Options to strengthen the EU ETS

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Executive Summary

After the Commission proposed legislation for amending the EU ETS for the post-2020 period in July 2015, the discussions are still on-going in the European institutions as well as in the national ministries.

With the ambitious Paris agreement and the fact that the Commission proposal does still not put the EU ETS on a linear path to reach the long-term 2050 emission reductions target, the question emerged how to introduce more ambition to the EU ETS.

This study picks up this question and analyses several options to strengthen the EU ETS by increasing the ambition in the fourth trading period.

Scenarios modelled and assessment methodology

The study concentrated on four main options to strengthen the EU ETS:

1. A higher linear reduction factor
2. A tighter MSR
3. A combination a higher LRF and a tighter MSR
4. Effect of over-lapping policies (explanatory examples on national and EU level)

Furthermore, additional sensitivities are calculated which in total lead to roughly 130 carbon price scenarios which were modelled for this study. In this study only a couple of options are brought forward, more details can be found in section 2.2.

In order to model the effect of the assumed reforms on the EU ETS, the ICIS Timing Impact Model was used which incorporates fundamental developments as well as the trading strategies of compliance companies. The model is explained in section 2.1.

As not all features of the discussed post-2020 reform could be implemented in the study, the depth of the analysis presented is limited in certain areas. The limitations are detailed in section 2.3.

The options modelled are ranked in a criteria system which incorporates the two-target function of the EU ETS – deliver emission reductions cost-efficiently – as well as additional criteria around protection, predictability and support. To do so a “traffic light system” was developed to show how well a reform option achieves the success criteria (more details in section 2.4). The criteria used are:

1. Ambition in terms of emission reductions
2. Cost-efficiency
3. Effect on EU ETS supply volumes
4. Predictability of the system
5. Effect on compensation mechanisms for low GDP member states

In the four main groups several options were modelled to analyse in depth the effect of various options.

Coverage of analysis

The study brings forward carbon price projections until 2030 on various scenarios. Next to carbon prices, the effect on the fundamental supply volumes and the cumulative fundamental balance – the surplus of the system – is analysed. In order to assess the level of support for low GDP member states a special focus of the analysis lies on the effects of the reform on the compensation mechanisms, namely the modernisation fund and 10c/derogation volumes. As probably the central target of the EU ETS is to reduce emissions, the implemented abatement measures and consequently the emission reductions are featured.

Based on the modelling of ICIS Tschach Solutions, EURELECTRIC made an additional assessment about the effects on compliance costs for the power sector.

Findings of the study

The first scenario group, increasing the 2030 target by increasing the linear reduction factor, generally leads to later ambition in the fourth trading period. This late ambition applies to emission reductions, which are only significantly triggered towards the end of TP4, as well as higher carbon prices. The price developments under such scenarios deviate substantially from the Commission proposal only in the second half of TP4.

The second scenario group which addresses a more aggressive MSR concludes that a higher MSR intake rate as of 2019 is able to provide an immediate incentive for carbon prices to rise and reductions to be triggered in the first half of TP4. Such a reform would especially increase the inter-temporal efficiency of the system as reductions are triggered earlier compared to the Commission proposal. However, the study also concludes that a more frequent review of the MSR – and especially its thresholds – is necessary to ensure the effectiveness of the MSR in the long-term. As the market environment changes, the necessary “healthy over-supply” in the EU ETS also changes and the MSR thresholds need to be adjusted accordingly.

The third scenario group goes one step further and combines the two possibilities mentioned before to reform the EU ETS. Such a reform would increase emission reduction and price ambition over the entire fourth trading period. While the tightened MSR would introduce ambition early, the increase of target keeps the ambition and the reduction incentive alive towards the end of TP4. From a long-term cost-efficiency standpoint this would be the preferred option to be implemented, as a higher carbon price visibility in the long run would support long-term investment decisions.

Regarding over-lapping policies, the study finds that such reforms, if on national or EU level, would depress carbon prices in the long-term as the abatement incentive is shifted to outside the EU ETS. Most interestingly this means that emission reductions are not higher, but probably reached less cost-efficient. However, generally it can be concluded that over-lapping policies and the EU ETS can co-exist in a way that the ETS can still deliver cost-efficient emission reductions. Thus, to enable this, the ETS would have to be adjusted to account for the effects of the over-lapping policy.

More details of the results of the study can be found in section 3 and 4 of the study.

1. Introduction

The European Union decided to use am emissions trading scheme (or cap-and-trade market) as the cornerstone of EU policy to combat climate change and reduce greenhouse gas (GHG) emissions in 2003. The decision was taken as an emission trading scheme is a market based model that promises to deliver a targeted emissions reduction at lowest cost. Pioneered in the US NO_x and SO_x markets, cap-and-trade markets proved effective. The Kyoto Protocol established emissions trading also as one default instrument to reduce emissions to the same reason as mentioned above, it delivers emission reductions at lowest cost.

The EU Council agreed in 2009 to reduce its emissions by 80-95% below 1990 levels by 2050, and re-confirmed this ambition various times. In the European Commission's *Energy Roadmap 2050 Impact Assessment*[1], the Commission details that the ETS would need to deliver 48% emission reductions in 2030, and 92% reductions in 2050 to reach the 80% overall reduction threshold.

And indeed, the EU decarbonized its emissions trading sector drastically – in 2014, emissions were 20% below 1990 levels already. While this is a great achievement for the environment, it is unfortunately mainly triggered by less industrial production in the EU, and not so much by reduced carbon intensity. The financial crisis which drove down industrial production in Europe blurred that success picture and hides that emission reductions did not happen at a scale needed to achieve the envisaged long-term target, because the short-term production drop was enough to keep emissions below the cap.

