CLIMATE CHANGE
33/2022

Interim report

Rebasing the Cap and strengthening the Market Stability Reserve in the EU ETS

by:
Johanna Cludius and Jakob Graichen
Oeko-Institut e.V., Berlin

publisher:
German Environment Agency

German Environment Agency

Umwelt Bundesamt

CLIMATE CHANGE 33/2022

Ressortforschungsplan of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

Project No. (FKZ) 3720 42 501 0

Report No. (UBA-FB) FB000855/ENG

Interim report

Rebasing the Cap and strengthening the Market Stability Reserve in the EU ETS

by

Johanna Cludius and Jakob Graichen
Oeko-Institut e.V., Berlin

On behalf of the German Environment Agency

Imprint

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

/umweltbundesamt.de
/umweltbundesamt

Report carried out by:
Oeko-Institute .V.
Borkumstraße 2
13178 Berlin

Report completed in:
May 2022

Edited by:
Section Economic Aspects of Emissions Trading, Monitoring, Evaluation
Claudia Gibis, Jan Weiß

Publicationen as pdf:
http://www.umweltbundesamt.de/publikationen

ISSN 1862-4359

Dessau-Roßlau, July 2022

Abstract: Rebasing the Cap and strengthening the Market Stability Reserve in the EU ETS

In this paper, we evaluate the EU Commission proposal "Fit for 55" (FF55) regarding a rebasing of the ETS cap and the MSR parameters and compare this proposal to alternative rebasing and MSR parameter options. All of these options operate within the context of the EU's 55% reduction target for 2030, translating into a 61% reduction target in the EU ETS sectors. We therefore do not explore a raise in ambition of the EU or EU ETS targets that would be compatible with the 1.5 degree target. However, even if the overall target is not raised, adjustments to the cap and to the MSR can limit cumulative emissions in EU ETS and have a positive climate impact. We analyse effects on total allowance supply (used as a proxy for the effective emissions limit and therefore climate effectiveness in the EU ETS) in the fourth trading period and the development of the total amount of allowances in circulation (as an indicator for market stability). We find that the EU Commission proposal may lead to situations of persistent market imbalance, where a new structural market surplus is created and auction volumes are reduced ex-post by continued MSR intakes throughout the fourth trading period.

Introducing dynamic MSR thresholds that decline in line with the cap has the largest impact on the effective emissions limit and market balance of all the options investigated in this paper. Applying a proportional rather than a static intake rate also increases the ability of the MSR to balance the market. More ambitious rebasing of the cap becomes important in the context of a weak MSR (e.g. in case the current doubled intake rate of 24% is reduced again to 12%) or in a high emissions scenario. Therefore, going beyond the rebasing amount proposed by the EU Commission (e.g. 250 instead of the proposed 117 million allowances) can be seen as a no-regret option that has a limited impact in case of a strong MSR or low emissions, but can act as a safeguard against a weak MSR. However, even under stronger rebasing, strengthening the MSR by dynamically decreasing thresholds in line with the cap is imperative for strengthening climate effectiveness and ensuring market balance during the fourth trading period. Introducing dynamically declining thresholds also corresponds to expectations about future hedging and investment behaviour. Therefore, strengthening the MSR should be a focus of ETS reform efforts.

Kurzbeschreibung: Cap-Anpassung und Stärkung der Marktstabilitätsreserve im EU-Emissionshandel

In diesem Papier bewerten wir den Vorschlag der EU-Kommission "Fit for 55" (FF55) für eine Einmalanpassung des Caps (Rebasing) und Anpassung der MSR-Parameter und vergleichen diesen Vorschlag mit alternativen Optionen für ein Rebasing und MSR-Ausgestaltung. Alle untersuchten Optionen bewegen sich im Rahmen des EU-Reduktionsziels von 55% für 2030, was ein Reduktionsziel von 61% in den EU-ETS-Sektoren bedeutet. Wir untersuchen daher keine Zielverschärfung, die mit dem 1,5-Grad-Ziel vereinbar wäre. Doch selbst wenn das Gesamtziel nicht angehoben wird, können Anpassungen der Obergrenze und der MSR die kumulierten Emissionen im EU-ETS begrenzen und sich positiv auf das Klima auswirken. Wir analysieren die Auswirkungen der verschiedenen Optionen auf das Gesamtangebot an Zertifikaten in der vierten Handelsperiode (welches die effektive Emissionsgrenze und damit die Klimawirksamkeit des EU-ETS darstellt), sowie die Entwicklung der Gesamtmenge der im Umlauf befindlichen Zertifikate (als Indikator für die Marktstabilität). In Bezug auf diese beiden Faktoren kommen wir zu dem Ergebnis, dass der Vorschlag der EU-Kommission zu einem anhaltenden Marktungleichgewicht führen kann, bei dem ein neuer struktureller Überschuss entsteht, der dazu führt, dass für die Dauer der vierten Handelsperiode Auktionsmengen ex-post durch die MSR verringert werden (müssen).

Die Einführung dynamischer MSR-Schwellenwerte, die im Einklang mit dem Cap abgesenkt werden, hat von allen in diesem Papier untersuchten Optionen die größten Auswirkungen auf

die effektive Emissionsgrenze und das Marktgleichgewicht in der vierten Handelsperiode. Auch die Anwendung einer proportionalen statt einer statischen Entnahmerate erhöht die Fähigkeit der MSR, den Markt auszugleichen. Ein stärkeres Rebasing wird im Zusammenhang mit einer schwachen MSR (z. B. wenn die aktuell gültige Aufnahmerate von 24% wieder auf 12 % reduziert wird) oder bei einem Szenario mit hohen Emissionen wichtig. Daher kann eine stärkere Cap-Anpassung als von der EU-Kommission vorgeschlagen (z.B. 250 statt der vorgeschlagenen 117 Millionen Zertifikate) als eine Option angesehen werden, die im Falle einer starken MSR oder niedrigen Emissionen nur begrenzte Auswirkungen hat, aber als Absicherung im Falle einer schwachen MSR dienen kann. Auch bei stärkerem Rebasing ist die Stärkung der MSR durch dynamisch sinkende Schwellenwerte unerlässlich, um die Klimawirksamkeit des EU-ETS zu garantieren und das Marktgleichgewicht während der vierten Handelsperiode sicherzustellen. Gleichzeitig entspricht die Einführung von dynamisch sinkenden Schwellenwerten den Erwartungen an das zukünftige Hedging- und Investitionsverhalten der Marktakteure. Daher sollte die Stärkung der MSR ein Schwerpunkt der ETS-Reformbemühungen sein.

Table of content

List of figures

List of tables

List of abbreviations

CBAM	Carbon Border Adjustment Mechanism
CO_2	Carbon dioxide
$CO_{2\ eq}$	Carbon dioxide equivalent
COM proposal	European Commission's proposal in the context of the "Fit-for-55" package
ESMA	European Securities and Markets Authority
ETS	Emissions Trading System
EUA	European Union Allowance
FF55	„Fit-for-55" (package of legislative proposals from July 2021)
GHG	Greenhouse gas
LRF	Linear reduction factor (governing the ETS cap trajectory)
MSR	Market Stability Reserve
Mt	Million tons
TNAC	Total Amount of Allowances in Circulation
TP4	Fourth trading period

Summary

In July 2021, the European Commission published their proposals for making the EU Emissions Trading System (EU ETS) and the Market Stability Reserve (MSR) "fit for 55" – fit for reaching the 2030 goal of reducing EU greenhouse gas emissions 55% below 2005 levels. In this analysis, we compare the proposal by the EU Commission for a one-off reduction (rebasing) of the ETS cap and the different MSR parameters with a number of alternatives. We evaluate the EU Commission's proposal and the alternatives using two indicators: i) the total allowance supply in the fourth trading period as an indicator for the effective emissions limit and therefore climate effectiveness of the EU ETS and ii) the development of the Total Amount of Allowances in Circulation (TNAC) as an indicator of market stability. These two indicators are modelled using an ETS supply and demand simulation tool developed by Oeko-Institut for the German Emissions Trading Authority (DEHSt) and applying three emission trajectories that reflect i) the EU Commission's expectation of emissions development following their FF55 proposals (FF55 Policy scenario) and two scenarios that reflect possible emissions developments following Russia's invasion of Ukraine leading to i) higher overall emissions in the fourth trading period and ii) lower overall emissions in the fourth trading period respectively.

All cap rebasing options operate within the context of the 55% reduction target for 2030, translating into a 61% reduction target in the EU ETS sectors (compared to 2005 emission levels). We therefore do not explore a raise in ambition of the EU or EU ETS targets that would be compatible with the 1.5 degree target. However, even if the overall target is not raised, adjustments to the cap and to the MSR can limit cumulative emissions in EU ETS and have a positive climate impact.

We find that the EU Commission's proposal regarding a one-off reduction in the cap and the MSR parameters leads to a situation, where in the FF55 Policy scenario, the market surplus persists and the TNAC is above the upper threshold for the duration of the fourth trading period. Therefore, there is room for further limiting supply in EU ETS through stronger rebasing and strengthening the MSR, thus enhancing climate effectiveness and market stability.

In the context of the MSR parameters proposed by the EU Commission, more ambitious rebasing options have a limited effect on both the effective emissions limit in the fourth trading period and the TNAC, as the MSR compensates the larger cap with higher intakes and cancellations. However, more ambitious rebasing options do make a difference in the high emissions scenario and in case the MSR is weaker than proposed by the EU Commission (e.g. in case the current doubled intake rate of 24% is reduced again to 12%). What is more, there may be a signalling effect of more ambitious rebasing compared to the more indirect balancing through the MSR, which could lead to stronger abatement efforts of market participants.

We also investigate how a proportional MSR intake rate and dynamic MSR thresholds influence climate effectiveness and market balance. A proportional intake rate that operates on the basis of the difference between the TNAC and the lower threshold level is more effective in limiting overall allowance supply and controlling the TNAC than the static intake rate proposed by the EU Commission. Dynamic threshold levels that decline in line with the cap have an even higher impact and are particularly effective in the FF55 Policy and high emission scenarios. The combination of both a proportional intake rate and dynamically declining thresholds further increases the effectiveness of the MSR in bringing the TNAC into the range of acceptable levels throughout the fourth trading period.

In the current setting, therefore, adjusting the MSR parameters and in particularly the thresholds has a stronger impact on climate effectiveness than a one-off reduction of the cap.

With a weak MSR, however, ambitious rebasing can address the prevailing structural imbalance between the cap and emissions and increase climate effectiveness and market stability. In this sense, going beyond the rebasing amount proposed by the EU Commission (e.g. 250 instead of 117 million allowances) can be seen as a no-regret option that has a limited impact in case of a strong MSR or low emissions, but can act as a safeguard against a weak MSR.

However, even under stronger rebasing, strengthening the MSR by dynamically decreasing thresholds in line with the cap is imperative for ensuring climate effectiveness and market balance during the fourth trading period. Introducing dynamically declining thresholds also corresponds to expectations about future hedging and investment behaviour. Therefore, strengthening the MSR via decreasing the thresholds should be a focus of ETS reform efforts.

