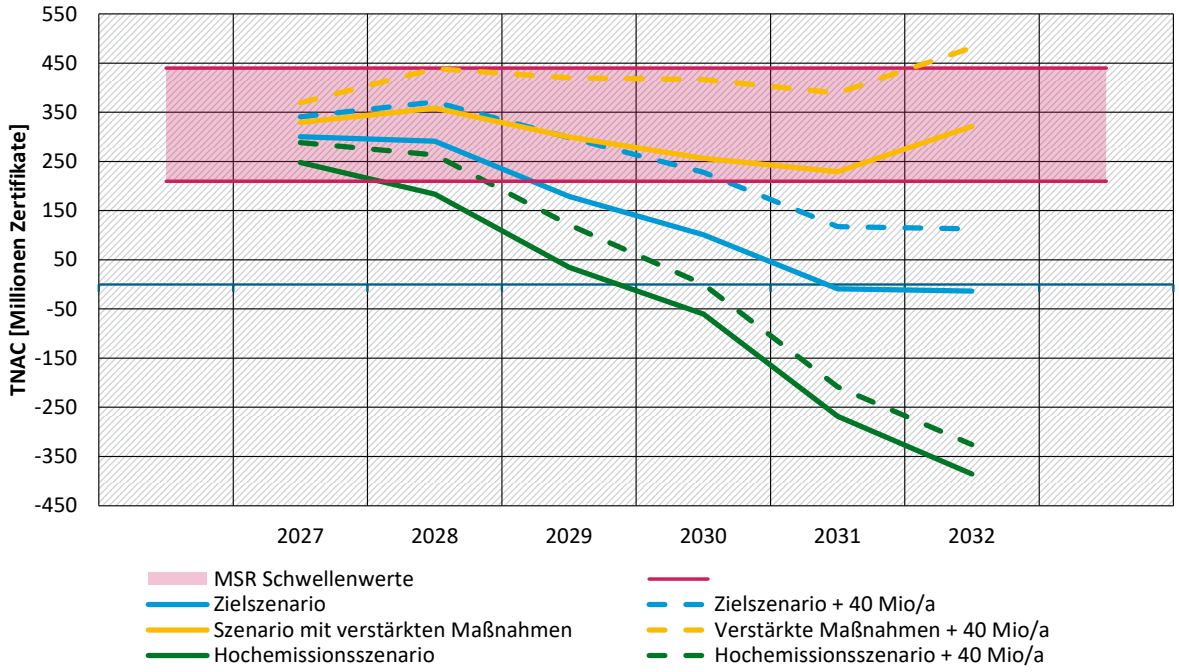
Im Zielszenario ist die Gesamtzahl der im Umlauf befindlichen Zertifikate (TNAC, die Differenz zwischen Angebot und Nachfrage) eine Funktion des Frontloading-Mechanismus, da die Emissionen der Obergrenze folgen. Im Jahr 2027 beträgt die TNAC 300 Millionen Zertifikate; dieser Wert sinkt bis 2031 auf Null. Die MSR ist nicht in der Lage, die TNAC in dem Bereich zwischen 210 und 440 Millionen Zertifikaten zu halten, der seitens des europäischen Gesetzgebers als optimal für die Liquidität im ETS 2 angenommen wird (Abbildung 2, blaue Linie). Dies liegt daran, dass die Aktivierung der MSR erst erfolgt, nachdem die Zertifikate in der MSR ihre Gültigkeit verloren haben, es stehen keine Zertifikate zur Ausschüttung zur Verfügung. Selbst mit den höchsten modellierten Preiskontrollmechanismen von 40 Millionen zusätzlichen Zertifikaten pro Jahr erreicht der TNAC-Wert nur 113 Millionen.

Im Szenario mit verstärkten Maßnahmen (gelbe Linien) kompensieren die rasch sinkenden Emissionen den Frontloading-Effekt, d. h. der TNAC-Wert bleibt in allen Jahren innerhalb des Schwellenwerts. Selbst im Szenario mit maximalem Zusatzangebot bleibt die TNAC für alle Jahre außer 2032 innerhalb der Bandbreite. Im Jahr 2033 würde die MSR dann beginnen das Angebot zu reduzieren.

Im Hochemissionsszenario (grüne Linien) wird die TNAC im Jahr 2030 negativ und sinkt bis 2032 auf minus 385 Millionen Berechtigungen. Selbst mit dem zusätzlichen Angebot würde der

TNAC-Wert bereits 2031 bei minus 210 Millionen liegen und weiter sinken. Dies ist ein kontrafaktisches Szenario: Ein so hoher negativer TNAC-Wert bedeutet, dass nicht genügend Zertifikate für alle Emissionen zur Verfügung stehen, d.h. die erfassten Unternehmen wären nicht in der Lage, ihre gesetzlichen Verpflichtungen zu erfüllen. Die MSR und die Preisdämpfungsmechanismen wären nicht stark genug, um ein Gleichgewicht zwischen Angebot und Nachfrage zu gewährleisten. In einem solchen Szenario würden die CO_2-Preise extrem steigen, bis die Emissionen ausreichend zurückgehen.

Abbildung 2: TNAC Entwicklung in den Jahren 2027 – 2032 in den verschiedenen Emissionsszenarien mit und ohne Preissteuerung



Quelle: Eigene Darstellung, Öko-Institut.

Wechselwirkungen mit anderen Klimapolitiken

Das ETS 2 gilt einheitlich für alle Mitgliedstaaten, ist aber Teil der differenzierten Klimaschutzverordnung (ESR). Die nationalen ESR-Ziele unterscheiden sich stark nach dem Wohlstand der Länder; Bulgarien, das Land mit dem niedrigsten Pro-Kopf-BIP, hat für 2030 ein Reduktionsziel von nur 10 % gegenüber 2005. Die reichsten Länder inklusive Deutschland müssen ihre Emissionen um 50 % reduzieren. Da das ETS 2 über 60 % der ESR-Emissionen abdeckt und das Cap bis zum Jahr 2030 um 44 % ggü. 2005 sinkt, werden die Länder am unteren Ende der ESR-Zielspanne ihre Emissionsreduktionsziele sehr wahrscheinlich übererfüllen. Infolgedessen werden sie in der Lage sein, überschüssige Emissionsmengen an reichere Mitgliedstaaten zu verkaufen, für die das ETS 2 nicht genug Lenkungswirkung entfaltet, um die Einhaltung der ESR zu gewährleisten. Die Über- bzw. Untererfüllung wird wahrscheinlich noch höher ausfallen: Endverbraucher werden auf die durch das ETS 2 gestiegenen Kosten für den Energieverbrauch aus fossilen Brennstoffen reagieren, indem sie a) ihr Verhalten ändern (z. B. die Raumtemperatur senken) und b) in Energieeffizienz und nicht-fossile Energieversorgung investieren (z. B. bessere Isolierung und eine Wärmepumpe). Verhaltensänderungen können schnell erfolgen, während Änderungen am Wohnungs- und Fahrzeugbestand einige Zeit in Anspruch nehmen und ausreichende ökonomische Ressourcen erfordern. Aus diesem Grund gehen wir davon aus, dass das ETS 2 kurzfristig die Emissionen am stärksten in Ländern mit geringerer Kaufkraft reduzieren wird, in denen die steigenden Energiepreise am stärksten zu

spüren sein werden. Dies sind die Länder, die auch das niedrigste ESR-Ziel haben, d.h. sie werden noch mehr überschüssige Emissionen verkaufen können.

Deutschland hat im Jahr 2021 ein nationales Emissionshandelssystem (nEHS) mit einem etwas größeren Anwendungsbereich als das ETS 2 eingeführt. Höchstwahrscheinlich wird das nEHS in das ETS 2 überführt. Das bedeutet, dass Deutschland die zusätzlichen Sektoren in das ETS 2 einbeziehen wird, ansonsten aber das nationale ETS aufheben würde, sobald der EU-weite Handel beginnt. Auch wenn die Teilnahme an einem größeren EHS wirtschaftliche Vorteile mit sich bringt, könnte dieser Übergang die derzeitige Kluft zwischen den nationalen Maßnahmen und Zielen in Deutschland noch vergrößern. Das nEHS hat eine Emissionsobergrenze für 2030, die 46 % unter dem Niveau von 2016-18 liegt, die Obergrenze im ETS 2 liegt bei 38 %. Dabei ist allerdings zu beachten, dass es im ETS 2 keine nationalen Zielvorgaben gibt. Deutschland wird absehbar sowohl seine nationalen THG-Emissionsziele als auch das ESR-Ziel verfehlen. Wenn das nEHS nur durch das ETS 2 ohne weitere Maßnahmen ersetzt wird, könnte diese Lücken noch größer werden.

1 Introduction & Background

As part of the Fit for 55 package to implement the European Green Deal, the European Commission proposed in 2021 the introduction of a new emission trading scheme for road transport and buildings (ETS 2). After deliberation between Member States and the European Parliament the ETS 2 was expanded in scope to also cover energy use in industry and energy installations outside the EU-ETS (ETS 1). On 16 May 2023 the amendments to the ETS Directive were published in the Official Journal of the European Union (EU 2023b).