However, it is expected that in the year 2020 the EU ETS emissions will exceed the 2020 target – this is possible because companies can bank and hand in unused allowances from earlier years when emissions were below the cap. Because this is the fact investment in emissions reduction measures are delayed. Furthermore, the volatile and generally low emission allowance price is not providing an incentive to invest – and the promise of more ambitious climate targets in the future was disenchanted multiple times in the last decade. A market that is changed every other year through reforms is not predictable.

To reduce emissions by 92% in the EU ETS sectors by 2050, Europe needs as much abatement, as early as possible – and this cannot be done by the power sector alone which already significantly reduces emission due to increase renewable energy power generation. Europe needs a strong incentive to invest in emission reductions technology in all ETS covered sectors. In the EU ETS, this can only be achieved through a strong commitment from politicians to an ambitious system and a high emission allowance price. In ICIS' experience, industrial companies do not care too much about emissions trading as long as they have enough allowances for free or prices for these allowances are low.

As global warming is a truly global problem, the EU has to make sure that emissions are not simply re-locating to countries outside of the EU – this would not help the environment and would risk jobs within the EU. So the EU ETS needs to be balanced: While on the one side being ambitious, it needs to protect companies that face fierce international competition or member states that cannot afford to decarbonise its economy as quick as others.

The EU ETS needs to be reformed (again), and it needs more ambition to finally consistently trigger abatement of emissions outside and inside the power sector. The reform should result in a stable market environment that is somewhat predictable, while companies in international competition are protected and low-GDP member states get additional support to transition to a low carbon economy.

In this study, several options are discussed (and analysed) to achieve such reform, and compared against a set of success criteria.

[1] Mode details can be found here: link

2. Model and analysis background

In this study, the ICIS' proprietary Timing Impact Model to forecast EUA price development through 2030 is used. A wide range of different scenarios (in total 129) to show various effects and uncertainties are assessed. Finally, the different scenarios and uncertainties are compared to allow an easy valuation of the various options.

In this section of the study we describe the model, the scenarios, the model limitations as well as other important features of the analysis conducted for this study.

2.1 Qualitative explanation of the model

ICIS has pioneered the Timing Impact Model (TIM) – a modelling framework that was developed to take into account the uniqueness of emissions trading schemes. It is based on the belief that emissions at a certain time are not a good proxy for demand for allowances at that time.

Emission rights can be purchased long in advance, as storage is free of charge (except for capital costs). In addition, the surrender date allows to buy emission rights after the right was consumed and CO_2 was emitted. So the time of the emissions does not matter for the purchase decision. To model the demand and supply which impact carbon prices, it is key to model when companies are buying (and selling) their emission rights.

The Timing Impact Model is, therefore, an extension of classical fundamental models. It segments the companies covered by the EU ETS and calculates the shortage (or excess) of allowances for each segment – called “agents”. Each agent is then assigned to a specific behavioural profile, which details how this group of companies is buying (or selling) its allowances.

For a very prominent agent, “large Central European utility”, first, the fundamental balance for each year is calculated through 2030. The fundamental emission modelling is based on current forward curves for fuels (and EUAs), norm weather, a power demand forecast and renewable energy capacity development forecast. The allocation until 2020 is based on the latest Commission publications (EU Transaction Log). For the period post-2020, the allocation is based on the modelled post-2020 scenario.

For each agent, an abatement profile is assumed. The abatement of the power sector is largely dependent on fuel switch. The fuel switch reacts on changes in the EUA price, which has in turn implications on the hedge: If fuel switch is financially viable in the future (linked to future production which is already hedged), the EUA position is adjusted already at the time this change is planned – it is impacting the demand already in advance.

On top of the fundamental layer, the agent gets a behavioural profile assigned, which relates to its power hedge. The question the model asks is: When are the companies hedging its power generation and thus buying the underlying fuels? ICIS has collected extensive historical data on this, which covers 2/3 of the EU ETS power sector's short position. Based on this data and assumptions on the future of such hedge programs, hedge curves are assumed.

On industry side, the model uses qualitative assumptions around abatement technology, investment decisions and deployment cycles. We believe that estimating the cost of the technology is only secondary in forecasting long-term abatement on industry side – key is to understand the investment decision process on industrial side. How long do prices need to exceed a certain level until companies feel comfortable that this level can be sustained? How much do they trust that the EU ETS is ambitious in the long run? Which payback time do they expect? So instead of using a bottom um MACC (marginal-abatement-cost-curve), we use qualitative assumptions to forecast industrial abatement.

Once both layers (fundamental and behaviour) are combined, a “traded position” is calculated. This represents the demand/supply of that player over time. After aggregating all agents and adding auctions & other supply, a total traded balance is calculated, which shows demand and supply shortages over time.

By using a price sensitivity curve, the volume deltas are translated into price changes.

As outlined before, the model fully incorporates the behaviour of compliance companies and, therefore, assumes a certain healthy over-supply in the EU ETS which is driven by the demand for risk management of compliance companies – especially forward hedging in the power sector.

Due to the incorporation of this feature the cumulative fundamental balance of the EU ETS approaches this healthy over-supply. As the modelling of the risk management suggests that a quite significant amount of volumes is necessary to enable such risk management, emission reductions are triggered even at a surplus of around 1,000m EUAs. This means that the market experiences scarcity although surplus is in the system, which can be seen by increasing prices.