Zusammenfassung

Im Juli 2021 veröffentlichte die Europäische Kommission ihre Vorschläge, um das EU-Emissionshandelssystem (EU-ETS) und die Marktstabilitätsreserve (MSR) "fit for 55" zu machen – also sie in die Lage zu versetzen zur Erreichung des Ziels, die Treibhausgasemissionen in der EU bis 2030 um 55% unter das Niveau von 2005 zu senken, beizutragen. In dieser Analyse vergleichen wir den Vorschlag der EU-Kommission für eine einmalige Reduzierung (Rebasing) des ETS-Caps und die verschiedenen MSR-Parameter mit einer Reihe von Alternativen. Wir bewerten den Vorschlag der EU-Kommission und die Alternativen anhand von zwei Indikatoren: i) dem Gesamtangebot an Zertifikaten in der vierten Handelsperiode als Indikator für die effektive Emissionsgrenze und damit für die Klimawirksamkeit des EU-ETS und ii) der Entwicklung des Gesamtmenge der im Umlauf befindlichen Zertifikate (TNAC) als Indikator für Marktstabilität. Diese beiden Indikatoren werden mit Hilfe eines vom Öko-Institut für die Deutsche Emissionshandelsstelle (DEHSt) entwickelten Modells simuliert. Dazu wird auf drei Emissionstrajektorien zurückgegriffen, die i) die von der EU-Kommission erwartete Emissionsentwicklung nach ihren FF55-Vorschlägen (FF55-Politikszenario) widerspiegeln, sowie zwei Szenarien, die die mögliche Emissionsentwicklungen nach dem Einmarsch Russlands in die Ukraine widerspiegeln und zu ii) höheren Gesamtemissionen in der vierten Handelsperiode bzw. ii) niedrigeren Gesamtemissionen in der vierten Handelsperiode führen.

Alle Optionen zur Anpassung des Caps bewegen sich im Rahmen des EU weiten 55%-Ziels bzw. ETS-Ziels von 61%. Wir untersuchen daher keine Anhebung der Ziele der EU oder des EU-ETS, welche mit dem 1,5-Grad-Ziel vereinbar wäre. Doch selbst wenn das Gesamtziel nicht angehoben wird, können Anpassungen der Obergrenze und der MSR die kumulativen Emissionen im EU-EHS begrenzen und sich positiv auf das Klima auswirken.

Wir stellen fest, dass der Vorschlag der EU-Kommission bezüglich eines einmaligen Rebasings und der MSR-Parameter zu einer Situation führt, in der im FF55-Politikszenario der Marktüberschuss bestehen bleibt und die TNAC für die Dauer der vierten Handelsperiode über der oberen Schwelle liegt. Daher besteht Spielraum für stärkeres Rebasing und eine Stärkung der MSR, wodurch die Wirksamkeit des EU-ETS und die Marktstabilität erhöht werden.

Im Zusammenhang mit den von der EU-Kommission vorgeschlagenen MSR-Parametern haben ehrgeizigere Rebasing-Optionen eine begrenzte Auswirkung sowohl auf die effektive Emissionsgrenze in der vierten Handelsperiode als auch auf die TNAC, da die MSR höhere Caps durch höhere Entnahmen und Löschungen ausgleicht. Ehrgeizigere Rebasing-Optionen machen jedoch einen Unterschied im Szenario hoher Emissionen und für den Fall, dass die MSR schwächer ausfällt als von der EU-Kommission vorgeschlagen (z. B. wenn die aktuell gültige Aufnahmerate von 24% wieder auf 12% reduziert wird). Darüber hinaus könnte ein stärkeres Rebasing im Vergleich zum eher indirekten Ausgleich durch die MSR eine Signalwirkung haben, die zu stärkeren Minderungsbemühungen der Marktteilnehmer führen könnte.

Wir untersuchen auch, wie eine proportionale MSR-Entnahmerate und dynamische MSR-Schwellenwerte die Klimawirksamkeit und das Marktgleichgewicht beeinflussen. Eine proportionale Entnahmerate, die auf der Grundlage der Differenz zwischen der TNAC und dem unteren Schwellenwert definiert ist, ist effektiver in Bezug auf die Klimawirksamkeit und das Marktgleichgewicht als die von der EU-Kommission vorgeschlagene statische Entnahmerate. Dynamische Schwellenwerte, die entsprechend dem Cap-Verlauf abgesenkt werden, haben eine noch größere Wirkung und sind besonders wirksam im FF55-Politikszenario und im Hochemissionsszenario. Die Kombination aus einer proportionalen Entnahmerate und dynamisch sinkenden Schwellenwerten stellt eine weitere Erhöhung der Wirksamkeit der MSR

dar, indem sie die TNAC während der gesamten vierten Handelsperiode in den Bereich akzeptabler Werte bringt.

In der gegenwärtigen Situation wirkt sich also eine Anpassung der MSR-Parameter und insbesondere der Schwellenwerte stärker auf die Klimawirksamkeit und Markstabilität aus als eine einmalige Senkung der Obergrenze. Bei einer schwachen MSR kann stärkeres Rebasing jedoch das vorhandene strukturelle Ungleichgewicht adressieren und die Klimawirksamkeit und Marktstabilität erhöhen. In diesem Sinne kann ein Überschreiten der von der EU-Kommission vorgeschlagenen Rebasing-Menge (z.B. 250 statt 117 Mio. Zertifikate) als eine "No-regret"-Option angesehen werden, welche im Falle einer starken MSR oder niedrigeren Emissionen nur begrenzte Auswirkungen hat, aber als Absicherung bei einer schwachen MSR dienen kann.

Selbst bei stärkerem Rebasing ist eine Stärkung der MSR durch dynamisch sinkende Schwellenwerte unerlässlich, um die Klimawirksamkeit und das Marktgleichgewicht während des vierten Handelszeitraums zu gewährleisten. Die Einführung dynamisch sinkender Schwellenwerte entspricht außerdem den Erwartungen an das zukünftige Hedging- und Investitionsverhalten der Marktakteure. Daher sollte die Stärkung der MSR durch Senkung der Schwellenwerte ein Schwerpunkt der ETS-Reformbemühungen sein.

1 Introduction

In July 2021, the European Commission published their proposals for making the EU Emissions Trading System (EU ETS) and the Market Stability Reserve (MSR) "fit for 55" – fit for reaching the 2030 goal of reducing EU greenhouse gas emissions 55% below 2005 levels. For the EU ETS, the EU Commission proposes to increase the reduction target until 2030 to 61% below 2005 levels.[1] This necessitates a new cap trajectory, which the EU Commission proposes to achieve by increasing the linear reduction factor from 2.2% to 4.2% from 2024 onwards. In addition, a one-off reduction is applied which reduces the cap by an additional 117 million allowances in 2024. This quantity reflects the impact on emissions if the new LRF was applied from 2021 already. Without this one-off reduction the LRF would have to be equal to 5.1% from 2024 onwards in order to reach the 2030 reduction target. Related to the Market Stability Reserve, the EU Commission proposes to retain the doubled intake rate of 24% beyond 2023, to introduce a mechanism that avoids threshold effects, limit the maximum amount of allowances in the MSR to 400 million and slightly alter the calculation of the TNAC (Cludius und Graichen 2021).

In this paper, we stay within the proposed reduction target for ETS sectors of 61% below 2005 levels until 2030. We analyse different rebasing options and design options for the parameters of the MSR and how they interact. We use an ETS supply and demand simulation tool developed by Oeko-Institut for the German Emissions Trading Authority (DEHSt) at the German Environment Agency and define a number of emission scenarios in order to analyse impact and performance along two indicators reflecting overall climate effectiveness and market stability (Section 2). We first analyse the EU Commission proposal as a base case (Section 3) to compare other options against. These other options are related to alternative rebasing options (Section 4) and a variation in the parameters of the MSR (Section 5). In Section 6, we conclude.

[1] The 61% reduction refer to all sectors covered by the EU ETS (including aviation and maritime transport), while for stationary sectors the reduction target is equal to 62%.

2 Methodology

2.1 Modelling approach

We use the MSR simulation tool developed by Oeko-Institut for DEHSt to evaluate the functioning of the Market Stability Reserve under different scenarios. It is a static annual quantity-based model i.e. it calculates the quantity of allowances by category and year under given rules for the EU ETS and a given emission trajectory. The principal categories are the number of allowances allocated for free/auctioned, allowances retained/released by the MSR, the size of the MSR, the quantity of allowances cancelled and the total number of allowances in circulation (TNAC). The model allows to change key design parameters both of the MSR (e.g. definition of TNAC, intake rate, thresholds) as well as the ETS (e.g. cap, rebasing, share of free allocation, CBAM rules, scope of the ETS). Emission projections are an exogenous input into the model; we do not estimate the impact of scarcity/ surplus of allowances in the ETS on the emission development.

For this study, we use three different emission trajectories for the stationary ETS for the years 2022 until 2030 to assess the behaviour of the MSR and the overall supply and demand in the ETS. The estimate for 2021 is based on first ETS numbers from the EU Commission published in April 2022 indicating that emissions from stationary installations were 7.3% higher in 2021 compared to 2020 (DG Clima 2022).

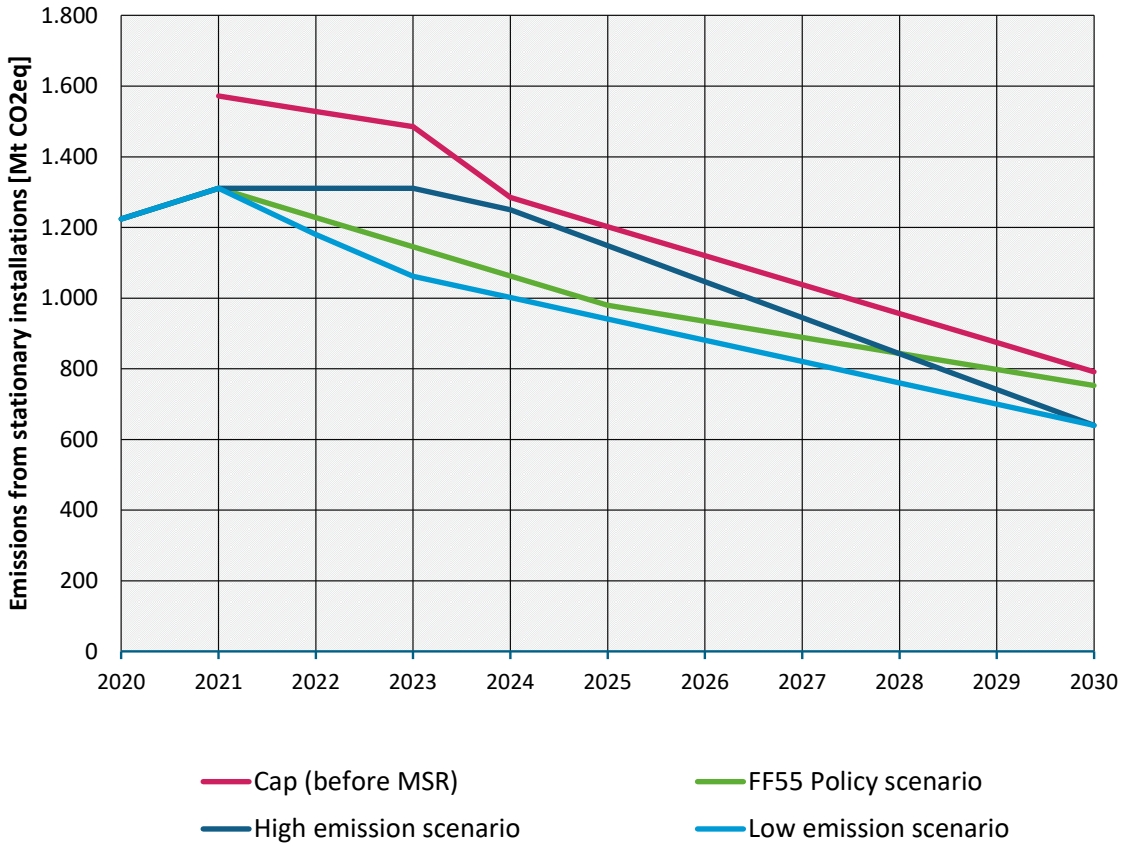
- Fit for 55 Policy scenario: This pathway is based on the MIX scenario used for the impact assessment which accompanied the EU Commission's proposal (E3Modelling 2021). It reflects the emission development if the proposal is implemented as proposed.