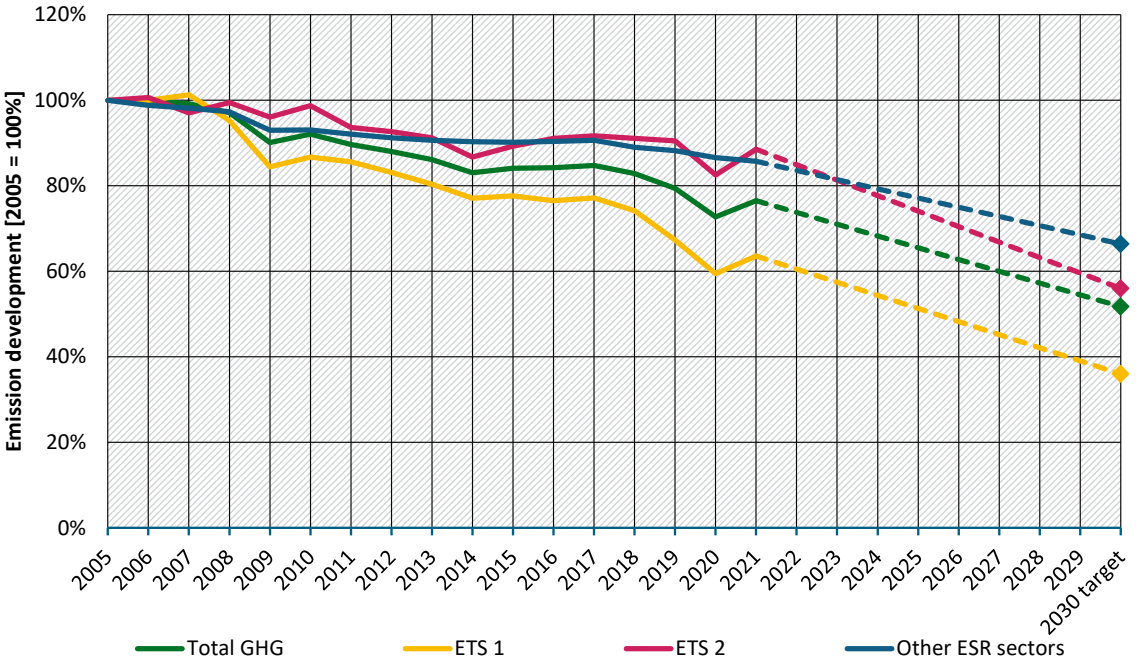
The ETS 2 complements the ETS 1 but has a different standing in the EU's climate architecture; it resides fully within the Climate Action Regulation (also known as the Effort Sharing Regulation, ESR) and is a measure to help achieve its targets. The ESR covers most emissions not included in the ETS 1, specifically transport except for aviation and international shipping, energy and industry sectors outside the ETS 1, buildings, agriculture and waste. The ETS 2 will cover road transport, buildings and small energy and industry installations. Emissions from these sectors have declined much slower than in the ETS 1: Emissions covered by the ETS 1 have reduced by 36 % between 2005 and 2021. In contrast, emissions from those sectors that will be covered by the ETS 2 only reduced by 11 %. In the other ESR sectors (mainly agriculture and waste), emissions have declined even less (Figure 3). At the same time, ambitious reductions in these sectors are required to meet the EU's ESR target of a 40 % reduction below 2005. Without significant increase in policies and measures tackling those sectors, the ESR target will not be achieved (EEA 2022b).

The aim of the ETS 2 is therefore to help bring down emissions in some of the ESR sectors through carbon pricing. With a target of 44 % below 2005, it will require ambitious emission reductions in the next years. To comply with the cap development in the ETS 2, covered sectors will need to reduce emissions by unprecedented velocities: Between 2005 and 2021, the annual average emission reduction was about 11 Mt CO_2. The ETS 2 cap decreases by about 62 Mt CO_2 per year, more than five times as fast. Carbon pricing, together with other policies such as efficiency standards for buildings, an accelerated deployment of renewable energies and CO_2 emission limits for vehicles, will play a major role in ensuring these emission reductions.

In contrast to the ESR, an ETS has the added benefit of a much stricter compliance mechanism. It is unclear and remains to be seen what will happen if Member States are found to be in non-compliance under the ESR. This can happen for the first time in the year 2028 when the compliance for the period 2021-2025 is assessed (Gores et al. 2019). In the ETS 2, covered entities are directly responsible and will face severe penalties up to prison sentences if they do not fulfil their obligations.

This study aims to explain the rules and mechanisms governing the new ETS 2 for road transport, buildings and other sectors (chapter 2). In chapter 3 the development of supply and demand under different assumptions on emission and price developments are analysed. To do so, we use our MSR 2 tool to simulate the behaviour of the Market Stability Reserve (ETS 2) and its interaction with the mechanisms in cases of excessive price increases. Auction quantities, corresponding revenues and their distribution across Member States is discussed in chapter 4. Lastly, chapter 5 looks at the interaction between the ETS 2 and Member States' targets under the Effort Sharing Regulation, the German national ETS and gives a short outlook at the questions that will need to be resolved for the period after 2030.

Figure 3: Emission development since 2005 and 2030 target (EU 27)



Note: The methodology to calculate historic emissions in the scope of the ETS 2 is explained in Annex A.
Source: own illustration, Öko-Institut with data from EEA (2023) and EEA (2022a).

2 Overview of the new ETS for buildings, road transport and other sectors

2.1 Scope

The **scope** of the emissions trading system for buildings, road transport and additional sectors (ETS 2) as detailed in Annex III of the amendment of Directive 2003/878/EC is defined as follows:

Emissions of **CO_2**[3] from the sectors of buildings and road transport as defined by the following source categories of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006):

- Road transportation (CRF category 1.A.3.b)
- Commercial/ institutional buildings (CRF category 1.A.4.a)
- Residential buildings (CRF category 1.A.4.b)
- Combined Heat and Power (CHP) plants (CRF category 1.A.1.a(ii)) and Heat plants (CRF category 1.A.1.a(iii)) when producing heat for commercial or residential buildings, either directly or via district heating networks

Moreover, facilities from the energy sector (CRF category 1.A.1) or the industry sector (CRF category 1.A.2) which are not included in the EU ETS 1 are included in the new scheme. Activities where the emission factor of the used fuel is set as zero as well as cases where waste is used as fuel are not included.[4]

Article 30j of the ETS Directive includes the possibility for an inclusion of additional sectors or parts thereof previously not included into either the EU ETS 1 or into the ETS 2. An extension of the scope of the ETS 2 beyond the scope described above can be pursued unilaterally by member states if approved by the European Commission. By end of October 2031, the Commission is required by Article 30i to provide an assessment of the feasibility of the integration of sectors covered by the ETS 2 into the EU ETS.

2.2 Calculation of the emissions cap

The **total quantity of available allowances** in the ETS 2 is set based on the 2024 emission limits for the sectors included in the scheme and will decrease linearly each subsequent year. The 2024 allowance amount is calculated based on the reference emissions under Article 4(2) of Regulation (EU) 2018/842 (Effort Sharing Regulation) multiplied with the average emission share of the covered sectors in the years 2016-18. For the years 2025 to 2027, a linear reduction factor (LRF) of 5.1 % of average 2016-18 emissions of the covered sectors is applied to determine the cap. Due to data uncertainties linked to the introduction of a new ETS, the basis of the LRF will be updated to average 2024-26 emissions starting in 2028. To accommodate for the lower reference value due to the (expected) emission reductions due to the ETS 2, the linear reduction factor is set to 5.38 % from then onwards.

[3] While the EU Emissions Trading System (EU ETS) as established by Directive 2003/87/EC covers different gases depending on the subsector considered, only CO_2 is covered in the ETS for buildings, road transport and other sectors.

[4] The current proposition includes the option of adding municipal waste installations to the EU ETS from 2028 or 2031 at the latest after a feasibility assessment report. At present, no such addition is planned for the ETS II.

If the emissions for the years 2024 to 2026 are more than 2 % higher than the cap for 2025 determined according to the rules described above, the linear reduction factor is recalculated according to the following formula:

$$LRF_{adj} = 100\% \cdot \frac{MRV_{2024-2026} - (ESR_{2024} - 6 \cdot LRF_{2024} \cdot ESR_{2024})}{5 \cdot MRV_{2024-2026}}$$

Where:

- LRF_{adj} is the adjusted linear reduction factor,
- $MRV_{2024\text{-}2026}$ is the average of the emissions for the years 2024-2026,
- ESR_{2024} is the initial allowance value for the year 2024, and
- LRF_{2024} is the initial linear reduction factor of 5,1 %

This rule ensures that the cap for the year 2030 is not (substantially) higher than intended even if short-term ETS 2 emissions are higher than anticipated. The reverse is not true: if emissions decrease faster than anticipated, the LRF of 5.38 % remains unchanged and the overall ambition of the ETS 2 will increase.

2.3 Frontloading and auctioning quantities

Starting in 2027, allowances in the ETS 2 are fully auctioned, except for those placed in the Market Stability Reserve (MSR, see section 2.4). In 2027, the volume of allowances available will be at 130 % of the volume determined by the calculations as laid out in section 2.2. Those additional allowances will be deducted from the volume for the period of 2029-2031 and will be auctioned until the end of May 2028. In this respect the effective aggregated volume of allowances auctioned until 2030 is increased slightly by the frontloading of allowances from the year 2031.

In 2027, 600 million ETS 2 allowances are created for the ETS 2 Market Stability Reserve; these allowances are in addition to the cap.

Of the quantity of allowances auctioned, 150 million will be directly auctioned for the Social Climate Fund (SCF). Additionally, further allowances from both the EU ETS and the ETS 2 will be attributed to the SCF with the goal of creating a maximum cumulated revenue of EUR 65 billion until 2032. The quantity of allowances attributed to the SCF depends on the CO_2 price in the ETS 1 and ETS 2.

The revenues from the auctioning of the remaining allowances will be distributed to the Member States in shares relative to their reference emissions from the period of 2016 to 2018 (see Articles 4(2) and 4(3) of Regulation (EU) 2018/842), irrespective of the Member State they are auctioned in. Member States shall use these revenues to fund measures intended to contribute to the decarbonisation of the heating and cooling as well as the transport sector and to address the social challenges of carbon pricing in these sectors – complementing the SCF.

In case of exceptionally high energy prices, the start of the emissions trading scheme can be postponed by one year from 2027 to 2028. These high prices are defined as follows: If either the average price for natural gas in the six months before July 2026 is higher than the average price in February and March 2022 or the average Brent crude Oil price in the first six months of 2026

is more than double the average during the five preceding years.[5] The Commission will publish in the Official Journal until 15th July 2026 whether these conditions have been met.

In this case, the quantity of allowances is first established for the year 2028 and the start of the auctioning also starts in this year. The additional volumes for the start of the auctioning (as described in section 2.3) will be deducted from the volumes for the period of 2030 to 2032 and the initial amounts in the MSR will be created in 2028.[6]

2.4 Market Stability Reserve

The ETS for buildings, road transport and additional sectors includes a Market Stability Reserve which is operated separately from the one implemented for the EU ETS 1.

As described in section 2.3, the MSR is created in 2027 with a volume of 600 million allowances. These 600 million allowances are not part of the regular cap. On 1 January 2031, any remaining share thereof are invalidated.

The regular operation of the MSR starts in 2028 and proceeds as follows:

- If the Total Number of Allowances in Circulation (TNAC) is higher than 440 million in a given year, 100 million allowances will be deduced from the number of allowances to be auctioned and placed in the reserve over a period of twelve months starting on 1st September of the following year.
- If the TNAC is lower than 210 million in a year, 100 million allowances will be released from the MSR and added to the volume of allowances to be auctioned. If there are less than 100 million allowances in the MSR, all remaining allowances will be released.

For example, in May 2028 the TNAC value for 2027 will be published by the Commission. If that value is above 440 million/below 210 million, the MSR will withhold/issue 100 million units over 12 months starting in September 2028.