2.2 Scenarios modelled

In this study, various adjustments to the EU ETS were modelled to make the system more ambitious. The analysis assumes four main categories of supply scenarios:

1. Change of the EU ETS 2030 emissions reduction target and consequently a higher linear reduction factor (LRF)
2. Adjustment of the Market Stability Reserve (MSR) by changing the intake rate and/or the thresholds
3. Combination of changing the EU ETS 2030 target and an adjustment of the MSR
4. Impact of an increase of over-lapping policies on the EU ETS

The basis of the calculation for all supply scenarios is the Commission proposal for the post-2020 reform. The changes from scenario to scenario are always limited to the scenario parameter analysed.

The study does not aim to model different free allocation methodologies, but focus on the scenario groups outlined before. For the free allocation methodology, the Commission proposal is assumed including the two period free allocation cycle as well as a binary carbon leakage list and a flat-rate adjustment of benchmarks. For benchmarks a flat-rate adjustment of 1% for all sector is assumed.

Regarding the innovation fund the Commission proposal with 450m – 50m in 2019-2020 and 400m in 2021-2030 – is assumed. The monetisation in the fourth trading period is done in a gradual way and reduces on a yearly basis from 2021 to 2030. For the modernisation fund, the study assumes that 2% of the cap are used and monetised along the regular auctions.

In addition, to the scenarios above some sensitivity scenarios were calculated to assess additional effects on the EU ETS:

1. Greece eligible for the compensation mechanisms
2. A Brexit from the EU ETS
3. A change auction share to 52%
4. A low hedge behaviour scenario

Next to the uncertainties in the supply scenarios, several demand scenarios are modelled to show the effect of different GDP and RES capacity paths on the price developments.

For each scenario we modelled a combination of various supply and demand scenarios to show sensitivities and impacts of changes.

2.3 Model limitations

The authors believe that the models used are an accurate representation of the EU ETS. However, some areas of the modelling approach limit the depth of the results.

First, the abatement modelling is not based on an actual stack model of the European energy landscape, but on considerations around renewable energy additions, fuel switch and abatement technology investment. The member state specific emission reductions in the power sectors as well as the costs for the power sector and industry related to each scenario were based on EURELECTRIC's assumptions and data and are not derived from the ICIS TIM.

Second, the ICIS modelling does not cover all possible scenarios. It focusses on key parameters that can be changed in the EU ETS – but does not vary all possible parameters. In addition, several assumptions around the fundamental development of the EU as well as the behaviour of companies are kept constant across all scenarios. So while the sensitivity bands give a good indication of the variance across the scenarios, they are not necessarily a min-max range.

For the benchmark development a flat-rate adjustment of all sectors by 1% is assumed. As in the Commission proposal three different flat-rates, 0.5%, 1.0% and 1.5%, are brought forward, the used approach is a simplistic one.

Third, our model ends in 2030 and does not look into long-term effects post-2030. As the EU ETS is, however, build to reach a 2050 emissions target, our model cannot check which policy is most cost-efficient through 2050. Second, price visibility post-2030 is not assumed, meaning companies do not act based on the prices they expect for post-2030. Based on the historic developments in the EU ETS, this is, however, a fair assumption to be made. So far, companies mainly optimised their strategies regarding the EU ETS for the short-term and not for such a long horizon.

2.4 Definition of the success parameters

Each scenario is assessed by ranking it on five criteria which are outlined below. Each criterion is assessed by a “traffic light” system. The traffic light system ranks how a scenario performs towards a certain criterion. It is important to note that green is not necessarily the envisaged colour from a more ambitious standpoint. The explanation of the criteria is important to understand before judging the colours.

Each scenario has its advantages and disadvantages, and it is not the aim of this study to give a clear advice on which scenario to choose. However, it should help understanding the effect of each policy change and contribute to the decision making process by highlighting expected positive and negative results

1. Ambition

This criterion outlines how much emission reductions are triggered in a certain time frame. To distinguish between different time horizons, the criteria assumes three periods: 2016-2025, 2026-2030, and 2030-2050:

- Green: high reductions occur
- Yellow: medium reductions occur
- Red: low reductions occur

2. Cost-efficiency

Reflects on the question how much it costs to achieve the envisaged reduction target (solely focused on EU ETS related prices). This criterion differentiates between short-term and long-term cost-efficiency.

The short-term horizon assesses the cost-efficiency in relation with the envisaged 2030 target:

- Green: envisaged target is reached with lowest possible carbon price
- Yellow: envisaged target is reach by higher than necessary, but still medium carbon prices
- Red: envisaged target is reached by high carbon price (a lot of emissions transferred to MSR, means less allowances than envisaged by the cap are given out → cap is reached a high price)

The long-term horizon judges qualitatively the long-term cost-efficiency of a measure. A key assumption here is that the earlier abatement is triggered, the lower are the overall costs:

- Green: 2050 target reached with high cost-efficiency
- Yellow: 2050 target reached with medium cost-efficiency
- Red: 2050 target reached with low cost-efficiency

3. EU ETS Volume Effect

This criterion considers the questions, whether auctions and free allocation volume are most affected by a reform. For the power sector mainly auction volumes are assumed to be crucial while for industrial sectors, both pots, auctions and free allocation, are important.