As robust modelling results of the impact of the Russian invasion on emissions are not yet available, we make "best-guess" assumptions for two additional scenarios as follows:

- High emission scenario: In this scenario, we assume that the impacts of the attack of Russia on the Ukraine on gas prices will lead to a sustained high emission level, e.g. due to a switch from natural gas to coal in power (and heat) generation. This is followed by a recession and the impacts of a strong push for energy autarky leading to a higher share of renewable energy in Europe than foreseen in the EU Commission's proposal (e.g. see Taylor (10 May 2022)). We assume that the emissions in 2030 are 15% below the FF55 Policy scenario, i.e. the ETS sectoral target of -62% for stationary installations would be overachieved; overall, emissions are approx. 6% higher in the period 2021 to 2030.
- Low emission scenario: Because of the attack on Ukraine and associated higher energy prices a recession reduces emissions in the short term already. Similar to the high emission scenario, scaling up of renewable energy to end the dependency on Russian oil and gas imports leads to an emission level 15% below the policy scenario in 2030 and an overachievement of the ETS sectoral target; overall, emissions are approx. 6% lower in the in the period 2021 to 2030.

For aviation and shipping, the emission scenarios are identical and based on the impact assessments accompanying the FF55 proposal. Ideally the MSR is able to limit the effects of both significantly higher and lower demand on the overall ETS. The scenarios are constructed such that the overall demand change is similar. Against these scenarios the effectiveness of the MSR is measured using the indicators discussed in the next section.

Figure 1: Cap and emission scenarios for the stationary ETS applied in this analysis



Source: own illustration, Oeko-Institut

2.2 Measuring impacts

In the following sections, we employ two indicators to measure the impact and performance of the EU Commission proposal and other options regarding the ETS cap trajectory and MSR parameters. These indicators reflect overall climate effectiveness in the fourth trading period (total allowance supply) and market (im)balance (development of the TNAC).

2.2.1 Total allowance supply in the fourth trading period

We define the total allowances supply during the fourth trading period as the sum of:

- Free allocation to incumbents and new entrants in 2021-2030
- Allowances auctioned after deductions of MSR intakes in 2021-2030

We also show allowances that were invalidated from the MSR for informational purposes. These are allowances that do not contribute to total allowance supply in the fourth trading period.

The total allowance supply to the market can be viewed as an indicator of the overall climate effectiveness during the fourth trading period driven by both the ETS cap and the MSR. In Annex 8 ("Design options for the Market Stability Reserve") of their Impact Assessment of the ETS Directive, the European Commission uses the same indicator under the name "post-MSR cumulative supply" and the "cap post-MSR adjustments" as an important indicator comparing the different cap and MSR design options (e.g. EC 2021; Vivid Economics 2021).

2.2.2 Development of the Total Amount of Allowances in Circulation (TNAC)

Using the Total Amount of Allowances in Circulation (TNAC) as an indicator for market balance was introduced along with the proposal for and the introduction of the Market Stability Reserve in 2014/2015 (EC 2014; EU 2015). The TNAC is defined as:

TNAC = Aggregate supply of allowances – (Aggregate demand for allowances + allowances in the MSR) since 2008 and until 31 December of each year

The aggregate supply of allowances comprises free allocation and allowances auctioned in this timeframe, as well as international credits that have been surrendered by installations or exchanged for EUAs since 2008 and up until 31 December of each year. The aggregate demand for allowances comprises verified emissions from 2008 up until the 31 December of each year.

In the context of the MSR, a TNAC between values of 400 and 833 million allowances is desirable. These values reflect the EU's estimate of hedging (and speculation) needs on the market for EUAs or as the EU Commission puts it their Impact Assessment of the ETS Directive: "The TNAC thresholds for MSR intakes and releases are set in a manner that aims to reflect the range of secondary market holdings that would be consistent with the efficient functioning of the allowances market." (EC 2021, Annex 7, p.15). If the TNAC falls below 400 million, allowances from the MSR are put onto the market. If the TNAC is above 833 million, allowances are placed into the MSR.[2]

In Annex 7 ("Legal review of the Market Stability Reserve") of their Impact Assessment of the ETS Directive, the European Commission notes that: „A large or growing TNAC is an indicator of a lack of scarcity in the short-term, which may be associated with low market prices and therefore insufficient incentives to abate emissions. Likewise, a very low TNAC is an indicator that there may not [be] sufficient supply in the market, including enough available allowances to optimise low-carbon investment strategies across time periods." (EC 2021, Annex 7, p.6).

In this study, we use the TNAC as defined by the EU Commission including the Commission proposal for changing this definition from 2024 onwards, i.e. until the end of 2023 only amounts related to stationary installations (and maritime transport) are considered in the TNAC. From 2024 onwards, also amounts related to aviation are considered in the TNAC. As aviation has been a source of net demand for allowances from stationary installations, this definition leads to a constant difference of an estimated 170 million allowances between the TNAC as defined by the EU Commission and the TNAC visible to market participants, with the TNAC visible to market participants being lower than the estimated one. In addition, some Member States intend to use a flexibility mechanism under the Effort Sharing Regulation which will reduce the TNAC visible to the market by another 75 million allowances.

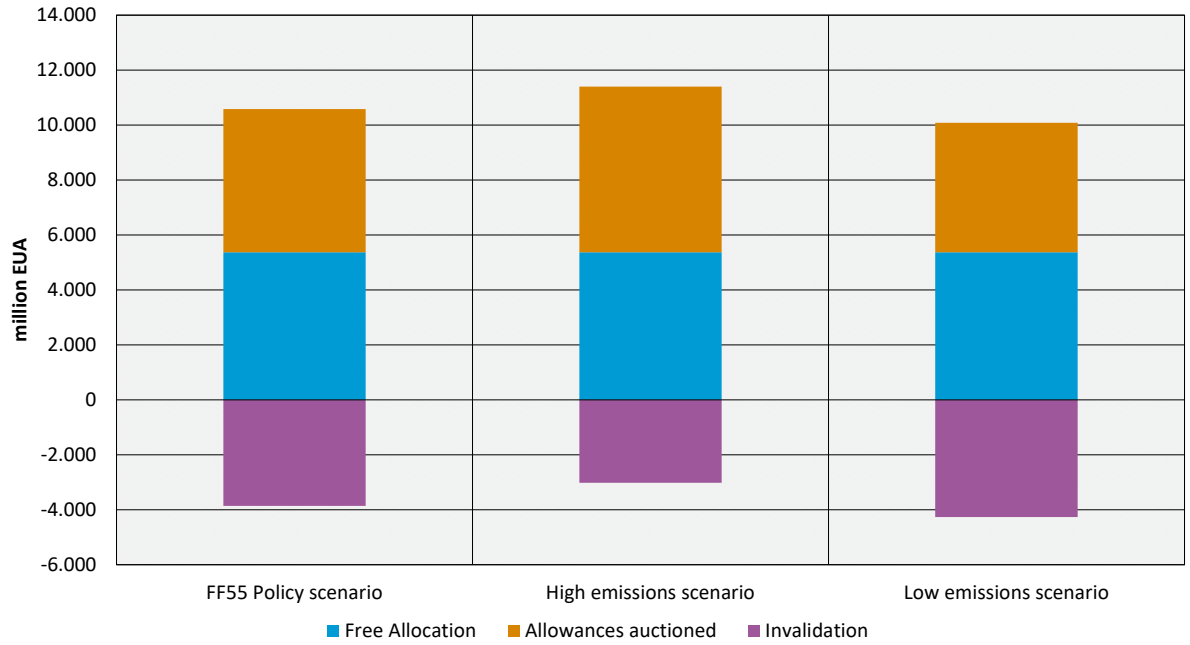
[2] The TNAC for the previous year is published each year by the EU Commission on 15 May. Adjustments in the auction calendars then take place over a period of 12 months starting in September following the publication of the TNAC.

3 Base case: FF55 COM proposal

As a base case, we analyse the EU Commission's FF55 Proposal regarding the ETS cap and MSR parameters. We apply the MSR simulation tool (Section 2.1) and employ the diverging emission scenarios (Section 2.2).

We find that the total allowance supply during the fourth trading period (Figure 2) is quite similar for the FF55 Policy and the low emissions scenario with a slightly higher amount invalidated in the low emissions scenario. This points to the fact that in a low emissions scenario, the MSR is more active in absorbing and invalidating allowances, such that the overall climate effectiveness is similar.

Figure 2: Total allowance supply and invalidation during the fourth trading period in the reference scenario under different baselines

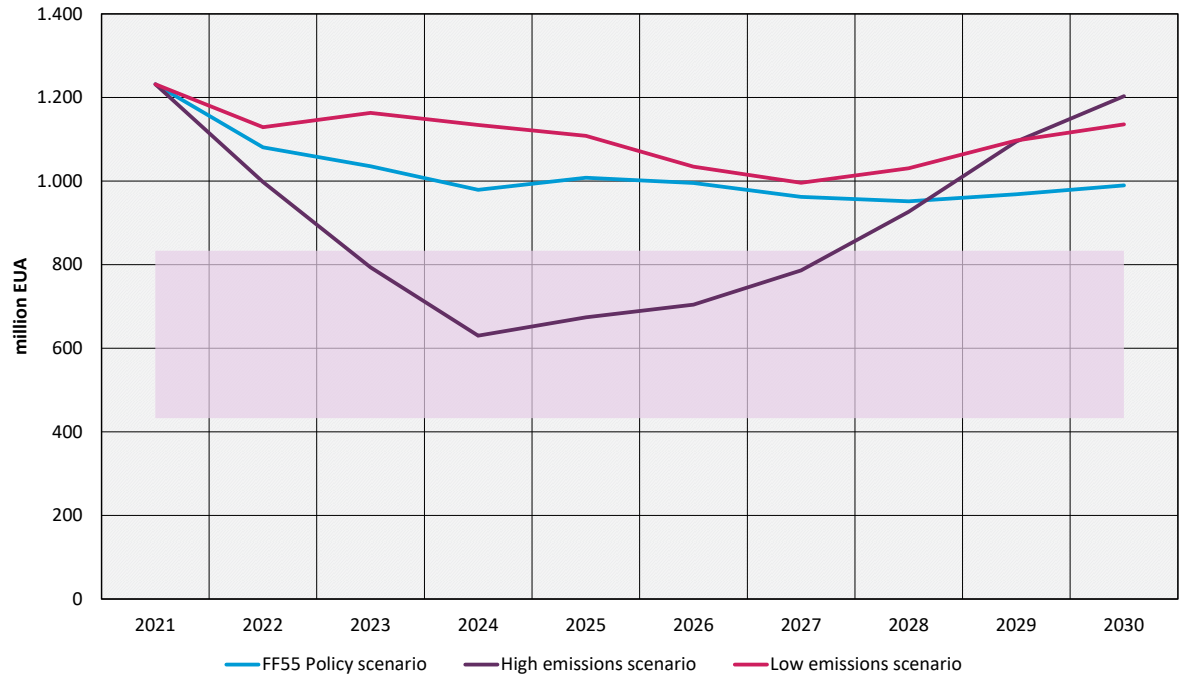


Source: own illustration, Oeko-Institut

In the high emissions scenario, the total allowance supply during the fourth trading period is notably higher and the amount of allowances invalidated lower than in the lower emission scenarios. This points to the fact that the TNAC is reduced due to higher emissions and therefore the MSR is less active during the fourth trading period. A higher supply of allowances corresponds to higher emissions under the scenario and points to the ability of the MSR to making a higher amount of allowances available than in lower emissions scenarios.