2.5 Measures in case of excessive price increase (Article 30h)

The regulation includes several measures to be taken in case of high prices of allowances or rapid increases thereof:

1. When the average price of allowances during three consecutive months is more than double the average allowance price of the six months prior, 50 million allowances will be released from the MSR (Article 30h(1)).
   In the years 2027 and 2028, this release will already take place if, for more than three consecutive months, the average allowance price is at more than 1,5 times the average allowance price of the six preceding months.
2. When the average price of allowances during three consecutive months is more than three times the average allowance price of the six months prior, 150 million allowances will be released from the MSR (Article 30h(3)).
3. When the average allowance price exceeds EUR_{2020} 45 for more than two consecutive months, 20 million allowances will be released from the MSR (Article 30h(2)). This mechanism is in place until the end of 2029. Before the end of 2029, the Commission needs to present a report assessing the effectiveness of this measure and a proposal on possible continuing and/or adjustment to the European Parliament and the Council. It is important to

[5] It is, of course, possible that both conditions apply at the same time.

[6] For the rest of this paper, we assume that the ETS 2 will start in 2027.

note that this threshold is indexed by inflation, i. e. the threshold is likely to be around EUR 60 in current prices in the year 2030.

In the event where one of the conditions apply, the Commission is required to publish the data on which this condition has been met in the Official Journal.

To avoid excessive release of allowances, the following restrictions apply:

- In case the conditions from Article 30h(2) are met on the same day as conditions according to Article 30h(1) or Article 30h(3), only the mechanism from the respective paragraphs 1 or 3 of Article 30h will be triggered.
- After allowances are released according to one of the three mechanisms, no additional allowances will be released for the 12 months following the release (Article 30h(6)). However, according to Article 30h(7), the Commission, together with Member States, may decide through an implementing act to overrule this rule in case the conditions from Article 30h(2) are met again in the second half of those 12 months. In this case, it is possible that allowances are released to any of the three cases described above, depending on which conditions are met.

3 Assessing the operation of the MSR under the ETS 2 regulation

3.1 Supply and demand of allowances

The rules that ensure funding for the Social Climate Fund, which is linked to the auction quantities under the ETS 2, are in force until 2032. For this reason, all quantitative assessments in this chapter look at the years 2027 until 2032. We also assumed that the start of the ETS 2 is not delayed by one year due to exceptionally high fuel prices. For a description of the MSR tool used in this study, see Annex B.

3.1.1 Supply of allowances: the cap

As discussed above, the supply of allowances (i.e. the cap) depends on the share of the emission covered by the Effort Sharing Regulation (ESR) that fall under the ETS 2 in the years 2016 to 2018, the 2024 ESR target and the ETS 2 emissions in the years 2024 to 2026. For this paper, all emission scenarios have a very similar development until 2026, so that the cap is not affected by the choice of scenario. The cap development for the period 2027 to 2032 as well as the steps for calculating the cap are shown in Table 3:

- **Cap for 2027:** Average emissions in the scope of the ETS 2 in the years 2016-2018 were 61.9 % of all emissions covered under the ESR.[7] This share is applied to the ESR target in 2024 setting the starting point for the cap trajectory at 1 228 Mt CO_2. Each year the cap is reduced by 5.1 % of the 2024 emission value resulting in 1 041 Mt CO_2 in 2027.
- **Cap 2028 to 2032:** A new cap trajectory is calculated which starts in 2025 at the average ETS 2 emissions of the years 2024-2026. From then on, the cap decreases by 5.38 % of this average. Under the emission projections used for this study, the 2025 starting value would be 1 166 Mt CO_2.

Compared to 2005, the ETS 2 sectors will need to reduce emissions by 44 % until 2030. This value is somewhat higher than 42 %, the figure normally used in the communication on the ETS 2. This difference might be due to the inclusion of the additional sectors and the uncertainty of estimating emissions in the scope of the ETS 2 in 2005. Table 3 also shows the effect the frontloading mechanism has: In 2027, an additional 305 million allowances will be auctioned. This quantity is deducted in equal parts from the auctioning quantities during the years 2029 to 2031.

[7] See Annex A for more information on the methodology to calculate historic and projected emissions in the scope of the ETS 2.

Table 3: Calculation of the ETS 2 cap and supply from 2027 until 2032

		2016 - 2018	2024 - 2026	2024	2025	2026	2027	2028	2029	2030	2031	2032
		Emissions [Mt CO_2eq]		Cap/ESR target [Mt CO_2eq]								
until 2027	ESR	2231		1985								
	ETS 2	1380		1228	1165	1103	**1040**					
	share	61.9%		61.9%								
	LRF				5.1%	5.1%	5.1%					
2028-32	ETS 2		1166		1166	1104	1041	**978**	**915**	**853**	**790**	**727**
	LRF					5.38%	5.38%	5.38%	5.38%	5.38%	5.38%	5.38%
ETS 2 Cap							**1040**	**978**	**915**	**853**	**790**	**727**
Frontloading							312		-104	-104	-104	
Supply							**1352**	**978**	**811**	**749**	**686**	**727**

Notes: Differences in totals are due to rounding effects.

Source: own calculation, Öko-Institut.

3.1.2 Demand for allowances: Emission scenarios used in the assessment

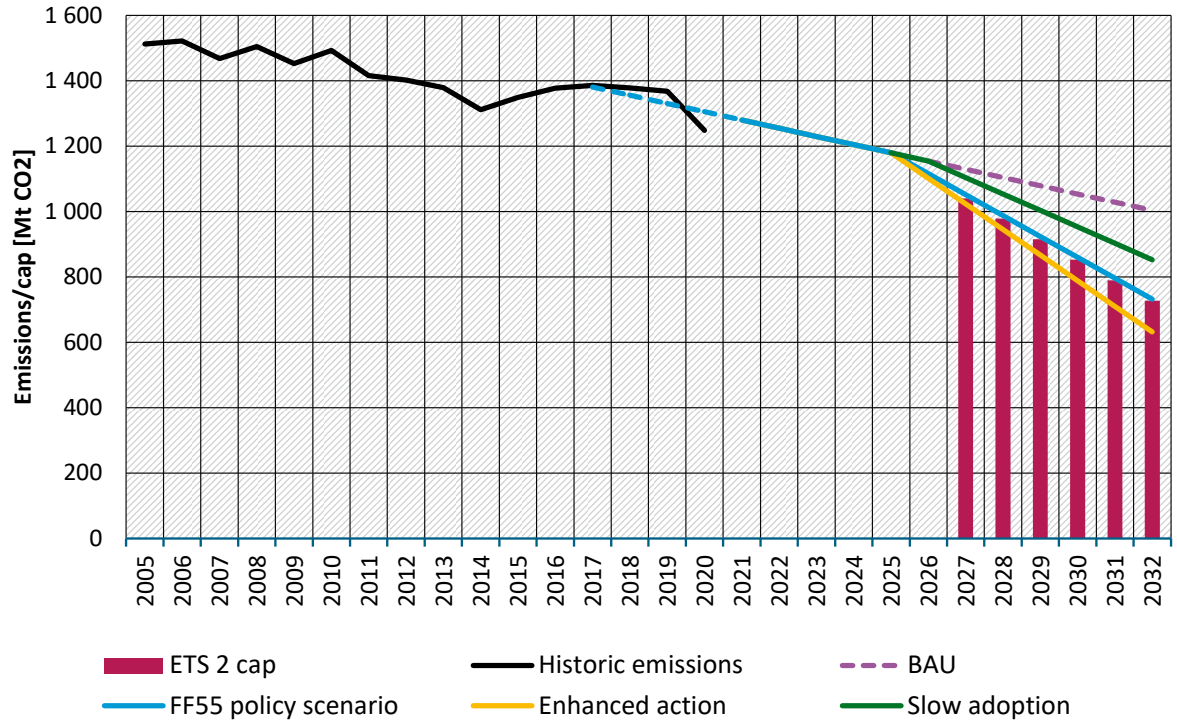
To assess the operation of the MSR 2 and the overall balance of the ETS 2 until the year 2032 we use three emission scenarios defined as follows:

- **FF55 policy scenario**: Together with the legislative proposals for the implementation of the European Green Deal (the so called Fit-for-55 package) the European Commission published a set of impact assessments. The impact assessment for the ETS 2 proposal includes a quantitative assessment of two different sectoral scopes (EC 2021, Table 46). It describes the policy case where the combination of the CO_2-price, enhanced regulatory measures and other policies and measures lead to an emission development that is in line with the cap trajectory. In this scenario, supply and demand balance each other out.
  Both of the scopes assessed in the impact assessment differ from the final scope as adopted. Therefore, the published projection was adjusted to match the more up to date emission data used for this paper. In addition, it was extrapolated until 2032 (see Annex A.2).
  Total emissions for the period 2027-2032 are 5 351 Mt CO_2 in the policy scenario.
- **Enhanced action scenario**: The second scenario assumes that the impacts of the adopted policies and measures and other drivers such as high fuel prices bring down emissions even faster than anticipated from 2025 onwards. By 2032, emissions will be 100 Mt CO_2 lower than in the policy scenario.
  Total emissions for the period 2027-2032 are 4 966 Mt CO_2, 7 % lower than the policy case.
- **Slow adoption**: In the third scenario, the trend until 2025 is extrapolated for one more year. With the start of the ETS 2 consumers react to the new CO_2 price and annual reduction rates double compared to the previous five years.

Total emissions for the period 2027-2032 are 5 870 Mt CO_2, 10 % higher than the policy case.

Historic emissions and the three scenarios are shown together with the cap (before frontloading) in Figure 4. In addition, the figure also shows the business-as-usual (BAU) trend. It is based on the annual historic emission reductions in the years 2010 to 2020 and starts at the 2017 value; until 2025, the BAU development is identical to the three emission scenarios. While the BAU line is a very pessimistic extrapolation not taking into account the effect of overall FF55 package (e.g. the improved CO_2 emission standards for vehicles), it does give an impression on the scale of the required emission reductions to meet the ETS 2.

Figure 4: Historic emissions, emission scenarios and the cap under the ETS 2



Source: own illustration, Öko-Institut with data from EEA (2023), EEA (2022a) and EC (2021).

3.1.3 Additional supply in the case of excessive price increase

The ETS 2 combines quantity control mechanisms with price control mechanisms. These mechanisms are independent of each other. In cases of low supply, it is likely that CO_2 prices would be high enough to trigger one or more of the price mechanisms in parallel to the MSR issuing additional allowances. In cases of high supply, it could happen that the MSR withdraws allowances in parallel to issuing them under Art. 30h(2). This would be the case if the CO_2 price would be above EUR_{2020} 45, for example due to expected scarcity in the future.[8] To assess the operation of the MSR and the overall balance of supply and demand it is therefore necessary to complement the cap and demand scenarios with scenarios for the price development.

[8] If not revised, the ETS 2 cap would reach zero by the year 2044. Market participants might expect much higher carbon prices in the future and buy more allowances than needed in the early years.