- Green: sector related volumes not affected
- Yellow: sector related volumes are reduced
- Red: sector related volumes are significantly reduced

4. Predictability

This criterion reflects on the questions whether the system needs another adjustment soon or if the policy framework provides a clear, trustable, long-term pathway:

- Green: high predictability, system can be set on the right emission path with the reform, high visibility of future prices
- Yellow: medium predictability, either system needs another cap adjustment to reach long-term target or long-term price visibility is not given
- Red: low predictability, system needs another cap adjustment to reach long-term target or long-term price visibility is not given

5. Effect on compensation mechanisms

This criterion assesses how a certain scenario affects the estimated monetary value of the compensation mechanisms:

- Green: positively affected, estimated value increases
- Yellow: not affected, values stays rather constant
- Red: negatively affected: estimated value decreases

3. Detailed results of different scenario groups

This part of the study outlines the results from the modelling executed for the study in order to put the various reform options into context. As a lot of scenarios were modelled for this study, the results are presented in the scenario groups outlined before in this study. The four different groups are:

- A higher linear reduction factor, respective 2030 EU ETS carbon reduction target
- An adjusted MSR
- A combination of a higher LRF and an adjusted MSR
- Strengthening of over-lapping policies

For every scenario group a brief introduction is given followed by the impact of the reform on the fundamentals of the system. Furthermore, the effects on the EU ETS price developments and the monetary values of the compensation mechanisms is shown. Last, and based on EURELECTRIC calculations, the effect on compliance costs for the power sector is outlined for the different scenario groups.

3.1 Scenario group 1: Higher target, higher LRF

The first scenario group assesses the effect of an increase of the linear reduction factor on the EU ETS.

The target brought forward by the Commission in its proposal for the post-2020 EU ETS reform is the one set by the Heads of States in the *2030 Framework for Climate and Energy Policy Framework*[2]. The Heads of States set the EU 2030 greenhouse gas (GHG) reduction target to at least 40% reduction compared to 1990, whereas 43% reduction (compared to 2005) will be delivered through the EU ETS.

This 43% reduction target translates into a 2.2% linear reduction factor for the EU ETS from 2021-2030. When extrapolating this 2.2% LRF until 2050, the EU ETS would achieve 84% reductions compared to 2005. As EU leaders are committed to reach 80-95% reduction by 2050 this target would need to be increased post-2030 in order to reach the upper range of the long-term target.

As it is, furthermore, long-term more cost-efficient to reduce emissions rather early than later, a later adjustment of the target is not in line with the second target of the EU ETS: reaching the reduction target in a cost-efficient way.

[2] See European Council Conclusions from 23/24 October 2014 – link

Next to the base Scenario, which assumes the Commission proposal post-2020 (referred to as Scenario 1), three more scenarios are modelled in this scenario group:

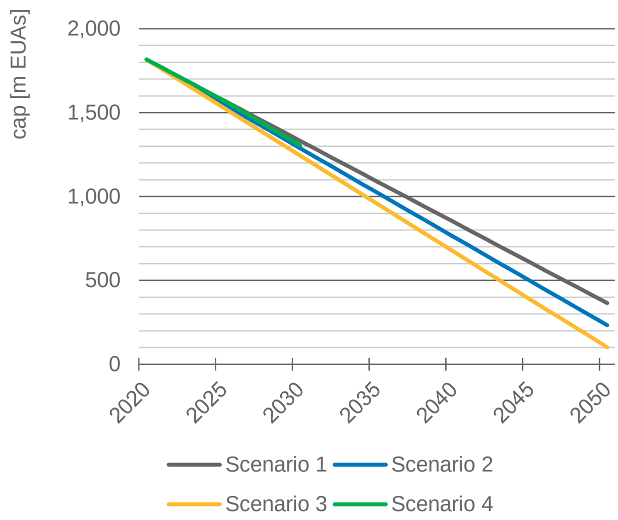
- Scenario 2: 2.4% LRF
- Scenario 3: 2.6% LRF
- Scenario 4: 5-year-review LRF with 2.2% from 2021-2025 and 2.45% from 2026-2030

The different caps are outlined in Figure 4.1.1.

Figure 4.1.1: Cap developments under various linear reduction factors

	2030	2040	2050
2.2% linear reduction factor			
Reduction target (vs 2005)	43%	64%	85%
Cap [EUAs]*	1,333m	849m	365m
2.4% linear reduction factor			
Reduction target (vs 2005)	45%	68%	90%
Cap [EUAs]*	1,289m	761m	233m
2.6% linear reduction factor			
Reduction target (vs 2005)	47%	71%	95%
Cap [EUAs]*	1,245m	673m	101m
5-year-review			
Reduction target (vs 2005)	44%	not defined	not defined
Cap [EUAs]*	1,305m	not defined	not defined

** excluding aviation*



Source: ICIS Tschach Solutions

Effect on fundamental volumes

The fundamental effect of an increase of the linear reduction factor on the supply volumes is complex as nearly all parts of the cap are affected.