Regarding the TNAC trajectory (Figure 3) in the FF55 Policy and the low emission scenarios, the TNAC is above the upper threshold for the duration of the fourth trading period, indicating a market with little scarcity. In the high emissions scenario, the TNAC is within the threshold band for several years but climbs up above the upper threshold for the last three years of the trading period.

Figure 3: TNAC trajectory under the different emission scenarios: COM proposal base case



Source: own illustration, Oeko-Institut

It becomes clear that there is a structural oversupply of allowances in a situation when emissions develop along the trajectory assumed in the EU Commission's impact assessment (FF55 Policy scenario) with the TNAC consistently above the upper threshold during the fourth trading period. The MSR is able to withhold sufficient allowances to ensure a stable market situation but is not able to bring the TNAC within the thresholds. Likewise, in scenarios with accelerated decarbonisation towards the end of the trading period - our low and high emissions scenarios (cf. Section 2.1) -, the design of the cap and MSR as proposed by the EU Commission are not sufficient to stabilize the TNAC within the thresholds (in the high emissions scenario in particular towards the end of the trading period).

This is partly due to the mechanism to avoid a threshold effect: if the TNAC is between 833 and 1 096 million allowances, only the difference between the upper threshold and the TNAC is withdrawn by the MSR. The effective intake rate is shown in Table 1. In many years, the effective intake rate is considerably lower than the maximum 24%.

Table 1: Yearly MSR intake rate by emission scenario in the base case

	2024	2025	2026	2027	2028	2029	2030
FF55 Policy scenario	20%	15%	17%	16%	13%	12%	14%
Low emission scenario	24%	24%	24%	19%	16%	19%	24%
High emission scenario	0%	0%	0%	0%	0%	10%	24%

Note: Values of 0% represent years where the MSR is not triggered, i.e. the TNAC in the previous year(s) is smaller than 833 million allowances.

Source: own calculation, Oeko-Institut

4 Options for rebasing the cap

4.1 Rationale for rebasing

The primary approach to setting ambition in the EU ETS is the determination of the cap and the cap trajectory through the linear reduction factor (LRF). Rebasing can be used to bring the cap in line with emissions if there is a persistent discrepancy between these two values. This has been the case for the EU ETS where emissions have been far below the cap since the financial and economic crisis in 2009. Also, during the fourth trading period the cap is considerably higher than emissions projected in the Impact Assessment throughout the trading period (cf. Figure 1). Stronger rebasing could reduce or eliminate the discrepancy between the cap and emissions.

4.2 Analysed rebasing options

The EU Commission proposes a one-off reduction (rebasing) of 117 million allowances to bring the cap in line with a pathway that would have materialised if the new LRF would have been applied from 2021 onwards already (cf. Section 1). We assess two additional options:

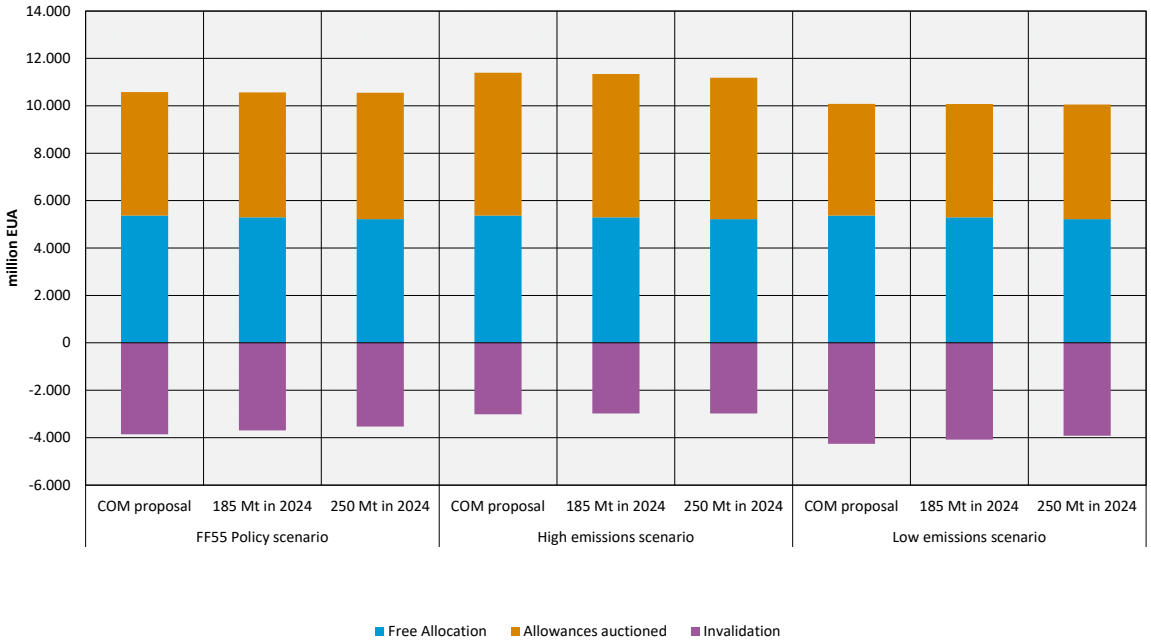
- 185 million allowances: This value includes the additional allowances which have entered the market in the years 2021 to 2023 due to the old LRF of 2.2%. Applying this higher rebasing value leads to the same emissions budget over the entire period as if the higher LRF of 4.2% would have been applied from 2021 already. The EU Commission proposal only achieves the linear trajectory towards 2030 from 2024 onwards. Since the reduction goal for 2030 is kept at 62% compared to 2005 values for the stationary sector, with a rebasing of 185 million allowances the LRF could temporarily be reduced to 3.7% from 2024 until 2030.
- 250 million allowances: This value corresponds roughly to the average difference between the cap and the FF55 Policy scenario in the years 2023 to 2025 (Figure 1). The value also corresponds well to the average difference between cap and emissions in the years 2018-2020 without the UK. Since the reduction goal for 2030 is kept at 62% compared to 2005 values for the stationary sector, with a rebasing of 250 million allowances the LRF could temporarily be reduced to 3.2% from 2024 until 2030.

4.3 Results and interaction with the MSR

We find that the different rebasing options do not make a big difference regarding the overall emissions limit in the FF55 Policy and low emission scenarios (Figure 4), measured by "total allowance supply in the fourth trading period". If the rebasing amount is lower, there is more invalidation of allowances through the MSR mechanism. If the rebasing amount is higher, there is less invalidation of amounts from the MSR. The MSR and its invalidation mechanism compensate a higher cap (with less rebasing) to some extent.

In the high emissions scenario, however, the different rebasing options do have an impact on the total allowance supply during the fourth trading period. This is due to the fact that higher emissions lead to a lower TNAC and therefore less MSR activity. In this case, stronger rebasing has a higher impact compared to a situation with strong MSR activity (which is the case in the low emissions scenarios).

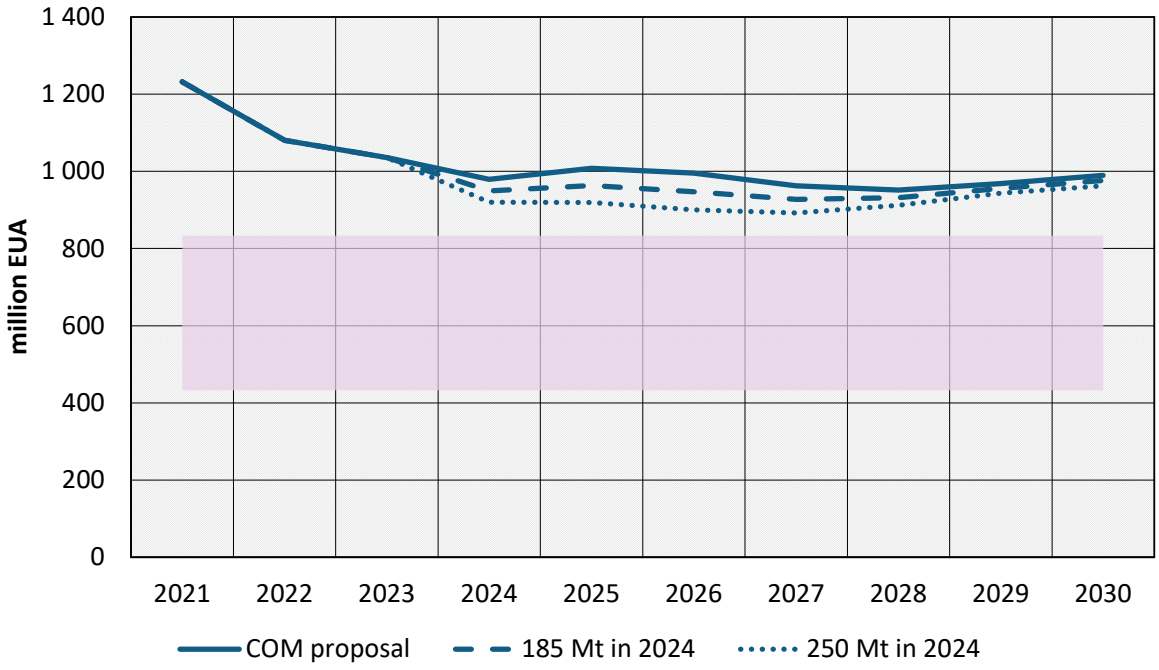
Figure 4: Total allowance supply in the fourth trading period: The rebasing options under different emission scenarios



Source: own illustration, Oeko-Institut

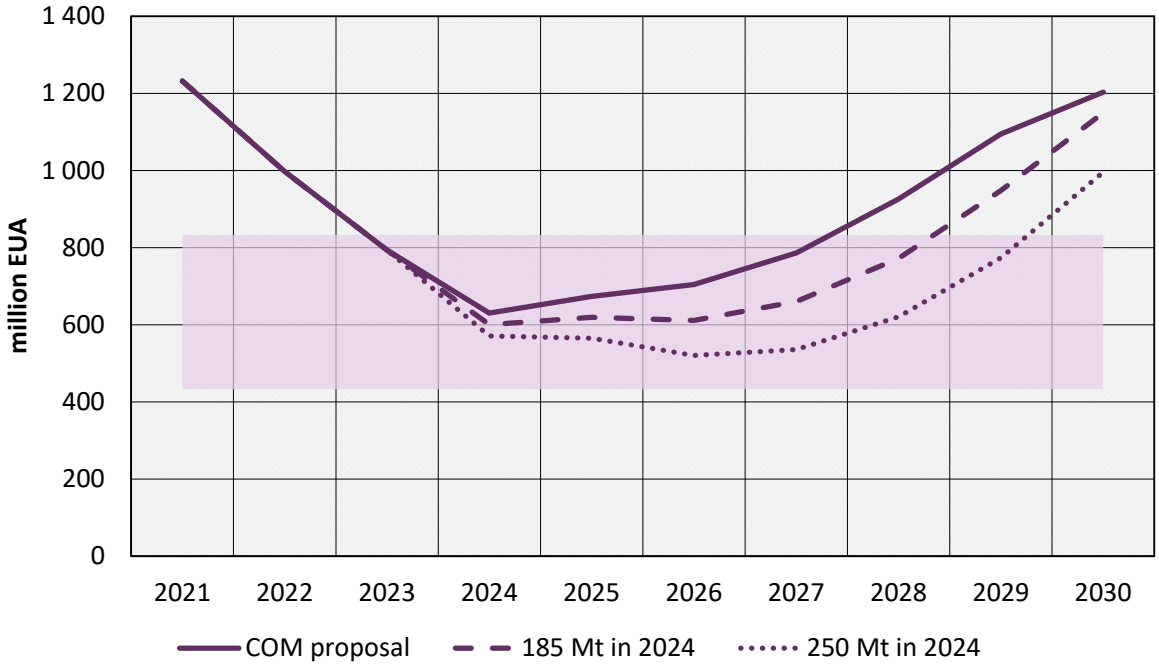
Also related to the trajectory of the total amount of allowances in circulation (TNAC), we find that a higher rebasing has a limited impact in the FF55 Policy scenario and low emission scenario (Figure 5, Figure 7). The TNAC trajectories differ slightly in the middle of the trading period and reach very similar values towards the end of the trading period.