3.1.3.1 Price expectations Art. 30h(2)

If the auction price exceeds EUR_{2020} 45 for two months in a row, additional 20 million allowances are released by the MSR. ETS 2 price expectations in the literature vary greatly: at the lower end is the Commission's Impact Assessment which modelled a value of 50 EUR by 2030 in the MIX policy scenario and 84 EUR in a policy scenario relying more heavily on carbon pricing (MIX-CP) (EC 2021).[9] Rickels et al. (2023) calculated two scenarios: one in which the cap is met which would lead to a CO_2 price of 264 EUR by 2030. In the other scenario, they calculated that 415 million additional allowances would be needed until 2030 to ensure that the CO_2 price does not exceed 45 EUR. Vivid Economics in an unpublished study estimated that the ETS 2 price would be at 140 EUR by 2030 under the assumption that the ETS 2 cap would reach zero by 2044 as in the current regulation (Braungardt et al. 2022). The Ariadne Project used different models and calculated ETS 2 prices of 170 EUR and 340 EUR by 2030 (Jan Abrell et al. 2022).

While all of these price predictions depend on a large number of assumptions, most studies show that very high – three digits – carbon prices are a real possibility.

3.1.3.2 Historic analysis for prices increases covered by Art. 30h(1) and Art. 30h(3)

Similarly, to the absolute carbon prices it is not possible to predict the number of times that the carbon price meets the criteria for the triggers linked to steep price increases. As an indicator for a possible frequency, we assessed the development of the ETS 1 futures and auction prices for the time period 09/2005-12/2022. To do this, we compared the average monthly EUA price over three months to the price average in the six preceding months. The highest historic EUA price increase for this timeframe was 69 % in April 2018. Price increases of more than 50 % were detected only 8 times (4 % of datapoints analysed), while in 43 % of all cases, the change of the 3-months monthly average compared to the 6 preceding months was at less than 20 % (Table 4). 39% of cases showed a price decrease. Not once would the criteria of doubling/tripling of the EUA price have occurred in the ETS 1 since its inception.

Table 4: Historic change rates in monthly EUA price averages over three months compared to the six months prior

Increase	Occurrence	Share of cases
69 % (maximum)	1	0.5 %
More than 50 %	8	4 %
Less than 50 % but more than 40 %	6	3 %
Less than 40 % but more than 30 %	10	5 %
Less than 30 % but more than 20 %	13	7 %
Less than 20 % but more than 0%	85	43 %
Price decrease	78	39 %

Source: own calculation, Öko-Institut with data from EEX (2022)

The ETS 2 might behave differently, especially in the initial years higher volatility is possible i.a. due to uncertainties about data quality and the effect of the carbon price on consumer

[9] All prices have been converted into EUR_{2020} for this paragraph.

behaviour. At the same time, it seems unlikely that a doubling/tripling of the carbon price will occur often if at all.

3.1.3.3 Art. 30(h) scenarios used in this study

Based on the discussion above we use the following scenarios for the application of Art 30(h) to assess the operation of the MSR 2 and the overall balance of the ETS 2 until the year 2032:

- **No usage:** This scenario is based on the Impact Assessment where carbon prices never exceed 45 EUR_{2020} and rise gradually.
- **Constant 20 mn:** In this scenario, we assume that the ETS 2 price remains above 45 EUR_{2020} during the entire period as expected in the studies above. The possibility to release allowances twice in a 12-month period (Art. 30(h)6) is not used.
- **Constant 40 mn:** Similar to above but the possibility for using Art. 30h(2) is used twice per year until 2030.[10] This scenario is based on the estimate that over 400 million allowances would be needed until 2030 to keep the price below 45 EUR_{2020}, i.e. prices will remain above the threshold even if Art 30h(2) is applied twice per year. This is because that would only add 160 million allowances to the supply, well below the required 400 million.
- **150 mn allowances in 2028:** This scenario assumes that initially prices remain low but increase steeply in 2028. Afterwards, the additional allowances ensure that the carbon price remains below the 45 EUR_{2020} threshold.

There is no separate scenario for the 50 million issuance under Art. 30h(1). In terms of additional quantities, this is similar to the scenario where 40 million allowances are issued per year.

In all scenarios allowances are only issued if the MSR still holds sufficient quantities. As the initial 600 million allowances are not valid after 2030 anymore, any release after that date depends on the intake of allowances in the prior years.

3.2 Performance of the MSR

3.2.1 Approach used for the assessment

In the following chapters, the performance of the MSR is assessed under three different emission scenarios (*FF55 policy* scenario, *enhanced action* scenario and *slow adoption* scenario). For each scenario, we look at the scenario without further supply of allowances (no usage of Art. 30(h)). A table shows the cap for each scenario, annual auction volumes after any intervention by the MSR, the emission scenario, TNAC development and the allowances in the MSR. The cap is almost identical in all emission scenarios.

In a second part, three different applications of Art 30h (constant 20 mn, constant 40 mn, 150 mn in 2028) are modelled and compared to the base case without further supply.

3.2.2 Performance of the MSR in the *FF55 policy* scenario

3.2.2.1 No usage of Art. 30h

In the *FF55 policy scenario* emissions follow the ETS 2 cap closely; over the entire period until 2032 there is only a deficit of 14 million allowances (Table 5 and Figure 5). Initially, the TNAC is

[10] Currently, Art. 30h(2) is limited until 2029, i.e. there should be no issuance of allowances in 2030. For the purposes of this study and to show the impact of a larger additional supply, we assume that the EU Commission will recommend an extension of this mechanism (see section 2.5).

within the range of the thresholds due to the frontloading of auctions to ensure liquidity in the market. In the years 2029 to 2031 – when the frontloading is compensated – TNAC drops to almost zero and remains there. Without the frontloading mechanism, there would be no liquidity in the market directly from the start.

The MSR issues allowances only once in 2030: the threshold value of 210 million is passed in 2029 for the first time. This leads to the activation of the MSR in 2030, when one third of 100 million allowances enter the market. In theory, the other two thirds should be issued in 2031. Due to the invalidation of the initial 600 million allowances, the MSR is empty by then and cannot be activated.

Table 5: ETS 2 supply and demand in the *FF55 policy* scenario without application of Art. 30h [million allowances]

	2027	2028	2029	2030	2031	2032	Total
Cap	1 040	978	916	853	790	727	5 304
Auctions	1 352	978	812	782	686	727	5 338
Verified/ projected emissions	1 052	988	924	860	796	732	5 351
TNAC	301	291	179	101	-9	-14	-
Allowances in MSR	600	600	600	567*	0	0	-

Note: *Values given are for the end of the year; the remaining allowances in the MSR in the year 2030 will become invalid on 1 January 2031, i.e. are not available in 2031 anymore.
Source: own calculation, Öko-Institut.

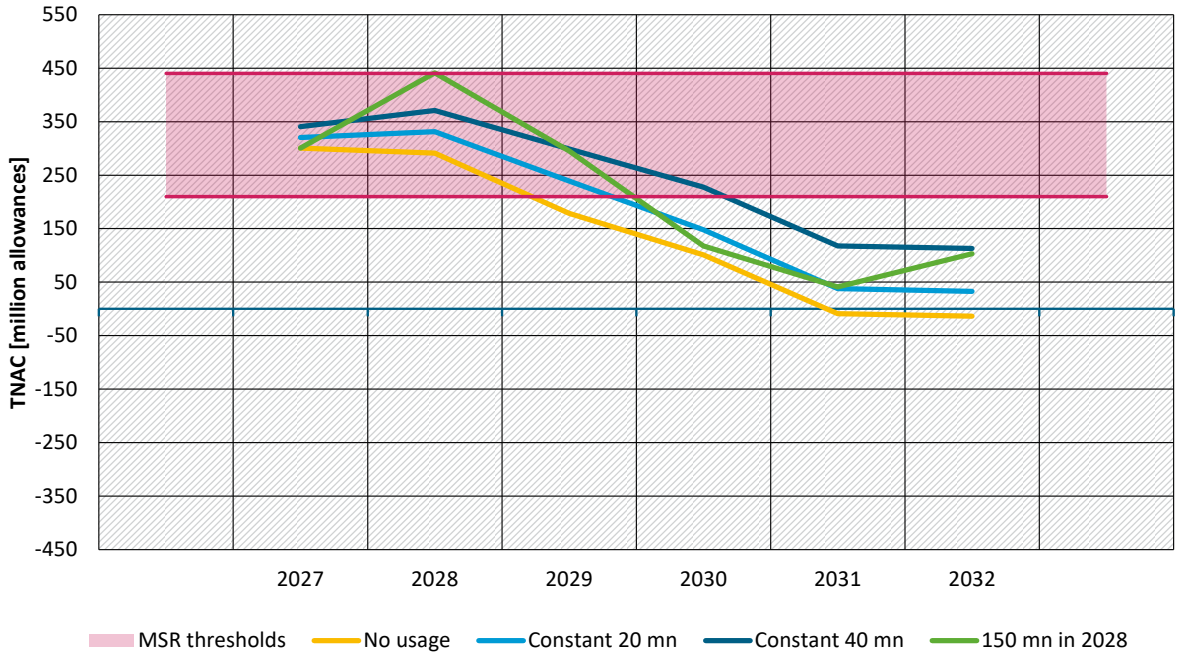
3.2.2.2 With usage of Art. 30h

In the scenarios where Art. 30h(2) is triggered once (*constant 20 million*) or twice (*constant 40 million*) per year, the TNAC-development follows a similar path with a small to moderate offset compared to the base case without further supply. In the *constant 20 million* scenario, the offset grows to 60 million allowances until 2029. In 2030, it decreases again. This is because the MSR issues 33 million allowances in the scenario without any additional supply but not in the *constant 20 million* scenario; as a result of the additional supply in the prior years, the TNAC only drops below the lower threshold in 2030 and no allowances are issued from the MSR. The offset remains constant in the years 2031 and 2032.

The same effect can be seen in the *constant 40 million* scenario. The offset increases by 40 million allowances per year until 2029, in 2030 it only increases by an additional 7 million allowances. Afterwards, it remains constant.

In the *150 million in 2028* scenario, TNAC rises again in 2032. The difference here is, that the TNAC value was above the upper threshold in 2028 and the MSR therefore withdraws 100 million allowances in 2029/2030. These allowances are not invalidated and can be released into the market from 2031 onwards.

Figure 5: TNAC development 2027 – 2032 in the *FF55 policy* scenario and different Art. 30h scenarios



Source: own illustration, Öko-Institut.