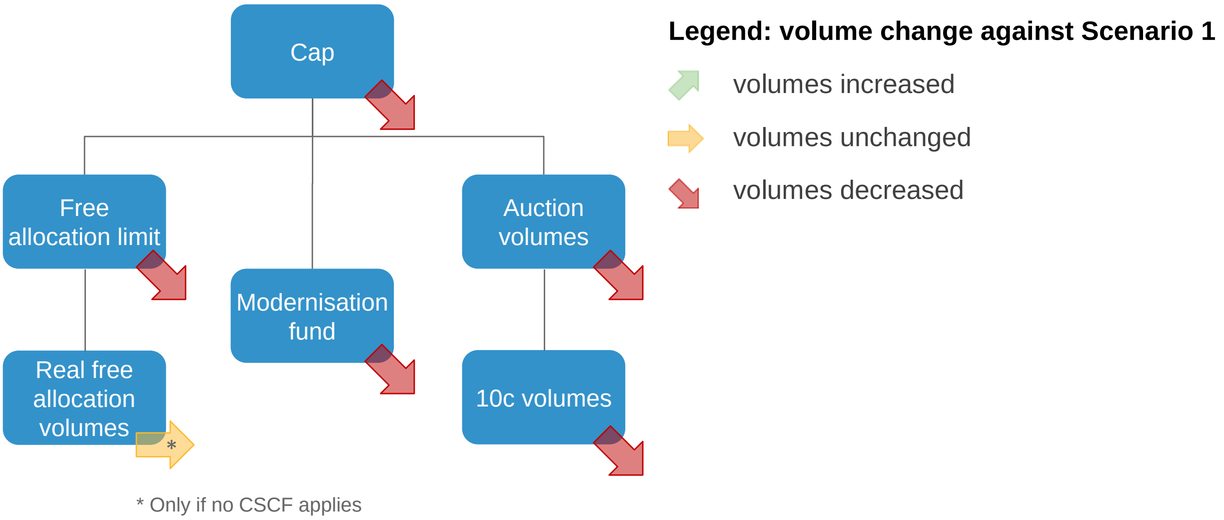
First, the cap decreases faster if the 2030 target and consequently the LRF is tightened. Second the auction volumes, as they are defined as 57% of the cap in the Commission's proposal, decline. As the modernisation fund is made up of 2% of the cap (taken from the auction share), the total volume of the modernisation fund would also decrease if the cap is tightened. The maximum 10c/derogation volumes would also be affected as they are determined by a percentage of the auction volumes of the eligible member states.

On the allocation side the maximum available amount of allowances for free allocation would decrease. However, as the allocation methodology would not be affected, the free allowances which are transferred to installations would only be reduced, if the volume earmarked for allocation is not high enough to allow for all application to be considered to the full extent. This would mean that a cross-sectoral-correction-factor (CSCF) would apply and cut all free allocation volumes short in order to bring the free allocation volumes below the maximum available volumes.

Assuming a 1% flat-rate benchmark adjustment for all sectors, baseline production periods as well as the carbon leakage list proposed by the Commission, the analysis shows that no CSCF would apply to allocation applications in Scenario 1, 2,3, and 4. Consequently, the free allocation volumes would not be affected in TP4, but only the left-over of unused allocation volumes in 2030 would be reduced.

It has to be noted again, that this study did not intend to make a complete analysis of the effects of a more ambitious post-2020 reform on free allocation given out to EU ETS installations as outlined before in this study.

Figure 4.1.2: Effect on fundamental volumes under various linear reduction factors



Source: ICIS Tschach Solutions

Effect on price developments

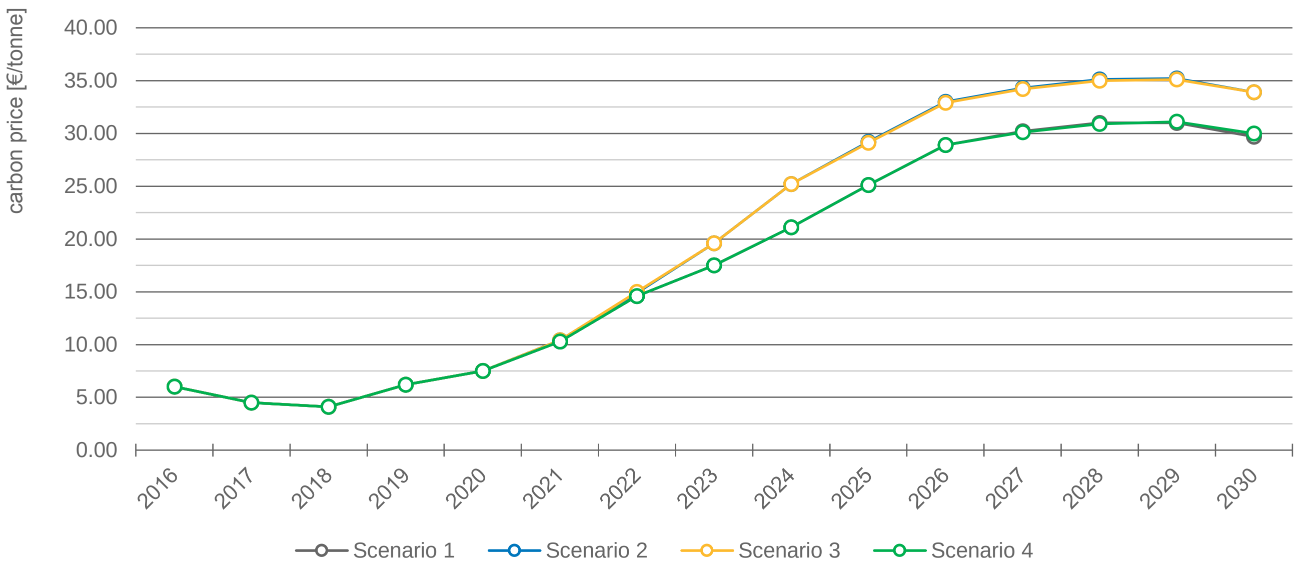
The four scenarios analysed in this scenario group have generally the same effect on the price development in the fourth trading period. The two scenarios, Scenario 2 and 3 (higher linear reduction factor), both increase prices towards 2030, but only marginally in the first half of the fourth trading period.