Figure 5: TNAC trajectory under the different rebasing options: FF55 Policy scenario



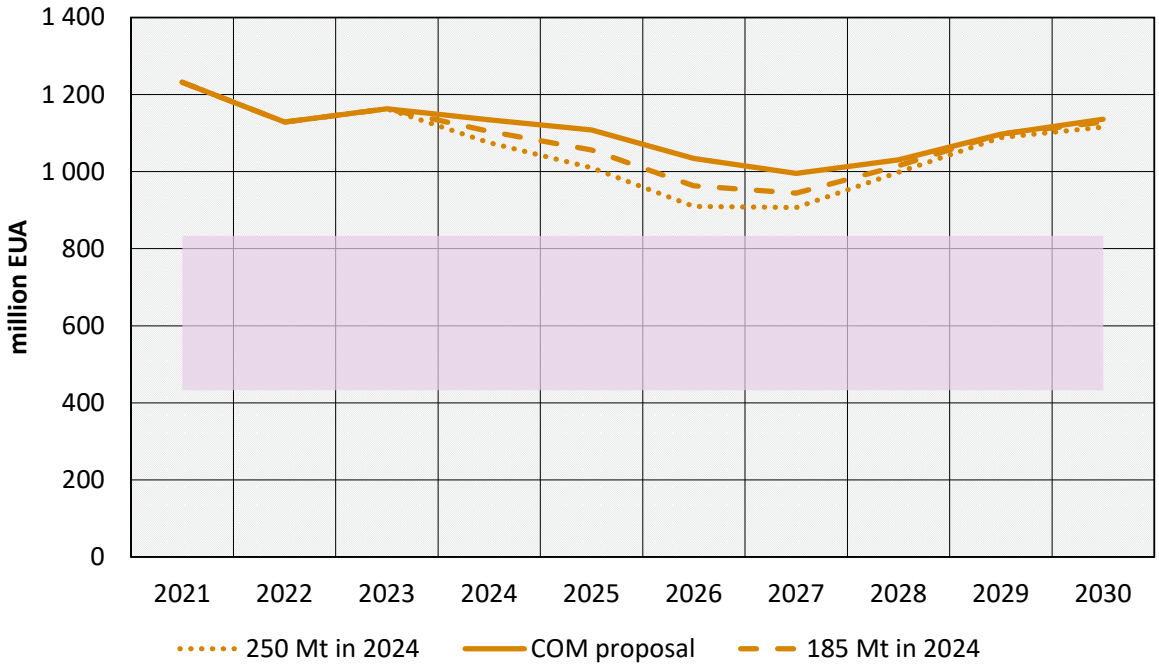
Source: own illustration, Oeko-Institut

Figure 6: TNAC trajectory under the different rebasing options: High emissions scenario



Source: own illustration, Oeko-Institut

Figure 7: TNAC trajectory under the different rebasing options: Low emissions scenario



Source: own illustration, Oeko-Institut

A higher impact of the different rebasing options is observed in the high emissions scenario (Figure 6), leading to a difference of about 100 million allowances in the TNACs from 2026 onwards, which starts to converge towards the end of the period. This is related to the fact that rebasing takes place in a period with less MSR activity thus affecting the TNAC trajectory during and until the end of the period. Due to the steep emission trajectory toward the end of the

trading period, the TNAC rises quite rapidly during these years. The more ambitious rebasing options delay the point in time when the TNAC exceeds the upper threshold by 1-2 years. It can be expected that were this trend extrapolated to the future, the three trajectories in Figure 6 would also converge after a short amount of time post 2030.

The interrelation between rebasing and the MSR intake is shown in Table 2. Higher rebasing leads to a lower effective intake rate. Once the effect of the different rebasing options has been compensated by the MSR reaction, the TNAC converges leading to similar effective intake rates. The exception is the high emission scenario, where the MSR is inactive at least until 2028. In some point in the future the MSR would bring the three TNAC pathways together in that case as well.

Table 2: Yearly MSR intake rate by emission scenario and rebasing option

Scenario	Rebasing	2024	2025	2026	2027	2028	2029	2030
FF55 Policy scenario	COM proposal	20%	15%	17%	16%	13%	12%	14%
	185 Mt in 2024	20%	12%	14%	12%	10%	11%	13%
	250 Mt in 2024	20%	9%	9%	7%	7%	9%	12%
High emission scenario	COM proposal	0%	0%	0%	0%	0%	10%	24%
	185 Mt in 2024	0%	0%	0%	0%	0%	0%	12%
	250 Mt in 2024	0%	0%	0%	0%	0%	0%	0%
Low emission scenario	COM proposal	24%	24%	24%	19%	16%	19%	24%
	185 Mt in 2024	24%	24%	21%	14%	12%	18%	24%
	250 Mt in 2024	24%	23%	17%	8%	8%	17%	23%

Note: Values of 0% represent years where the MSR is not triggered, i.e. the TNAC in the previous year(s) is smaller than 833 million allowances.

Source: own calculation, Oeko-Institut

Although we show that the MSR is – in some sense – able to offset a lower rebasing amount / a higher cap, there are other reasons why strengthening ambition directly through the cap rather than indirectly through MSR invalidation has advantages. Referencing Vivid Economics (2021), the EU Commission states that the potential impact on market prices of strengthening the cap directly is likely higher than that of the MSR (EC 2021). In fact, Vivid Economics (2021) summarise a number of studies that show that relying too heavily on the MSR as a mechanism to increase ambition may have the opposite effect and is less certain than increasing ambition through the cap directly.

4.4 Interim results

The structural imbalance between supply and demand in the EU ETS stretching back to the year 2009, provides a reasonable impetus to reduce allowances one-off in order to bring into better correspondence cap and emissions. The one-off reduction of the cap in 2024 by 117 million allowances as proposed by the EU Commission, however, is not sufficient to fully balance cap and emissions. Comparing the proposed reduction to two more ambitious rebasing alternatives does increase the climate effectiveness of the system in a setting where emissions are higher

than expected in the central FF55 Policy scenario. In scenarios with medium or low emissions, the more ambitious rebasing options yield little difference compared to the EU Commission proposal. This is due to the fact that the MSR together with its invalidation mechanism in part compensate for a less ambitious rebasing. In case of a less ambitious MSR (e.g. if the proposed continuation of the doubled intake rate does not make it through the trialogue), rebasing does make a difference in terms of the overall supply of allowances during the fourth trading period (EC 2021). Beyond the mechanical effects calculated here, rebasing may, however, present a stronger and more certain signal to the market than the indirect balancing achieved through the MSR with accompanying effects on emissions and prices.

Finally, we find that in both the FF55 Policy scenario and the low emissions scenario, the TNAC is consistently above the upper threshold during the duration of the fourth trading period, even in a situation with a more substantial rebasing of the cap, pointing to the importance of a reform of the parameters governing the MSR, such as the intake rate and in particular the thresholds. Matthes (2022) who analyses the impact of rebasing and MSR parameter options in the context of a dynamic model that can simulate a number of uncertainties related to the behaviour of market participants also notes that besides an adjustment of the cap, strengthening the MSR is imperative for a robust achievement of the ETS reduction targets. We will explore a number of options to strengthen the MSR in the next section.

5 Optimising the MSR

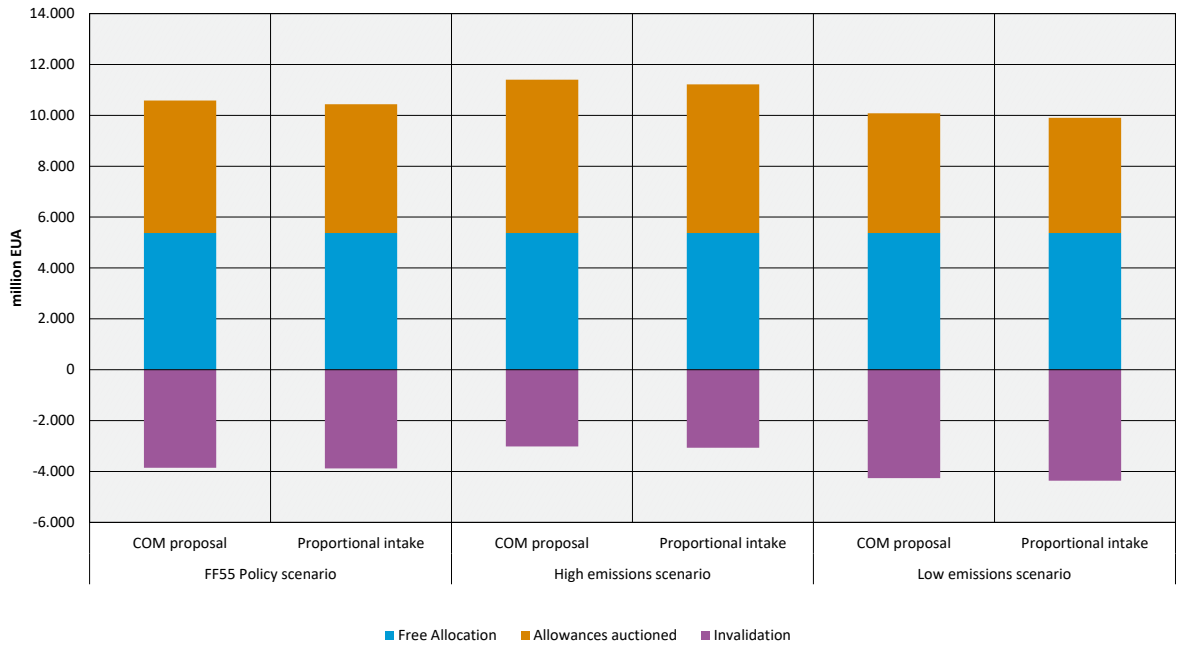
Following results from the previous section, we expect the TNAC to remain well above the upper threshold in the FF55 Policy and low emissions scenarios if the MSR parameters are not adjusted. The TNAC may even increase towards the end of the trading period if our assumptions on accelerated decarbonisation in the second half of the trading period come true. This implies that the current design of the MSR is not yet optimal. In the following, we investigate the impact changes to the intake rate and threshold levels would have on the overall allowance supply in the fourth trading period as well as on the development of the TNAC.