3.2.3 Performance of the MSR in the *Enhanced action* scenario

3.2.3.1 No usage of Art. 30h

The *Enhanced action* scenario is characterized by emissions which are below the cap for all years; in addition, emissions decrease faster than the cap. Without any price intervention TNAC remains within the corridor defined by the upper and lower thresholds until 2032 (Table 6 and Figure 6). TNAC starts at 329 million allowances and rises in 2028 due to the low emissions. Afterwards, despite the enhanced emission reductions, TNAC decreases again for three years. The reason for this is the compensation for the frontloading. In 2032 TNAC once again rises.

Table 6: ETS 2 supply and demand in the *Enhanced action* scenario without application of Art. 30h [million allowances]

	2027	2028	2029	2030	2031	2032	Total
Cap	1 040	974	912	849	787	724	5 287
Auctions	1 352	974	808	745	683	724	5 287
Verified/ projected emissions	1 023	945	867	789	710	632	4 966
TNAC	329	359	300	256	229	321	-
Allowances in MSR	600	600	600	600*	0	0	-

Note: *Values given are for the end of the year; the remaining allowances in the MSR in the year 2030 will become invalid on 1 January 2031, i.e. are not available in 2031 anymore.

Source: own calculation, Öko-Institut.

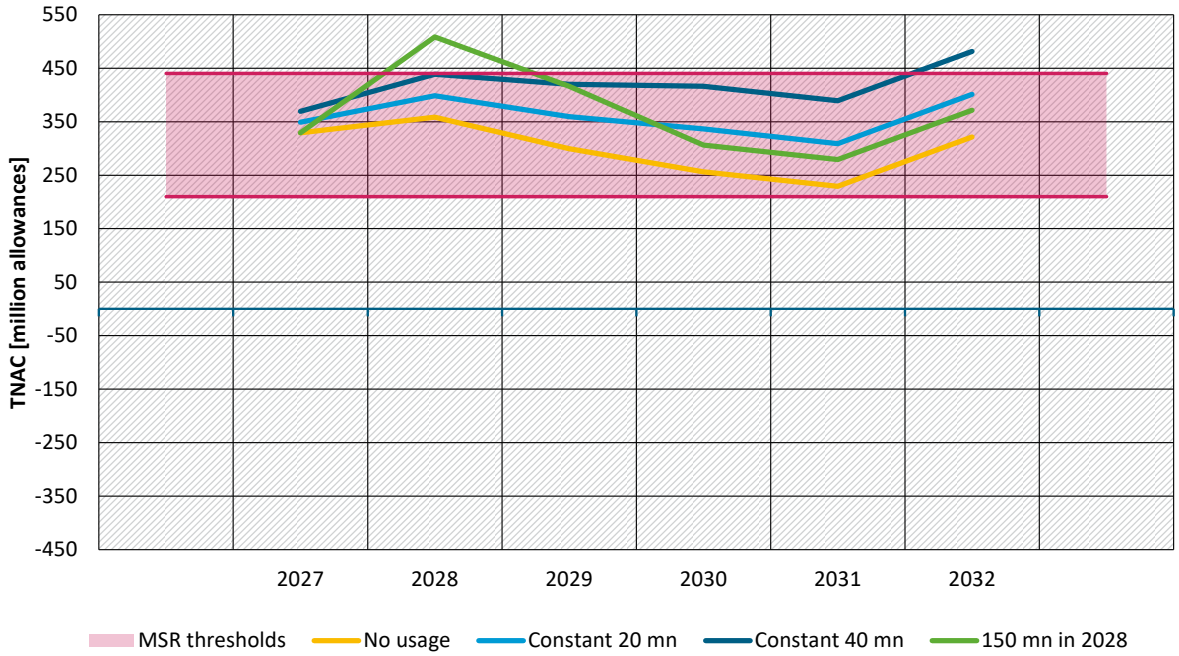
3.2.3.2 With usage of Art. 30h

In the *constant 20 million* scenario, the TNAC-offset compared to the base case increases each year, but TNAC remains within the range where the MSR stays inactive. The *constant 40 million*

scenario is similar: TNAC almost reaches the upper threshold in 2028 but stays just below it. Only in 2032 TNAC exceeds the upper threshold, the MSR would be activated in 2033.

The TNAC-development in the *150 million in 2028* scenario follows a similar pattern as in the *FF55 policy case*. A sharp increase in 2028 activates the MSR intake, a steep decline then brings the TNAC below the other two price intervention scenarios but the TNAC remains within the thresholds until 2032.

Figure 6: TNAC development 2027 – 2032 in the *Enhanced action* scenario and different Art. 30h scenarios



Source: own illustration, Öko-Institut.

3.2.4 Performance of the MSR in the *Slow adoption* scenario

3.2.4.1 No usage of Art. 30h

The *Slow adoption* scenario shows the balance of supply and demand in a case where emissions persistently remain above the cap. Due to the frontloading mechanism the initial TNAC is within the thresholds but then declines steeply (Table 7 and Figure 7). In the scenario without Art. 30h intervention, in the year 2028 the TNAC is already below the threshold of 210 million allowances – despite the substantial frontloading in 2027. The MSR issues a total of 133 million allowances in 2029 and 2030 but this is not enough to compensate the high emission levels.

This scenario is counterfactual and of a theoretical nature; the deficit quickly becomes so large that the covered entities would not be able to fulfil their obligations under the ETS 2 and would be in non-compliance. Very high CO_2 prices would be the result and should lead to additional emission reductions to ensure that the cap is met.

Table 7: ETS 2 supply and demand in the *Slow adoption* scenario without application of Art. 30h [million allowances]

	2027	2028	2029	2030	2031	2032	Total
Cap	1 040	989	926	862	799	735	5 352
Auctions	1 352	989	855	858	695	735	5 485
Verified/ projected emissions	1 104	1 054	1 004	953	903	853	5 870
TNAC	248	183	35	-60	-268	-386	-
Allowances in MSR	600	600	567	467*	0	0	-

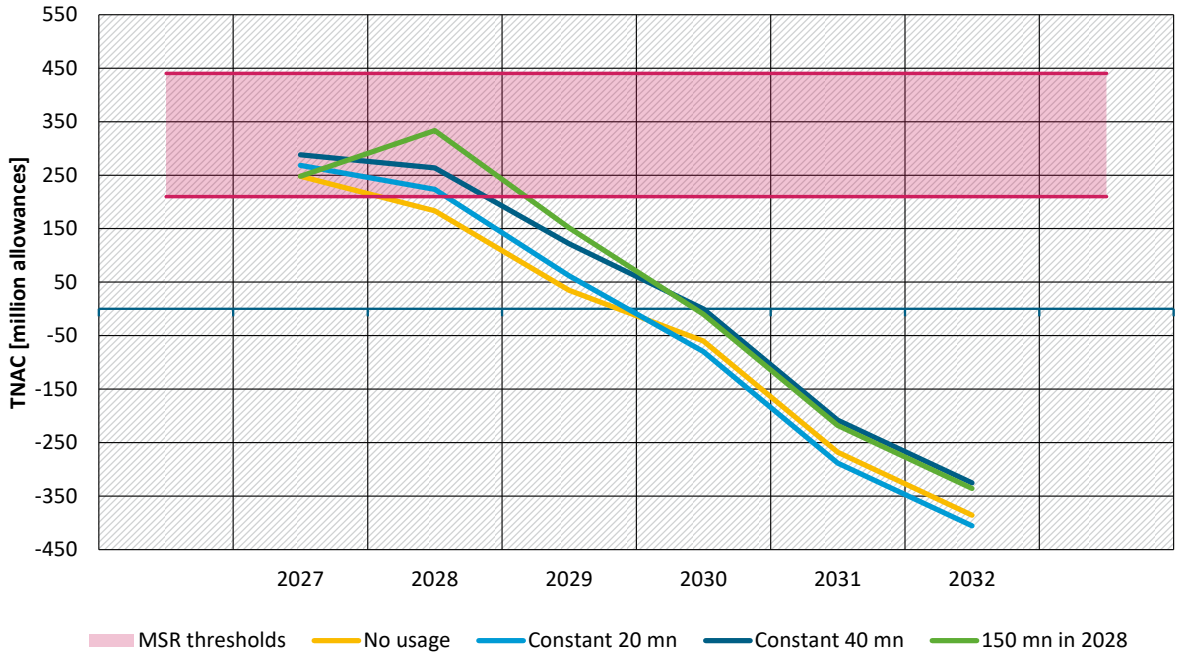
Note: *Values given are for the end of the year; the remaining allowances in the MSR in the year 2030 will become invalid on 1 January 2031, i.e. are not available in 2031 anymore..
Source: own calculation, Öko-Institut.

3.2.4.2 With usage of Art. 30(h)

In this emission scenario, the price countering mechanism of the MSR is not strong enough to change the overall situation; the development depicted remains counter-factual and not in line with ETS compliance regulations. Even in the variant with the highest quantity of additional supply (*constant 40 million*), there would still be a negative TNAC of -325 million allowances by 2032. The MSR is triggered in 2029 and issues 33 million allowances in 2030 in all three scenarios with price intervention. No further allowances are available after invalidation on 1 January 2031. The result is that TNAC is lower in the *constant 20 million* scenario than in the base case from 2030 onwards. This is because the MSR is triggered one year earlier in the scenario without price intervention, the total supply over the entire period is 20 million allowances higher.

An emission development as assumed in this scenario would lead to very high CO_2 prices from right from the beginning of the ETS 2. In theory, such high prices would then lead to emission reductions both through behavioural changes and investments. In practice, a steep fuel price increase due to the ETS 2 might create so much political pressure that governments would feel obliged to intervene. The (temporary) reduction of fuel taxes in almost all Member States as a response to the energy crisis caused by the Russian invasion of Ukraine is an example for such interventions (T&E 2023).

Figure 7: TNAC development 2027 – 2032 in the *Slow adoption* scenario and different Art. 30h scenarios



Source: own illustration, Öko-Institut.

4 Auctioning quantities and revenues

Under the ETS 2, there is no free allocation. All allowances are auctioned by Member States or centrally for the Social Climate Fund (SCF). Contributions to the SCF stem from 3 sources:

- 50 million ETS 1 allowances,
- 150 million ETS 2 allowances (Art. 30d(3)), and
- additional ETS 2 allowances to raise EUR 65 billion in total (EUR 54.6 billion if the ETS 2 only starts in 2028) (Art. 30d(4)).

The quantity of allowances which will be auctioned by Member States therefore depends on the CO_2 price in both systems. For the analysis below, we assume that the ETS 1 price is 80 EUR, i.e. a contribution to the SCF of EUR 4 billion. The auction share by country depends on their share of emissions covered by the ETS 2 in the years 2016-18.