This is because the effect of a higher linear reduction factor is insignificant in the early years of TP4 and only the auction volumes (incl. the modernisation fund) are reduced. This reduction is in the range of 0-20m EUAs on a yearly basis, while in 2030, this effect on auction volumes increases to nearly 50m EUAs.

Prices in the Commission proposal scenario as well as in Scenario 4 increase to over €30.00/tonne in 2027-2029 while for Scenario 2 and 3, price surpass the €35.00/tonne mark in 2028-2029.

The respective price developments can be seen in Figure 4.1.3.

Figure 4.1.3: EUA price developments under various cap scenarios



€/tonne (real values)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Scenario 1	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.20	31.00	31.00	29.70
Scenario 2	4.10	6.20	7.50	10.40	14.90	19.60	25.20	29.20	33.00	34.30	35.10	35.20	33.90
Scenario 3	4.10	6.20	7.50	10.40	15.00	19.60	25.20	29.10	32.90	34.20	35.00	35.10	33.90
Scenario 4	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.10	30.90	31.10	30.00

Source: ICIS Tschach Solutions

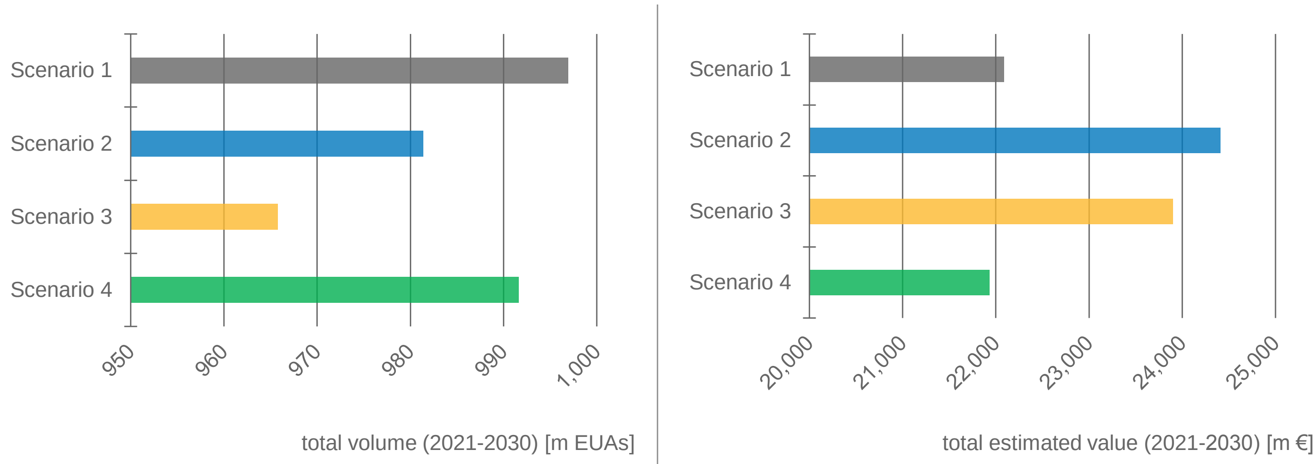
Effect on compensation mechanisms

Another key point of this study is to outline the effects of a more ambitious post-2020 reform on the compensation mechanisms, namely the modernisation fund and the 10c/derogation volumes.

The effects of a more ambitious reform are twofold. First, a higher target and alongside a higher LRF reduces the volumes of the compensation mechanisms. The sum of the modernisation fund and the 10c/derogation volumes are visualised in the left graph of Figure 4.1.4. It is apparent in the left graph that the effect on the volumes is relatively minor and ranges between 0-30m less EUAs available over the whole fourth trading period.

As the carbon price increases higher in the scenarios with a higher LRF, the total estimated value of the compensation mechanism in TP4 does also increase – the estimated value is shown in the right graph in Figure 4.1.4. In Scenario 2 the estimated value is the highest with over €24.4bn while for Scenario 4, the estimated value is the lowest with just under €22.0bn.

Figure 4.1.4: Total volume (left graph) and total estimated value of compensation mechanisms (right graph) in TP4 under various cap scenarios



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Volume [m EUAs]										
Scenario 1	113.7	110.6	107.5	104.4	101.2	98.1	95.0	91.9	88.8	85.7
Scenario 2	113.4	110.0	106.6	103.2	99.8	96.4	93.0	89.7	86.3	82.9
Scenario 3	113.1	109.4	105.8	102.1	98.4	94.7	91.1	87.4	83.7	80.0
Scenario 4	113.7	110.6	107.5	104.4	101.2	97.8	94.3	90.9	87.4	83.9
Estimated value [m €]										
Scenario 1	1,012	1,377	1,725	2,014	2,339	2,650	2,808	2,813	2,753	2,601
Scenario 2	1,015	1,392	1,839	2,312	2,715	2,999	3,131	3,111	3,032	2,863
Scenario 3	1,012	1,390	1,830	2,287	2,672	2,937	3,055	3,024	2,934	2,761
Scenario 4	1,012	1,377	1,725	2,014	2,339	2,640	2,782	2,771	2,709	2,564

Source: ICIS Tschach Solutions

Effects on the cumulative fundamental balance and overall abatement

The cumulative balance (all compliance instruments minus all emissions since 2008) for the higher target scenarios decreases quite quickly from around 1,500m EUAs in the end of 2020 to around 800m EUAs until 2030.

As the cumulative fundamental balance determines whether the MSR reduces auction volumes or not, this number is of particular interest. It can be seen that all four scenarios arrive below the upper threshold of the MSR, 833m, in 2028. Consequently, the MSR reduces auction volumes in 2029 only by a limited amount – from January to August based on the 2027 balance – and leaves auction volumes untouched in 2030. This has a substantial effect on the yearly fundamental balance, as auctions stay either flat although the cap is decreasing (2028 compared to 2029) or even increase by 45m EUAs (2029 compared to 2030).