5.1 Intake rate

The intake rate determines the amount of allowances that are withheld from auctions and added to the MSR if the TNAC is above the upper threshold level. In its original design, the MSR had an intake rate of 12% (EU 2015). It was then decided to double the intake rate and apply this 24% intake rate until 2023. In their FF55 proposal, the European Commission wants to extend the application of the 24% rate until 2030 and has also proposed the introduction of a mechanism that would avoid threshold effects when the TNAC is close to the upper threshold.

As results from Section 3 and 4 imply, this rate is likely too low – at least in some settings – to keep the TNAC between the upper and lower threshold levels. Zaklan et al. (2021) find that using a proportional intake rate instead of a static one is a robust way to effectively control the size of the TNAC, especially in the context of low emission scenarios. In this section, we adopt the proportional intake rate proposed by Zaklan et al. (2021) and compare results to the EU Commission's proposal.

Figure 8: Impact of a proportional intake rate on total allowance supply in the fourth trading period



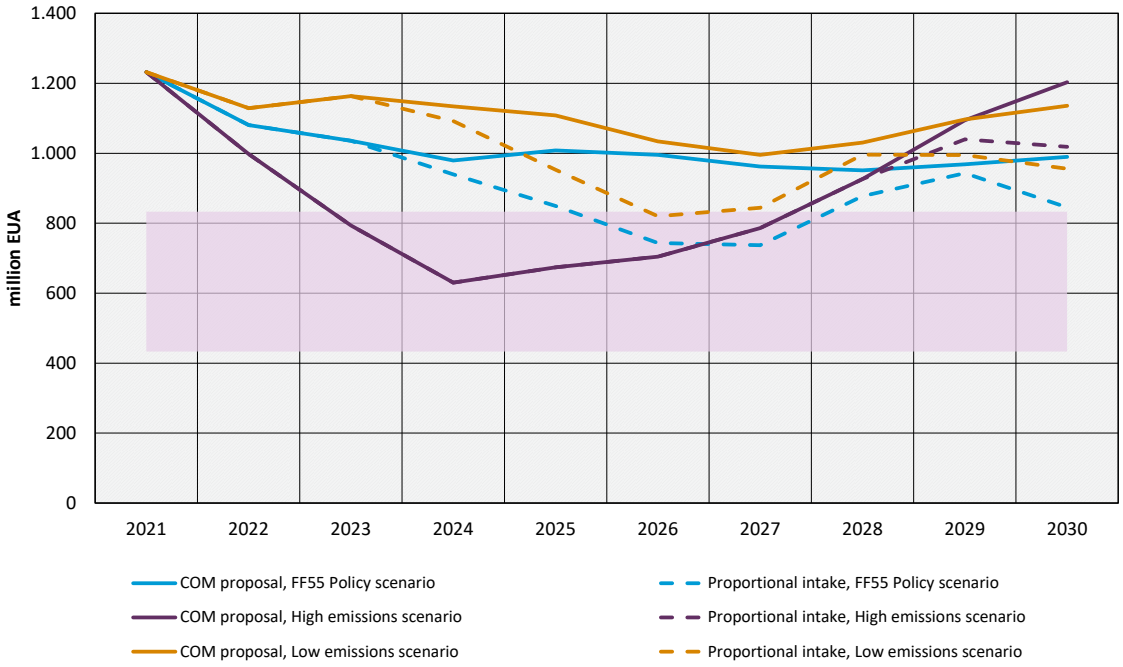
Source: own illustration, Oeko-Institut

The proportional intake rate is equal to the scalar obtained when the TNAC is divided by the lower threshold value (TNAC/lower threshold) multiplied by 12%. Since the intake rate is in

itself scaled to the size of the difference between the TNAC and the threshold levels, there is no need for an adjustment mechanism to avoid threshold effects as in the COM proposal.

Under all considered emission scenarios, the proportional intake rate leads to a slightly lower total allowance supply than the intake rate proposed by the EU Commission (Figure 8).

Figure 9: Impact of a proportional intake rate on the development of the TNAC during the fourth trading period



Source: own illustration, Oeko-Institut

Especially for the FF55 Policy scenario and the low emissions scenario, we observe that – between 2024 and 2027 - a proportional intake rate is more effective at bringing the TNAC into the threshold range than the intake rate proposed by the EU Commission (Figure 9). Since the TNAC lies between the threshold levels from 2023 onwards in the high emissions scenario and the proportional intake rate only applies from 2024 onwards, there is no large difference between the COM proposal and the proportional intake rate until the later years of the period, when the TNAC is starting to grow larger than the upper threshold.

The proportional impact rate is also more effective at the end of the trading period in both the low and high emissions scenarios. In these scenarios the TNAC is growing as we assume that the 62% reduction target in the stationary sector is overachieved due to accelerated decarbonisation as a consequence of the war in Ukraine and its repercussions (cf. section 2.1). This can also be observed in Table 3 where the effective proportional intake rate is always larger than the COM proposal intake rate. Even in the low emission scenario it is able to bring the TNAC within the thresholds at least for one year. It also shows that the mechanism to avoid a threshold effect for TNAC values between 833 and 1 096 million significantly reduces the activity of the MSR. In the FF55 Policy scenario, the MSR only withholds between 50 and 65% of the allowances compared to a constant intake rate of 24%.

Table 3: Development of the proportional intake rate by emission scenario

Scenario	Intake rate	2024	2025	2026	2027	2028	2029	2030
FF55 Policy scenario	COM proposal	20%	15%	17%	16%	13%	12%	14%
	Proportional	31%	28%	0%	0%	22%	26%	28%
High emission scenario	COM proposal	0%	0%	0%	0%	0%	10%	24%
	Proportional	0%	0%	0%	0%	0%	28%	31%
Low emission scenario	COM proposal	24%	24%	24%	19%	16%	19%	24%
	Proportional	35%	33%	29%	0%	25%	30%	30%

Note: Values of 0% represent years where the MSR is not triggered, i.e. the TNAC in the previous year(s) is smaller than 833 million allowances.

Source: own calculation, Oeko-Institut

The TNAC values shown here are the ones corresponding to the EU Commission's definition. The TNAC visible to the market is lower due to the net demand from aviation in the years until 2024 and due to the flexibility under the Effort Sharing Regulation. By 2030, the difference is approx. 245 million allowances lower than the TNAC (cf. Section 2.2.2).

5.2 Thresholds

The MSR threshold levels in effect describe the acceptable or needed level of surplus on the market for EUAs. This range has been defined to lie between 400 and 833 million EUAs and the EU Commission does not propose to change these values. Surplus allowances on the market are providing liquidity to the market and are used for i) hedging of future compliance obligations and ii) investment activity. Related to the latter, Vivid Economics (2021) points out that short-term investment, where allowances are held for less than a year before being resold is unproblematic, since the compliance cycle lasts for one year and certificates that are needed to comply with compliance requirements can be bought at any point in time during this year. Long-term investment, i.e. buying and holding allowances for more than one year (without selling them via a derivate contract), however, can have an impact on market liquidity if the amount held in this way becomes sufficiently high.

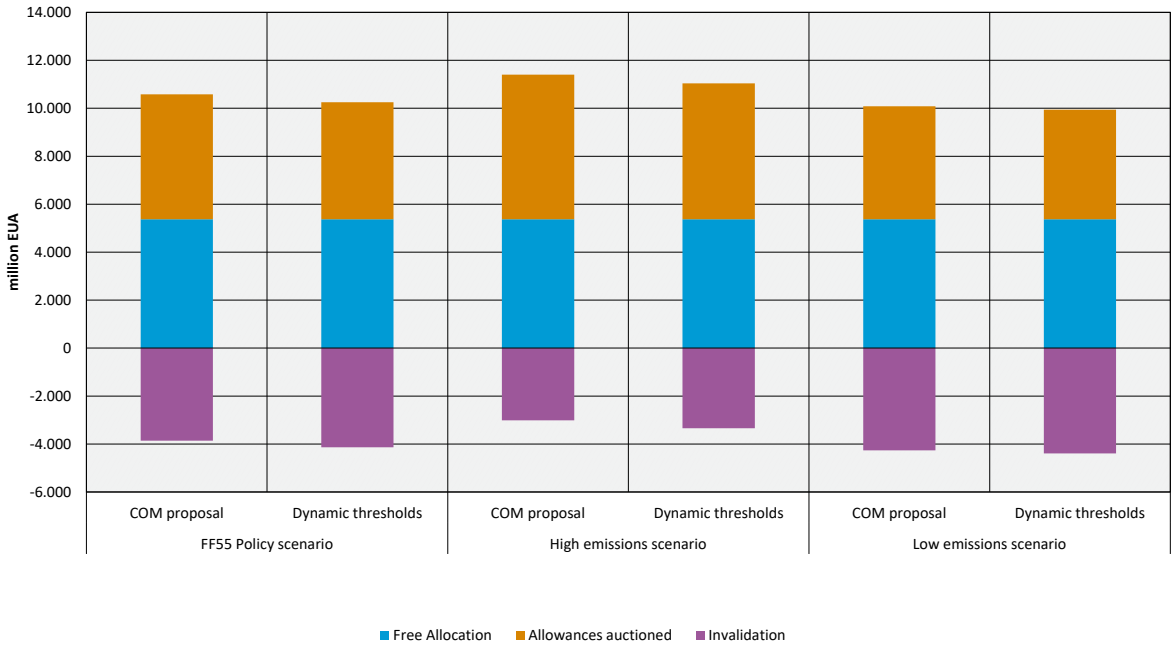
Based on Vivid Economics (2021), the EC (2021) estimates that hedging demand from the power sector will be reduced significantly during the course of the fourth trading period from a range of about 550– 950 million EUAs to 250 – 550 EUAs. While industrial hedging and hedging demand from aviation is likely to grow during the fourth trading period, the EC (2021) expects that neither this growth nor a possible growth in the demand for long-term investment in and holding of allowances will offset the decrease in demand for surplus allowances through reduced hedging demand from the power sector. The European Securities and Markets Authority, ESMA (2022), also concedes that the impact of long-term speculative behaviour (e.g. "buy- and hold strategies") is so far limited, but should be monitored. As emission reduction progresses and the cap gets smaller, measures to sustain liquidity may be needed. Further research is needed into this liquidity requirement and whether it poses limits to the way in which thresholds can decline over time.

ESMA proposes to extend position management controls and enhance transparency on derivative trading (ESMA 2022). They do not make proposals regarding the ETS cap or MSR

design, as they make recommendations from "a financial supervisory perspective" strictly related to market activities.

As an alternative option to the current thresholds, we apply dynamic threshold levels that decline with the rate of the cap from 2024 onwards. The rate of decline is defined as the 2021 cap compared to the cap in the relevant year. In effect, the relationship between cap and threshold is held constant at the 2021 value. Both the upper and lower threshold levels decline and the corridor becomes smaller during the course of the fourth trading period (cf. Figure 11).