The resulting auction volumes and revenues are shown in Table 8 for three different average ETS 2 CO_2 prices for the period 2027-2032. In the case of a low CO_2 price of 45 EUR_{2020}, an additional 1 206 million allowances would be auctioned for the SCF; at the other extreme – with an average price of 200 EUR_{2020}, only 155 million additional allowances would be necessary to raise the total of EUR 65 billion.

Germany will receive 23.7 % of the allowances that Member States can auction, by far the largest share. France with 15.6 % and Italy with 13.2% are the only other countries that receive more than 10 % of these allowances. 17 Member States receive less than 2 % of the auction quantities and revenues.

Table 8: Auction quantities and revenues by SCF and Member State and average CO_2 price

	Auction share	45 EUR/t CO_2		100 EUR/t CO_2		200 EUR/t CO_2	
	[%]	[mn EUA]	[bn EUR]	[mn EUA]	[bn EUR]	[mn EUA]	[bn EUR]
Social Climate Fund		**1 406**	**65.0**	**660**	**65.0**	**355**	**65.0**
Art. 10a(8b)		50 mn EUA (4 billion EUR) from ETS 1					
Art. 30d(3)		150	6.8	150	15.0	150	30.0
Art. 30d(4)		1 206	54.3	460	46.0	155	31.0
Member States		**3 949**	**178**	**4 694**	**469**	**4 999**	**1 000**
Austria	2.7%	105.5	4.7	125.5	12.5	133.6	26.7
Belgium	3.8%	151.6	6.8	180.3	18.0	192.0	38.4
Bulgaria	0.9%	35.8	1.6	42.6	4.3	45.4	9.1
Croatia	0.7%	26.8	1.2	31.9	3.2	33.9	6.8
Cyprus	0.2%	7.6	0.3	9.0	0.9	9.6	1.9
Czechia	2.5%	100.1	4.5	119.0	11.9	126.7	25.3
Denmark	1.2%	47.1	2.1	56.0	5.6	59.6	11.9
Estonia	0.3%	10.2	0.5	12.1	1.2	12.9	2.6
Finland	1.2%	46.4	2.1	55.2	5.5	58.7	11.7
France	15.6%	616.5	27.7	732.9	73.3	780.5	156.1
Germany	23.7%	937.2	42.2	1 114.2	111.4	1 186.6	237.3
Greece	1.6%	64.0	2.9	76.0	7.6	81.0	16.2
Hungary	1.8%	72.8	3.3	86.5	8.6	92.1	18.4
Ireland	1.5%	60.7	2.7	72.1	7.2	76.8	15.4
Italy	13.2%	520.7	23.4	619.0	61.9	659.2	131.8
Latvia	0.3%	12.8	0.6	15.2	1.5	16.2	3.2
Lithuania	0.5%	21.4	1.0	25.4	2.5	27.1	5.4
Luxembourg	0.6%	22.0	1.0	26.2	2.6	27.9	5.6
Malta	0.1%	2.2	0.1	2.6	0.3	2.7	0.5
Netherlands	4.2%	164.9	7.4	196.0	19.6	208.8	41.8
Poland	8.1%	320.4	14.4	380.8	38.1	405.6	81.1
Portugal	1.6%	62.4	2.8	74.2	7.4	79.0	15.8
Romania	2.5%	98.7	4.4	117.3	11.7	125.0	25.0
Slovakia	1.0%	39.3	1.8	46.7	4.7	49.8	10.0
Slovenia	0.5%	21.4	1.0	25.4	2.5	27.0	5.4
Spain	8.3%	326.7	14.7	388.4	38.8	413.6	82.7
Sweden	1.4%	53.7	2.4	63.8	6.4	67.9	13.6

Note: Auctioning quantities exclude MSR additions/removals. ETS 2 starts in 2027. We assume here that the ETS 1 contributes with 4 billion EUR to the SCF, i.e. an average CO_2 price of 80 EUR/t in the ETS 1.

Source: Own calculations, Öko-Institut.

5 ETS 2 and other climate policy

5.1 Member State's targets under the ESR

The ETS 2 is a measure to help Member States achieve their targets under the ESR (see chapter 1). Under the ESR, each country has annual limits for almost all the emissions not covered by the ETS 1 except the land-use sector. ESR targets were distributed mainly based on ability-to-pay, i.e. GDP per-capita with some modifications to enhance cost-effectiveness in high-income countries. Denmark, Germany, Luxembourg, Finland and Sweden need to reduce ESR emissions by 50 % compared to 2005 levels until the year 2030; Bulgaria, as the poorest Member State, has a reduction target of 10 % (EU 2023a). All other Member States have individual targets within this range. The ESR allows for trading of annual emissions allocations (AEA), the annual emission budget of each Member State. If a country has reduced emissions beyond the ESR pathway, it can sell the difference to others who have not achieved their targets through domestic reductions.

In contrast, the ETS 2 is a union-wide measure applying to all Member States without further differentiation. This could lead to an overachievement of ESR targets in low-income Member States and an underachievement in high-income countries.

In Figure 8 we estimate the potential effect of the ETS 2 on ESR target achievement. Compared to 2016-2018 emission levels, the ETS 2 requires a 38 % reduction until 2030. To achieve the overall ESR target of 32 % below 2016-2018, the residual ESR emissions sources outside of the ETS 2 will need to be reduced by 22 %. To estimate the impact of the ETS 2 by Member State we use two scenarios:

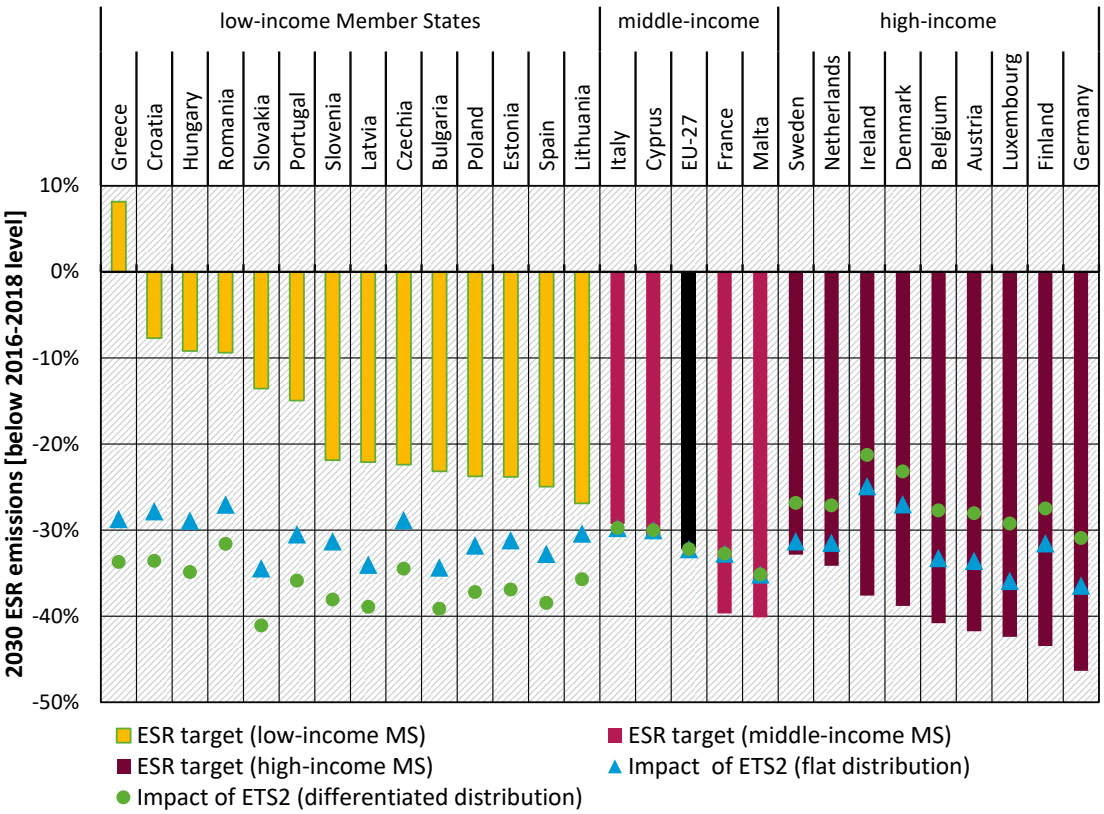
- Flat distribution: In this scenario, it is assumed that the ETS 2 will have the same effectiveness across all Member States, i.e. a 38 % reduction compared to the average 2016-18 levels until 2030. The likely higher impact on user behaviour in low-income countries is balanced by higher investment capabilities in high-income countries.
- Differentiated distribution: In this scenario we assume that the carbon price will mainly lead to reduced demand through user behaviour in the short term, as there is not enough time for large scale technical reduction measures until 2030. We assume that Member States below 80 % of the EU's average GDP/capita will reduce emissions by 10 percentage points above the EU average, i.e. a 48 % reduction compared to the average 2016-18 levels until 2030. Member States above 120 % of the EU's average GDP/capita will reduce ETS 2 emissions by 7.5 percentage points below the average, i.e. 30.5 %. In middle-income Member States the effect of the ETS 2 remains unchanged compared to the flat distribution.

The higher impact of CO_2 prices on user behaviour in low-income countries has two reasons: Firstly, due to lower energy taxes in many of the poorer countries the relative price increase will be greater than in countries with higher energy taxes. More importantly, income and therefore ability to pay for higher fuel prices varies greatly: The net equivalent income in the five poorest Member States is less than 20 % of this indicator in the eight richest countries (Braungardt et al. 2022). The 10 percentage points higher emission reduction effect of the ETS 2 in the differentiated scenario above is an assumption to illustrate the potential impact of a non-uniform response to the ETS 2.

The potential overachievement of ESR emission targets due to the ETS 2 is the highest in Greece (Figure 8)[11]: instead of meeting the ESR targets of a 10 % increase compared to 2016-2018[12], the ETS 2 might decrease emissions by 29 % to 34 % in the flat/differentiated distribution. As a result, Greece would be able to sell 17 to 19 million AEA (annual emission allocation, the ESR emission rights) alone for the year 2030. Price projections for AEA do not exist; if similar to the ETS 2 price, this would mean an additional revenue flow of several billion Euros only for 2030. Like the ETS 2, the ESR mandates annual emission limits, i.e. additional revenues would be generated in the years before 2030 as well.

Germany which has a reduction target of 46 % compared to 2016-2018, the highest value of all Member States, is at the other extreme: In the flat distribution scenario, emissions would only decrease by 36 %, a shortfall of 45 million AEA in 2030. In the differentiated scenario, this shortfall would increase to 70 million AEA (the next chapter contains a more detailed discussion of the situation in Germany).