This development is observable in the price developments in Figure 4.1.3, where a flattening of the price as of 2028 is visible and even a slight downturn in 2030.

Figure 4.1.5: Cumulative fundamental balance of the EU ETS under various cap scenarios

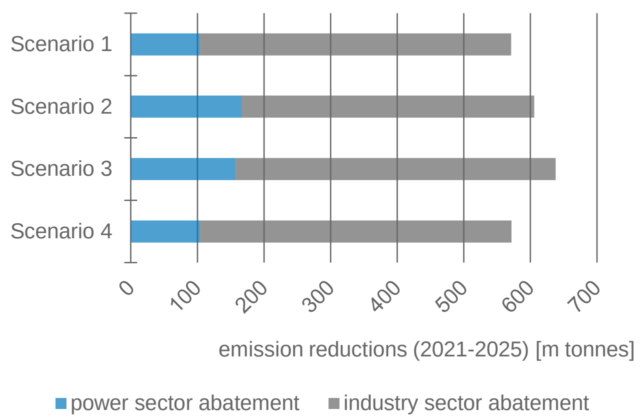
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cumulative fundamental balance [m EUAs]													
Scenario 1	1,745	1,589	1,490	1,316	1,108	1,066	1,046	1,014	958	882	798	742	803
Scenario 2	1,745	1,589	1,490	1,314	1,101	1,066	1,044	1,010	952	872	785	726	782
Scenario 3	1,745	1,589	1,490	1,311	1,093	1,066	1,041	1,006	946	863	773	708	758
Scenario 4	1,745	1,589	1,490	1,316	1,108	1,066	1,046	1,014	958	882	797	731	779

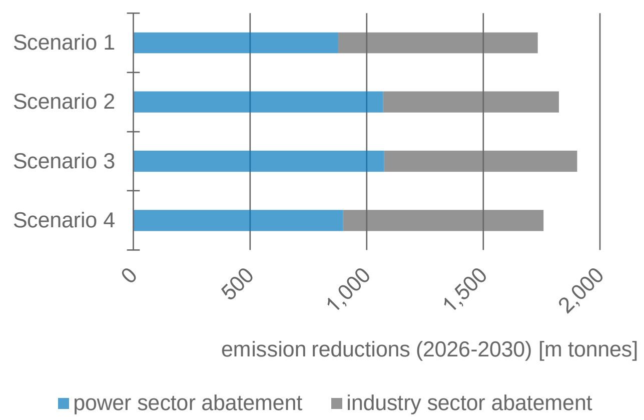
Source: ICIS Tschach Solutions

As outlined before the model also assesses how much additional emission reductions are implemented in the power and the industrial sectors on top of the *business-as-usual* reductions which are based on today's carbon and fuel prices. These additional reductions can be incentivised by higher carbon prices or by over-lapping policies. A comparison of the additional reductions triggered can be found in Figure 4.1.6.

Figure 4.1.6 shows that a higher linear reduction factor leads to higher additional emission reductions being triggered. For Scenario 2, 125m and for Scenario 3, 235m additional reductions are triggered in the fourth trading period. While it is clear that the bulk of the additional reductions from Scenario 1 to a higher LRF are mainly implemented in the power sector, the industrial sectors also contribute substantially to the emission reductions in TP4.

Figure 4.1.6: Emission reductions per sector in 2021-2025 (left graph) and 2026-2030 (right graph)





Source: ICIS Tschach Solutions

Effects on compliance costs

Based on the sectoral fundamental emission reductions modelled by ICIS Tschach Solutions, EURELECTRIC made an additional assessment about how such reform would translate into compliance costs.

It is apparent that a higher target is also linked to higher compliance costs as the carbon price increases. However, the values in Figure 4.1.7 are solely based on the compliance obligation in the EU ETS and do not incorporate any other costs, e.g. investment cost, which would also occur to reach the necessary emission reductions.

In total, the compliance costs for the power sector are predicted to increase by 8.3% if the LRF would be increased to 2.4%, while they would only increase by 8.2% if the LRF is increase to 2.6%. In Scenario 4, compliance costs would actually decrease slightly, by -0.3% compared to the Commission proposal.

This is because carbon prices increase higher if the EU ETS reduction target is increased in 2030. However, a mitigating effect is that due to more emissions being reduced, the overall compliance obligation of the power sector is also reduced.

Figure 4.1.7: Total compliance costs in the power sector from 2021-2030 subject to various cap scenarios

m € (real values)	Total compliance costs				Increase compared to Commission proposal		
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 2	Scenario 3	Scenario 4
Bulgaria	-6,677	-7,233	-7,236	-6,666	8.3%	8.4%	-0.2%
Croatia	-912	-991	-991	-910	8.6%	8.7%	-0.2%
Czech Republic	-9,031	-9,835	-9,774	-8,981	8.9%	8.2%	-0.5%
Estonia	-2,093	-2,280	-2,278	-2,084	8.9%	8.8%	-0.5%
Hungary	-1,898	-1,992	-2,004	-1,898	4.9%	5.6%	0.0%
Lithuania	-42	-45	-45	-42	7.9%	8.2%	-0.1%
Latvia	-328	-355	-356	-327	8.3%	8.4%	-0.2%
Poland	-29,642	-32,035	-32,013	-29,568	8.1%	8.0%	-0.2%
Romania	-2,156	-2,328	-2,336	-2,152	7.9%	8.3%	-0.2%
Slovakia	-1,548	-1,677	-1,649	-1,531	8.3%	6.5%	-1.2%
Total (incl. all MS)	**-170,783**	**-184,912**	**-184,757**	**-170,250**	**8.3%**	**8.2%**	**-0.3%**

Source: EURELECTRIC

As the compensation mechanisms, 10c derogation volumes as well as the modernisation fund, would be available for the power sector in certain member states, the estimated value of these mechanisms needs to be netted with the compliance costs. The costs after the compensation mechanism for the member states eligible for the compensation mechanisms are set out in Figure 4.1.8.