Figure 10: Impact of dynamically declining thresholds on total allowance supply in the fourth trading period



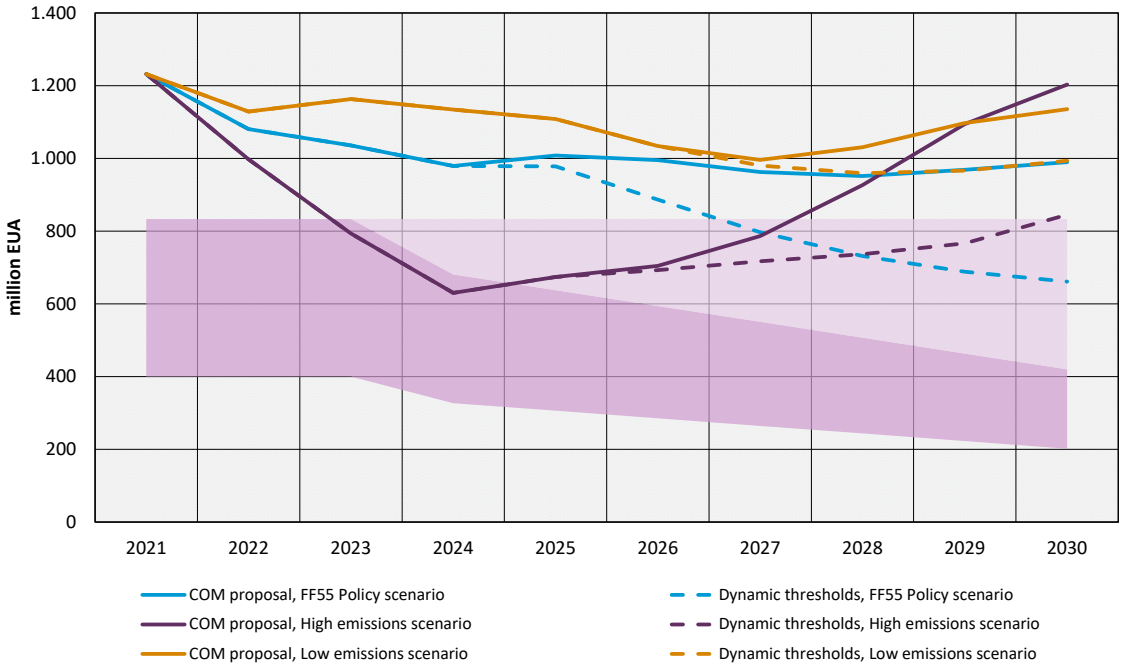
Source: own illustration, Oeko-Institut

Dynamically declining thresholds would increase the MSR intake, thus reducing the amount of allowances auctioned, as well as leading to a larger amount of allowances to be invalidated from the MSR during the fourth trading period (Figure 10). This applies to all three emission scenarios, whereas the effect is minimal in the low emissions scenario.

While dynamically declining thresholds are better able to keep the TNAC within or close to the corridor (Figure 11), a combination of the COM proposed intake rate and the dynamically declining thresholds does not lead to a situation where the TNAC lies between the dynamic threshold levels for any of the emission scenarios.

Especially towards the end of the trading period, however, dynamically declining threshold levels seem to me more effective in controlling the TNAC than the current threshold levels – and also compared to the proportional intake rate analysed in Section 5.1 for the emission trajectories assumed in this analysis (cf. Figure 11 and Figure 9).

Figure 11: Impact of dynamic thresholds on the development of the TNAC during the fourth trading period



Source: own illustration, Oeko-Institut

Similar to the results presented here, Vivid Economics (2021) also find that dynamic threshold levels lead to a longer MSR intake, a lower TNAC and higher prices than maintaining the current fixed thresholds. Matthes (2022) investigates the impact of dynamically declining thresholds as part of a simulation that takes into account different levels of aggregate hedging and investment demands and finds that 2030 reduction targets can only robustly be met if MSR thresholds decline. This holds for different cap trajectories, underlining the importance of strengthening the MSR even if the cap is adjusted.

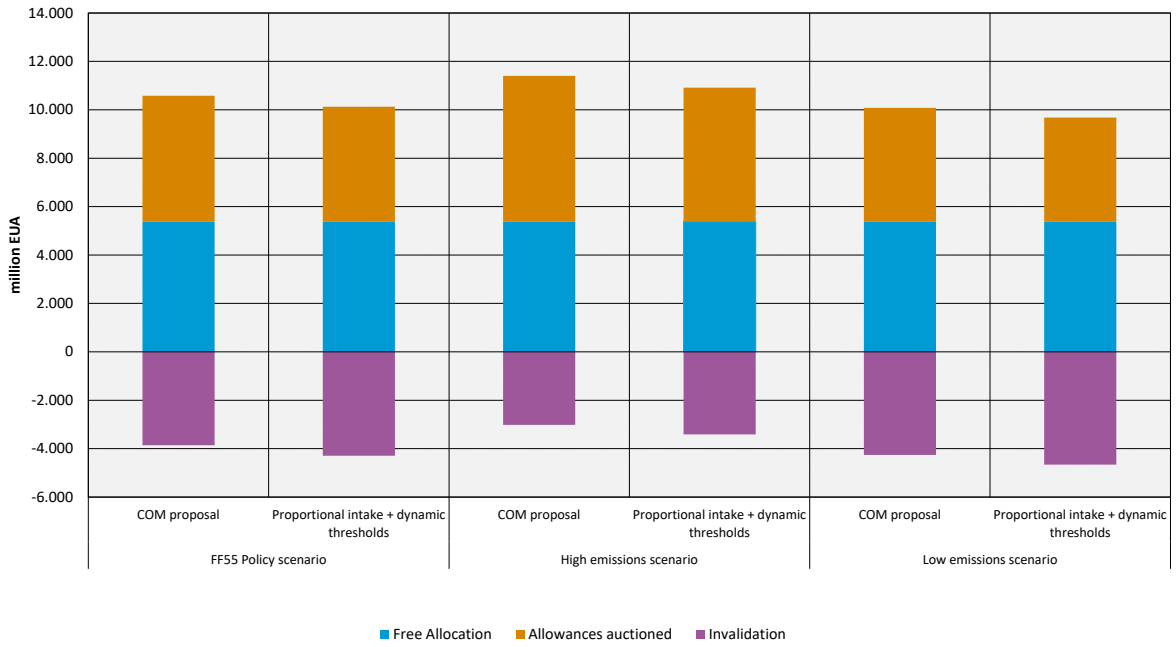
5.3 Combining a proportional intake rate with dynamically declining thresholds

As neither the proportional intake rate nor the dynamically declining thresholds alone are able to reduce the TNAC to levels in the vicinity of the newly defined thresholds, Figure 13 combines a proportional intake rate and dynamically declining thresholds. For all emissions scenarios, the TNAC is within or considerably closer to the defined corridor than under the COM proposal – or under the proportional intake rate or dynamically declining thresholds alone (Figure 13).

Combining a proportional intake rate with dynamically declining thresholds, is also the advice that Vivid Economics (2021) give in their Review of the MSR. In the EC (2021)'s Impact Assessment of the ETS revision proposal, the "MSR2" configuration combines a proportional intake rate (of 33% of the difference between the TNAC and the upper threshold) and dynamically declining thresholds (the upper threshold starting at 700 million EUA in 2024 and declining with the cap from 2025 onwards). Since Annex 8 of the Impact Assessment does not include the 24% intake rate (including a mechanism that avoids threshold effects) as proposed by the EU Commission, it is infeasible to directly compare our results to those of the Impact Assessment.

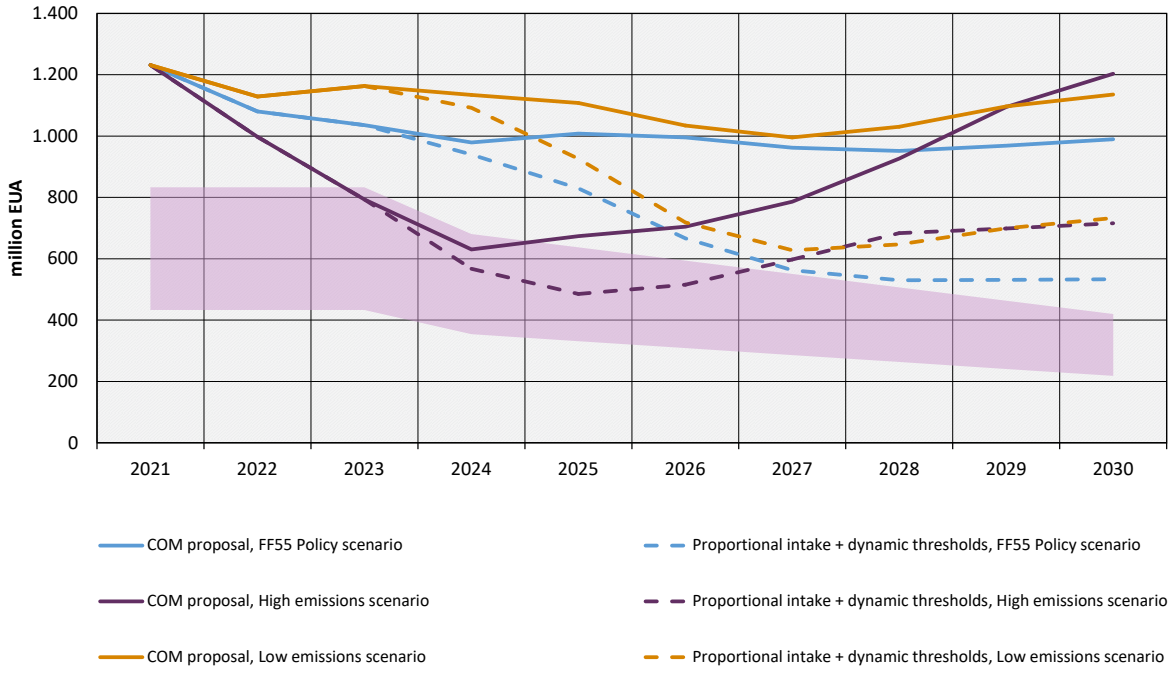
Besides more effectively balancing the TNAC, the combination of a proportional intake rate and dynamically declining thresholds lead to a lower overall supply of allowances during the fourth trading period in all three emission scenarios (Figure 12).

Figure 12: Impact of the combination of a proportional intake rate and dynamically declining thresholds on the total allowance supply in the fourth trading period



Source: own illustration, Oeko-Institut

Figure 13: Impact of the combination of a proportional intake rate and dynamically declining thresholds on the development of the TNAC during the fourth trading period



Source: own illustration, Oeko-Institut

We also explored the impact of the different rebasing options for a combination of dynamically declining thresholds and a proportional intake rate (cf. Figure 14 and Figure 15 in the Appendix). In a setting where a proportional intake rate and dynamically declining thresholds are combined, the different rebasing options only have a small impact on the overall allowance supply during the fourth trading period (Figure 14 in the Appendix). As in Section 4, we find that the strongest effect of the different rebasing options can be observed on the trajectory of the TNAC in the high emissions scenario – also in a case where dynamically declining thresholds are combined with a proportional intake rate (Figure 15).

6 Summary of findings and conclusion

In this analysis, we compare the proposal for a one-off reduction (rebasing) of the cap and the MSR parameters by the EU Commission with a number of alternatives for three emission scenarios: the FF55 Policy scenario, a high and a low emissions scenario. All of these options operate within the context of the EU's 55% reduction target for 2030, translating into a 61% reduction target in the EU ETS sectors (62% reduction in the stationary sector). We therefore do not explore a raise in ambition of the EU or EU ETS targets that would be compatible with the 1.5 degree target.