Figure 8: 2030 ESR targets compared to 2016-18 and the impact of the ETS 2 by Member State



Notes: 2030 ESR targets are expressed against average emissions 2016-18. Countries with a GDP/capita below 80% are classified as low-income, countries above 120 % of the EU average as high-income. Sorting is by ESR target compared to 2016-18 emissions within each income group.

Source: own illustration, Öko-Institut.

[11] We assume that the ESR emissions outside the ETS 2 decrease homogeneously in all Member States, i.e. 22 % below 2016-2018. Depending on national circumstances this might be different; the discussion here is to show the potential interaction between the ETS 2 and the ESR targets.

[12] Compared to 2005, Greece has a reduction target of 22.7% until 2030; due to the economic decline during the Euro crisis the 2030 target is higher than 2016-18 emissions.

5.2 The German national ETS

The German climate law sets both national and sectoral emissions limits to achieve climate neutrality by 2045. Overall, emissions need to decrease by 65 % compared to 1990 until 2030 and by 88 % until 2040. For the years 2021 to 2030 it also sets sectoral emission limits for energy, industry, buildings, transport, agriculture, and the remaining sectors. One of the main measures to achieve these limits is a national emission trading system (nETS) covering almost all energy use outside of the ETS 1, which was implemented in 2021. In scope it is slightly larger than the ETS 2, for example it also includes diesel locomotives and energy use in agriculture. The German and the European ETS 2 use the 2016-18 period for the determination of the cap until 2030. During these three years, emissions under the nETS scope were only 2 % larger than under the ETS 2 scope (Jörß et al. 2023). During a phase-in period the scope excludes some fuels/activities for the years 2021-2023. The full scope of the nETS will start in 2024.

A major difference exists in the price finding mechanism: Until 2025, there is a fixed CO_2 price path increasing gradually (Table 9). If demand exceeds supply, additional allowances will be created and introduced into the market. During this period, the ETS acts more like a CO_2 tax than like an ETS. In 2026 there will be a price range; from 2027 onwards the CO_2 price is unrestrained and set by the market.

Table 9: CO_2 price development in the German nETS

	2021	2022	2023	2024	2025	2026	2027 onwards
Current legislation	25 EUR/t	30 EUR/t	30 EUR/t	35 EUR/t	45 EUR/t	55 – 65 EUR/t	unrestrained
Planned changes				45 EUR/t	55 EUR/t		

Source: Deutscher Bundestag (2019), BReg (2024)

In terms of ambition, the nETS requires steeper emission reductions than the ETS 2 (Table 10), if the caps are directly compared: By 2030, the nETS cap is 46 % below 2016-2018 levels. In contrast, the ETS 2 only requires a 38 % reduction. In absolute terms, the difference is 26 Mt CO_2 in 2030 (using the nETS scope) or 85 Mt CO_2 for the entire period 2027 to 2030. It has to be stated however, that the nETS cap does not effectively limit the emissions of the regulated entities until 2026 and a decision for the price/cap regime for the nETS from 2027 onwards has not been taken so far.

Table 10: Cap development in the nETS compared to the ETS 2 (relative to 2016-2018)

	2016-2018	2027	2028	2029	2030
nETS	0%	-29%	-35%	-41%	-46%
ETS 2	0%	-25%	-29%	-34%	-38%

Source: Own calculations, Öko-Institut with data from Jörß et al. (2023).

So far, it is unclear what will happen to the nETS in the future. In their coalition agreement, the federal government has expressed its intention to transition to the EU-wide ETS (Bundesregierung 2021). In theory, several options exist:

- Replacement: from 2027 onwards, only the ETS 2 applies.
- Opt-in: Germany could replace the nETS with the ETS 2 but unilaterally include the additional emission sources which are outside the scope of the ETS 2.
- Opt-out under Art. 30e(3): Germany could try to use the option to delay the introduction of the ETS 2 until 2031. This is possible if a Member State has a national carbon tax higher than the CO_2 price in the ETS 2. We assume that the nETS would not qualify as a carbon tax.
- Parallel systems: To compensate for the lower ambition in the ETS 2, Germany could opt for a parallel mechanism. While the details would need to be worked out, there is a precedence with the carbon price floor for electricity generation in the UK under the ETS 1 (House of Commons Library 2018).

Based on the political debate around this issue in autumn of 2023 it seems likely that the government will decide to include the additional emissions covered by the nETS into the ETS 2 (opt-in option). Currently, Germany is not on track to meet the national GHG targets nor on track to meet the ESR obligations. If the nETS is only replaced by the ETS 2 without further measures, the gaps between the national targets and expected emission levels will increase even more.

Using the latest projections, even with additional measures there is still a cumulated gap of 194 Mt CO_2eq between the national targets and projected emissions between the years 2021 and 2030. In the same scenario, the gap between ESR targets and emissions for the period 2021-2030 is 152 Mt CO_2eq (Harthan et al. 2023). The scenario assumed a gradually increasing CO_2 price reaching 125 EUR/t CO_2 by 2030 (in current prices). The report also includes a sensitivity with a liberalisation of the CO_2 price in 2027 combined with a steep increase to 340 EUR/t CO_2 by 2030. In this scenario, despite the very high carbon price, emissions only reduce by 19 Mt CO_2 by 2030, a reduction of 8% compared to the main scenario.

5.3 Looking beyond 2030

Despite not being implemented yet, it is already necessary to look at the ETS 2 in the period after 2030. According to the European Climate Law, the Commission will need to publish a proposal for the EU's 2040 climate target by May 2024. In this context, several questions need to be addressed.

The **scope** of the ETS 2 could be expanded to cover the remaining energy-related CO_2 emissions not yet included in either ETS. This could lead to the inclusion of emissions from fossil energy use in agriculture, railways, inland shipping, the military, off-road transport (e.g. construction machinery) and other smaller sources. Another option is the inclusion of further greenhouse gases into the ETS 2 – either from industrial processes, from combustion processes or agriculture. Especially for agriculture this would raise many questions, e.g. on the quality of the reported emission data but also on the respective abatement curves and opportunities; a separate agriculture ETS might be more appropriate if at all.

The ETS Directive has no time limit, i.e. if not reformed, all rules will remain in place unchanged. Most relevant, **the linear reduction factor** (LRF) and therefore **the cap** will continue to apply. The last year with a positive cap value would be 2043; in theory, afterwards the cap would become negative. At the same time, it seems unlikely that all emission sources will be fully

decarbonised by then. This means that either the LRF will need to be changed or that emissions removals will need to be included in some way into the ETS 2.

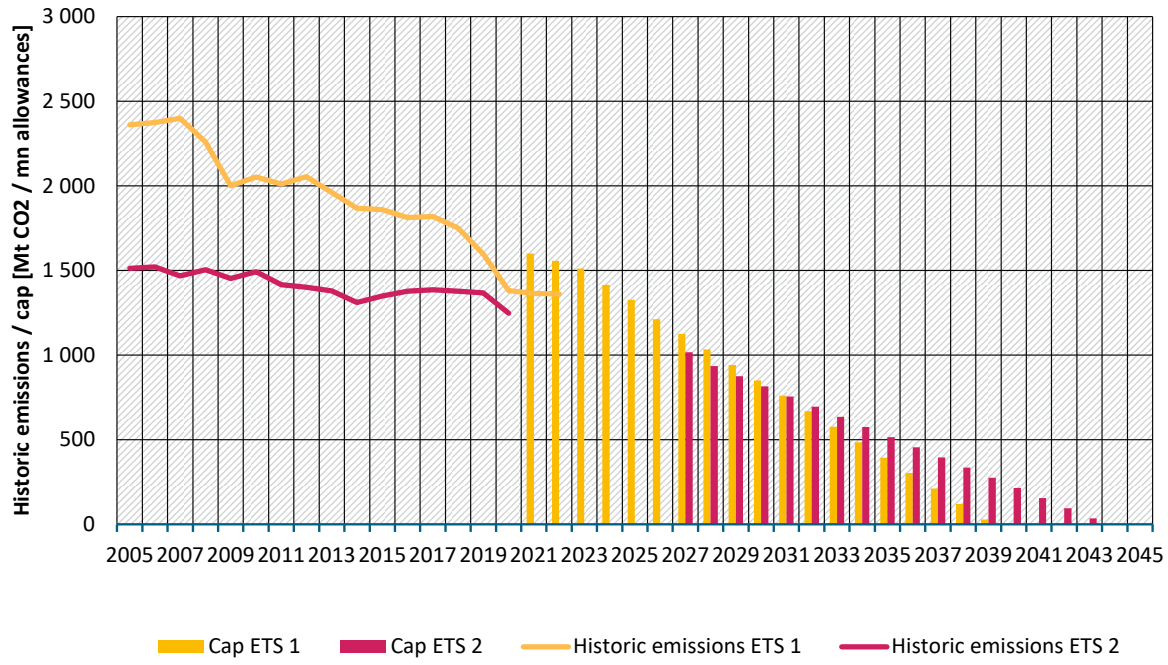
The third major issue will be the **coexistence or merger of the ETS 1 and ETS 2**. Economic theory shows that a larger scope would decrease overall costs and therefore lead to higher economic efficiency. The reason for starting with parallel systems initially was to ensure that any unforeseen development in the ETS 2 does not endanger the effectiveness of the ETS 1. Without verified actual data in the scope of the ETS 2, uncertainties are unavoidable. Especially the basis for calculating the cap will always remain an estimate based on assumptions to calculate the emissions in the ETS 2 scope in the years 2016-18. Uncertainties about the demand and resulting CO_2 price in the ETS 2 are also high (see sections 3.1.2 and 3.1.3). There are also other reasons for parallel emission trading systems:

- Impact on individual sectors: if the willingness and ability to pay is much higher in some sectors than in others, a merged ETS might have unintended consequences. For example, in road transport economic efficiency is only one of many factors that impact the choice of transport mode and investments by individuals. This could lead to very high CO_2 prices within a short time frame that could be prohibitive for some industry sectors.
- Pathways to carbon neutrality: To achieve the EU's objective of carbon neutrality by 2050, all emissions need to be reduced to the extent possible. Especially, almost all fossil fuel use will need to be phased out. Some transformations can be achieved within a relatively short time, but other transformation speeds are limited. For example, energetic refurbishment of buildings is limited by the availability of qualified personnel and availability of building materials. If the necessary renovation wave is delayed because other ETS sectors decrease emissions faster, it might not be possible to achieve the 2050 target.

Against this background it was deemed better to separate the two systems at least in the beginning. Unfortunately, the start of the ETS 2 will be too late to provide input into the review of the ETS for the period post-2030. In other words, if a merger between the two systems is envisaged for 2031 already, there would only be limited new information available compared to the situation during the introduction of the ETS 2.