We find that under the rebasing option and MSR parameters proposed by the EU Commission and against the backdrop of expected emissions in this policy context, the aggregate surplus does not grow further, but the TNAC is consistently above the upper threshold for the duration of the fourth trading period. The MSR is able to withhold sufficient allowances to ensure a stable surplus but is not able to bring the TNAC within the thresholds.

In the context of MSR parameters proposed by the EU Commission, more ambitious rebasing options have a limited effect on both the overall amount of allowances available in the fourth trading period (our proxy for the effective emission limit and therefore climate effectiveness) and the development of the TNAC (our proxy for market balance), as the MSR mechanism compensates the lower ambition of the cap with higher intakes and cancellations. However, more ambitious rebasing options do make a difference in the high emissions scenario and in case the MSR is weaker than proposed by the EU Commission (e.g. in case the current doubled intake rate of 24% is reduced again to 12%). What is more, there may be a signalling effect of more ambitious rebasing compared to the more indirect balancing through the MSR, which could lead to stronger abatement efforts of market participants.

We also investigate how alternative designs of the MSR intake rate and thresholds influence overall allowance supply and the development of the TNAC. A proportional intake rate that operates on the basis of the difference between the TNAC and the lower threshold level is more effective in limiting overall allowance supply and controlling the TNAC than the static intake rate proposed by the EU Commission. Dynamically declining thresholds have an even higher impact and are particularly effective in the FF55 Policy and high emission scenarios. The combination of both a proportional intake rate and dynamically declining thresholds further increases the effectiveness of the MSR in bringing the TNAC into the range of acceptable levels throughout the fourth trading period.

In the current setting, therefore, adjusting the MSR parameters and in particularly the thresholds has a stronger impact on the total amount of allowances in the market than a one-off reduction of the cap. With a weak MSR, however, the prevailing structural imbalance between the cap and emissions should be addressed by a more substantial rebasing than the 117 million proposed by the EU Commission. In this sense, going towards a rebasing amount in the order of 250 million can be seen as a no-regret option that has a limited impact in case of a strong MSR or low emissions, but can act as a safeguard against a weak MSR or low emissions. It is also in line with the expected difference between emissions in the fourth trading period and the cap.

Based on our analysis and results from the literature, strengthening the MSR by introducing dynamically declining thresholds is a priority reform option in the context of the upcoming trialogue discussions - even if adjustments to the cap are made. This necessity was recognised by the European Parliament's ENVI committee calling for dynamically declining and reduced threshold levels in its 17/05/2022 decision.

7 List of references

Cludius, J.; Graichen, J. (2021): Aligning the EU ETS and the Market Stability Reserve with the new EU climate change target for 2030 (Fact Sheet). German Environment Agency, 2021. Online available at https://www.umweltbundesamt.de/sites/default/files/medien/3521/dokumente/factsheet_cap_msr_en_final.pdf, last accessed on 13 May 2022.

DG Clima - European Commission DG Climate Action (2022): Emissions trading: greenhouse gas emissions up by 7.3% in 2021 compared with 2020. Online available at https://ec.europa.eu/clima/news-your-voice/news/emissions-trading-greenhouse-gas-emissions-73-2021-compared-2020-2022-04-25_de, last updated on 25 Apr 2022, last accessed on 12 May 2022.

E3Modelling (2021): 'Fit for 55' MIX scenario, Summary report: Energy, transport and GHG emissions, July 2021. Online available at https://energy.ec.europa.eu/document/download/dbfc4056-8657-403a-b852-93c3ef04e05a_en.

EC - European Commission (2014): Proposal for a Decision of the European Parliament and of the Council concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC (SWD(2014) 17 final), 2014, last accessed on 15 May 2015.

EC - European Commission (2021): Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC stablishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757 (COM(2021) 551 final), 14 Jul 2021. Online available at https://ec.europa.eu/info/sites/default/files/revision-eu-ets_with-annex_en_0.pdf, last accessed on 28 Aug 2021.

ESMA - European Security and Markets Authority (2022): Emission allowances and associated derivatives, Final report (ESMA 70-445-38), 2022. Online available at https://www.esma.europa.eu/sites/default/files/library/esma70-445-38_final_report_on_emission_allowances_and_associated_derivatives.pdf, last accessed on 11 Apr 2022.

EU - European Union (2015): Decision (EU) 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC. In: *OJ L* 264, pp. 1–5. Online available at https://publications.europa.eu/en/publication-detail/-/publication/01c4f171-6e49-11e5-9317-01aa75ed71a1/language-en, last accessed on 10 Nov 2018.

Matthes, F. C. (2022): The Revision of the EU ETS Directive - Assessing Cap and MSR Reform Options. Oeko-Institut. AirClim and Life ETX Consortium (ed.), 2022. Online available at https://carbonmarketwatch.org/wp-content/uploads/2022/05/Oko-Institut-2022-The-Revision-of-the-EU-ETS-Directive-Assessing-Cap-and-MSR-Reform-Options-v8finalRefFix-1.pdf, last accessed on 12 May 2022.

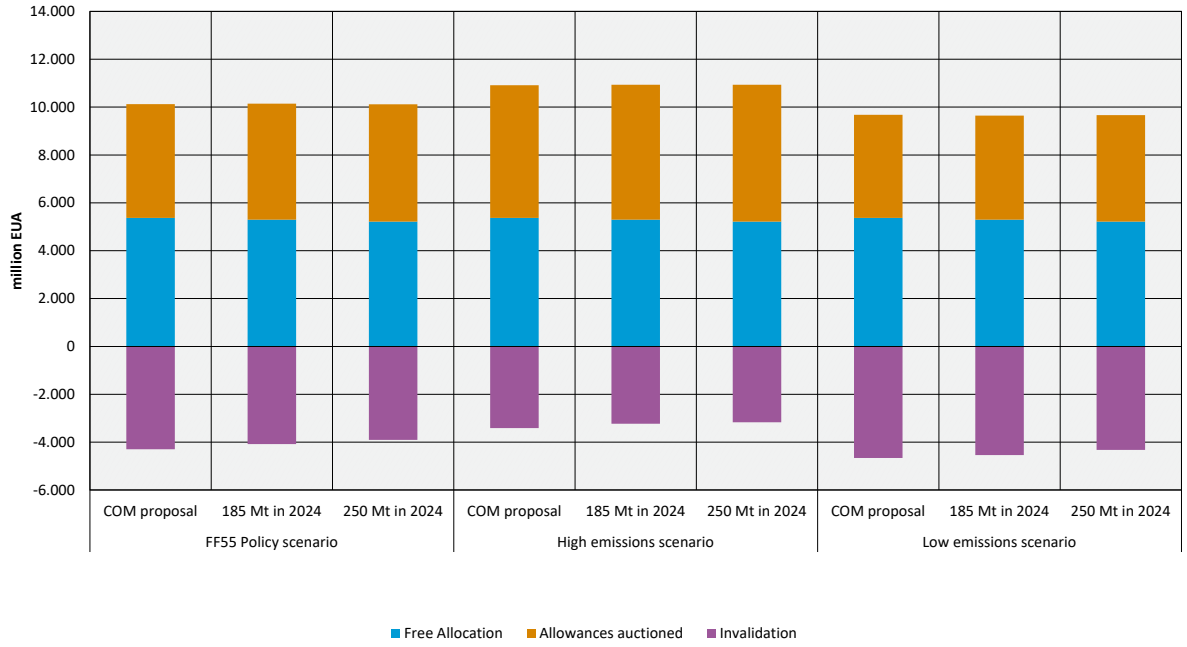
Taylor, K. (10 May 2022): LEAK: EU Commission considering higher renewable energy target for 2030. In: *Euractiv*, 10 May 2022. Online available at https://www.euractiv.com/section/energy/news/leak-eu-commission-considering-higher-renewable-energy-target-for-2030/, last accessed on 12 May 2022.

Vivid Economics (2021): Review of the EU ETS Market Stability Reserve. European Commission (ed.), 2021. Online available at https://op.europa.eu/en/publication-detail/-/publication/5fac10fc-353a-11ec-bd8e-01aa75ed71a1, last accessed on 23 Feb 2022.

Zaklan, A.; Graichen, J.; Graichen, V.; Hermann, H.; Cludius, J. (2021): Structural Supply Side Management in the EU ETS - Reviewing the Market Stability Reserve (Climate Change, 39). Deutsche Emissionshandelsstelle (DEHSt) im Umweltbundesamt, 2021. Online available at https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2021-05-19_cc_39-2021_msr_review.pdf.

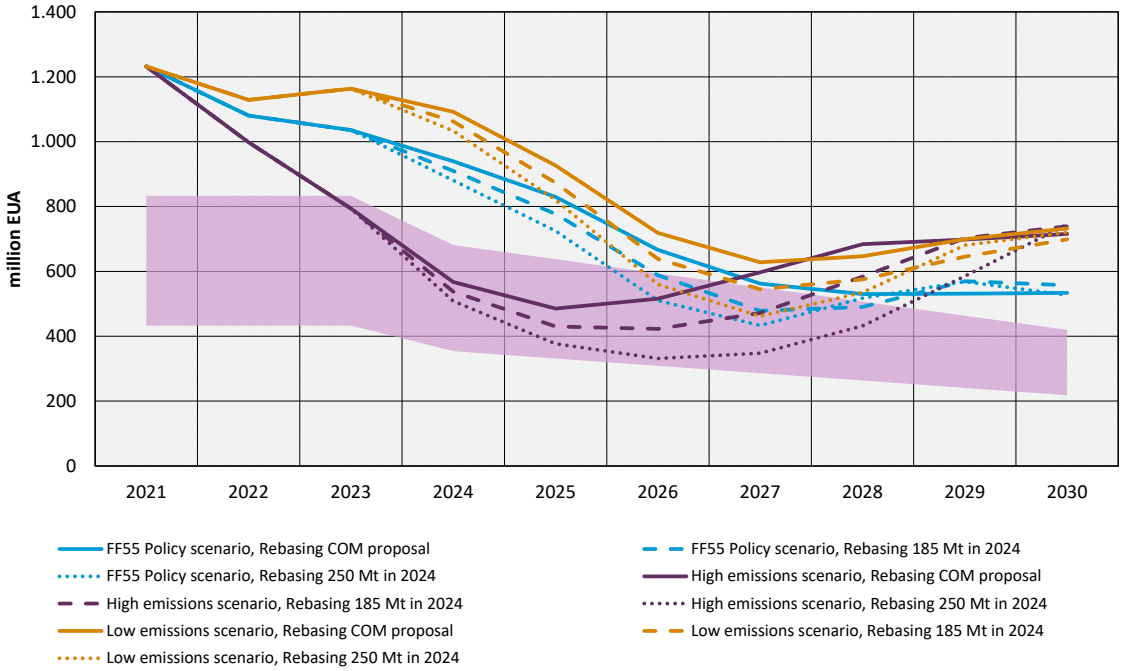
A Appendix

Figure 14: Impact of different rebasing options on total allowance supply in the fourth trading period for a combination of a proportional intake rate and dynamically declining thresholds



Source: own illustration, Oeko-Institut

Figure 15: Impact of different rebasing options on development of the TNAC during the fourth trading period for a combination of a proportional intake rate and dynamically declining thresholds



Source: own illustration, Oeko-Institut