Figure 9 shows the cap development in ETS 1 and ETS 2 under the current regulation until the year 2045. In 2027, the ETS 2 cap is still 10% lower than the ETS 1 cap. By 2031, both ETS have the same size and afterwards the ETS 2 becomes the larger system.

Figure 9: Historic emissions and cap development until 2045 in both emission trading systems



Note: Historic emissions and cap include aviation (from 2013 onwards) and shipping (from 2024 onwards). Until 2020 emissions from the UK are also included. In theory, the LRF would apply even if the cap would become negative.
Source: own illustration, Öko-Institut.

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A Methodology for estimating emissions in the scope of the ETS 2

A.1 Historic emissions

The methodology below is used to calculate historic emissions in the scope of the ETS 2 for this study. Data sources are the EU's greenhouse gas inventory[13] as published by the EEA (2023) and the greenhouse gas projections also published by the EEA (2022a). The ETS scope is estimated as the sum of:

- Road transport: CRF category 1.A.3.b (Road Transportation)
- Buildings: CRF categories 1.A.4.a (Commercial/Institutional) and 1.A.4.b (Residential)
- Additional sources:
  - Energy Industries outside of the ETS 1: EEA (2022a) reports emissions covered by the ESR from Energy Industries. This value includes non-CO_2 gases (mainly CH_4 and N_2O) and also CRF 1.B (Fugitive emissions from Fuels) which is not part of the ETS 2. The difference between all greenhouse gases and CO_2 emissions from CRF 1.A.1 (Energy Industries) as well as all emissions from CRF 1.B need to be deducted from the value for ESR emissions from energy industry as reported by EEA.
  - Manufacturing Industries and Construction outside of the ETS 1: Similar to energy industries the value reported by EEA (2022a) includes other greenhouse gases. Again, the difference between all GHG emissions and CO_2 only from CRF 1.A.2 needs to be deducted.

It is not necessary to separately add emissions from Combined Heat and Power (CHP) plants (CRF category 1.A.1.a(ii)) and Heat plants (CRF category 1.A.1.a(iii)) when producing heat for commercial or residential buildings outside of the ETS 1 (see chapter 2.1); these emissions are automatically included under the additional sources.

The resulting ETS 2 emissions are shown in Table 11. There remains some uncertainty in the historic numbers. This is especially true for the ESR emission share for CRF categories 1.A.1 and 1.A.2; these values are estimated by Member States in there national GHG projections. There is no harmonised methodology to do so, and data quality might differ considerably. In addition, there is some potential for inconsistencies with regard to the final scope of the ETS 2. For example, Germany reports emissions from construction vehicles under CRF 1.A.2(g) (Road transport – Other). This means that these emissions are part of the ETS 2 and the values below. Most other countries report these emissions under 1.A.3 (other transport) and they are not included in the ETS 2. These discrepancies are small and likely there will be some guidance in the future clarifying the exact scope.

Table 11: Historic emissions from sectors covered by the ETS 2

	2005	2010	2015	2020
ETS 2 scope	1 512.5 Mt CO_2	1 492.9 Mt CO_2	1 349.5 Mt CO_2	1 248.1 Mt CO_2

Source: own calculation, Öko-Institut with data from EEA (2023) and EEA (2022a)

[13] Greenhouse gas inventories are reported using a Common Reporting Format (CRF) with dedicated numbering for each emission source.

A.2 Projected emissions

The impact assessment which accompanied the proposal for the revised ETS Directive in the FF55 package includes two emissions scenarios with different sectoral scopes (EC 2021). While neither scope directly matches the agreed scope of the ETS 2, both follow the same relative emission development between 2016-2018 and 2030. This relative development was applied to the historic emissions as calculated above to create the FF55 policy scenario.

Table 12: Projected emissions from sectors covered by the ETS 2

	2016-2018	2020	2025	2030
ETS 2 scope	1 381 Mt CO_2	1 305 Mt CO_2	1 180 Mt CO_2	860 Mt CO_2

Source: own calculation, Öko-Institut with data from EC (2021).

B The ETS 2 MSR tool

B.1 Model description

The ETS 2 MSR tool is a spreadsheet-based model to calculate supply and demand of allowances under the new trading scheme including the market stability reserve. The tool's settings allow to select

- Different emission projections (For details on historic and projected emissions, see appendix A)
- 2027 or 2028 as starting year for the ETS 2
- Different AEA/cap assumptions
- Assumptions on price triggers
- MSR rules

Based on these settings the tool calculates the annual and cumulated supply of and demand for allowances for the years 2027 to 2032 and the inflow and outflow of the MSR. The projected emissions influence the change of the cap over time. This, in turn, determines the supply of allowances flowing into the Social Climate Fund and available for auctioning by governments as well as the number of allowances in the MSR.

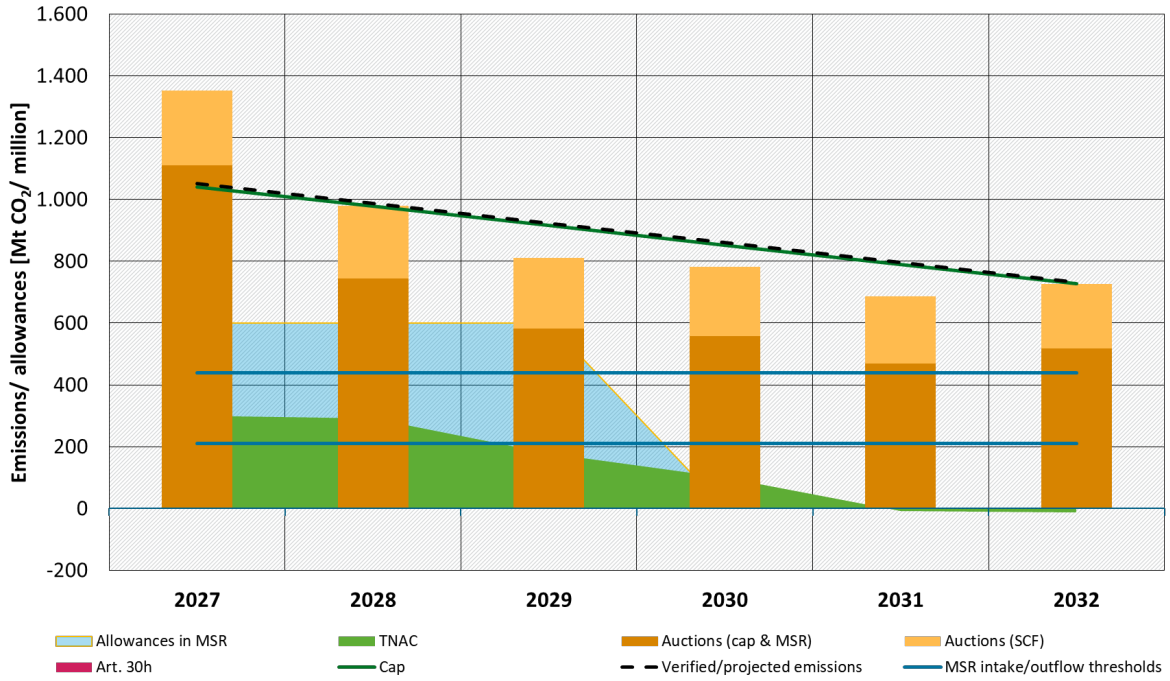
Furthermore, the tool provides the option to include different assumptions on price triggers according to Art. 30h. This allows to analyse the effect of different price developments.

B.2 Exemplary results

The following section shows two exemplary results from the model. Figure 10 shows the development of emissions and allowances for the years 2027 to 2032. The figure includes the projected emissions and the resulting cap as well as the development of allowances in the MSR and the total number of allowances in circulation (TNAC). The resulting number of allowances for the SCF and the auctions are illustrated as bars.

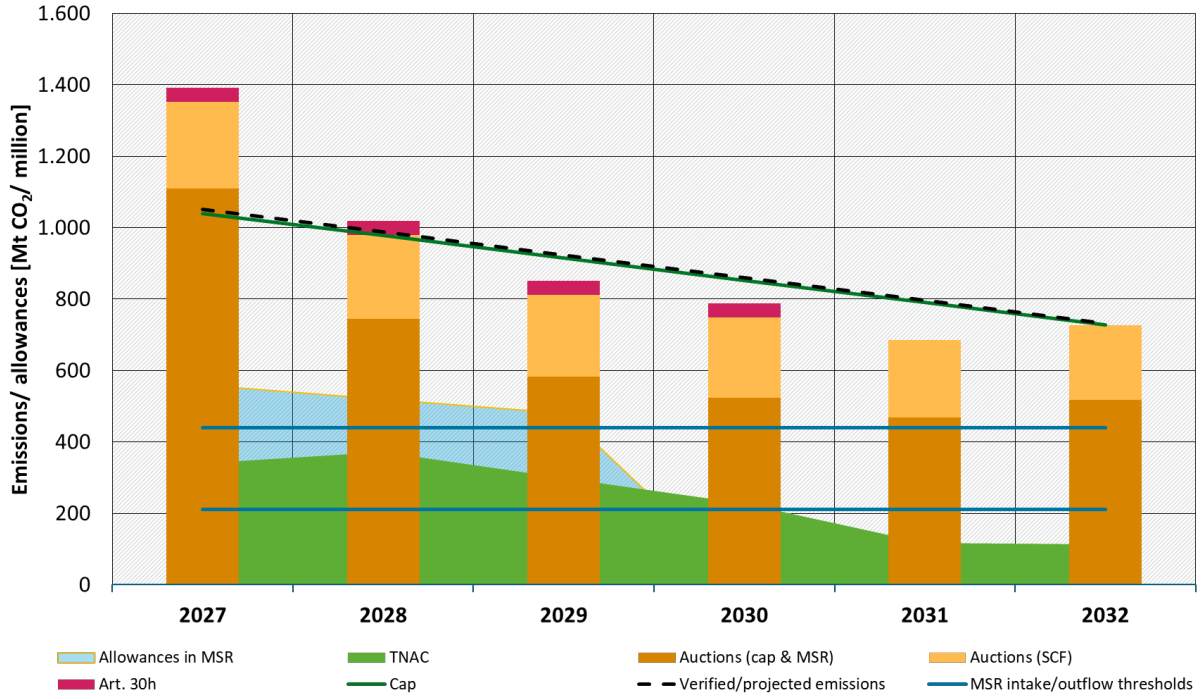
Figure 11 additionally includes an illustration of measures in case of excessive price increase according to Art. 30h. The exemplary scenario shows the release of additional allowances for the years 2027 to 2030.

Figure 10: Development of emissions and allowances over time, no Art 30h



Source: own illustration, Öko-Institut.

Figure 11: Development of emissions and allowances over time, with trigger of Art. 30h



Source: own illustration, Öko-Institut.