It can be seen that the value growth of the compensation mechanisms mitigates the effect of the higher compensation costs only slightly. In Scenario 2, the compliance costs for the Czech Republic increase by 8.9% without taking the compensation mechanisms into account. After adjusting the costs by the value of the compensation mechanism the increase shrinks to 7.8%.

The study clearly finds that a tightening of the 2030 target increases the compliance costs for the power sector. This increase is not fully compensated by a higher value of the compensation mechanisms – however, these mechanisms mitigate the higher compliance costs partly.

Figure 4.1.8: Compliance costs after compensation mechanisms for 2021-2030 subject to various cap scenarios

m € (real values)	Total balance of compliance costs vs compensation value				Increase compared to Commission proposal		
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 2	Scenario 3	Scenario 4
Bulgaria	-5,044	-5,428	-5,469	-5,044	7.6%	8.4%	0.0%
Croatia	-420	-447	-459	-422	6.5%	9.3%	0.4%
Czech Republic	-5,298	-5,711	-5,735	-5,275	7.8%	8.2%	-0.4%
Estonia	-1,483	-1,605	-1,617	-1,477	8.2%	9.1%	-0.4%
Hungary	-583	-538	-580	-591	-7.6%	-0.4%	1.5%
Lithuania	342	379	370	340	10.8%	8.2%	-0.8%
Latvia	-139	-146	-150	-139	5.4%	8.6%	0.5%
Poland	-20,136	-21,531	-21,727	-20,130	6.9%	7.9%	0.0%
Romania	856	1,001	923	838	16.9%	7.9%	-2.0%
Slovakia	-334	-335	-334	-325	0.2%	0.2%	-2.8%
Total	**-32,237**	**-34,360**	**-34,778**	**-32,225**	**6.6%**	**7.9%**	**0.0%**

Source: EURELECTRIC

Conclusions

As outlined before all different scenario groups are assessed with a reform success matrix to outline the various effects such a reform would have on the EU ETS.

An increase of the LRF would create only late additional incentive to reduce emissions. Consequently, the traffic light is red regarding reductions in the period 2016-2025. In the period until 2023, nearly no additional reductions are necessary as the historic surplus of the system is still high enough to cover the demand of market participants. As the higher LRF gradually increases, the ambition over the fourth trading period increase, which leads the traffic light to switch to yellow for the period 2026-2030. As ambition is only slightly increased over the entire TP4, significantly more reductions are necessary after 2030 – thus the traffic light turns green.

From a cost-efficiency perspective the system reaches the envisaged target in a cost-efficient way, as no additional volumes are withheld from the market. Even if the 2030 target changes across the different scenarios, it is in all cases reached at lowest possible carbon prices. When focusing on cost-efficiency in the long-term the analysis concludes that such a reform only enhances the Commission proposal slightly regarding long-term cost-efficiency. This is because reductions are still triggered only late in TP4.

Regarding the fundamental effect such a reform impacts both cap components, auctions and free allocation. As only marginal increases of the cap are discussed, the effects are however minor.

When changing the 2030 target already pre-2020, the predictability of the system can be significantly increased. The cap path could be set to reach the higher range of the aspired 2050 target of 80-95% reductions. Consequently, the system would need no additional reform of its cap post-2030.

All three higher LRFs scenarios would increase the estimated value of the compensation mechanism as the increase of carbon prices mitigates the lower volumes of the compensation mechanisms.

Overall, increasing the LRF would create additional ambition late in the fourth trading period. It is also apparent that moving directly to a 2.6% LRF instead of a 2.4% LRF would be advisable as even more ambition would be triggered in the end of TP4 which increases the overall inter-temporal efficiency.

However, when only tightening the cap, the EU ETS does not have a steering effect in terms of incentivising emission reduction until 2023. In the coming six years, the EU ETS would, consequently, not incentivise any further emission reductions.

Measure	Ambition (emission reductions)			Cost-efficiency		Affected sectors		Predictability	Effect on compensation mechanisms
	2016-2025	2025-2030	2030-2050	Short-term	Long-term	Power	Industry		
Higher LRF	red	yellow	yellow, green	green	red, yellow	yellow	yellow	yellow, green	yellow

3.2 Scenario group 2: Adjust the Market Stability Reserve

In the current set-up of the EU ETS towards 2020, not many additional emission reductions are necessary in order to achieve the 2020 reduction target. As it would even be possible that companies use left-over allowances from the period 2008-2019 for compliance in 2020, it is even possible emissions are above the cap in 2020. This would mean that the EU is not reaching its 2020 emission reduction target in 2030.

If a stocktake is currently done in the EU ETS, see Figure 4.2.1 (left graph), emissions in the EU ETS were already below the 2020 cap in 2014 and 2015. As carbon prices are currently stilly between €4.00-6.00/tonne it gets clear that the carbon price will not incentivise any more emission reductions towards 2020.

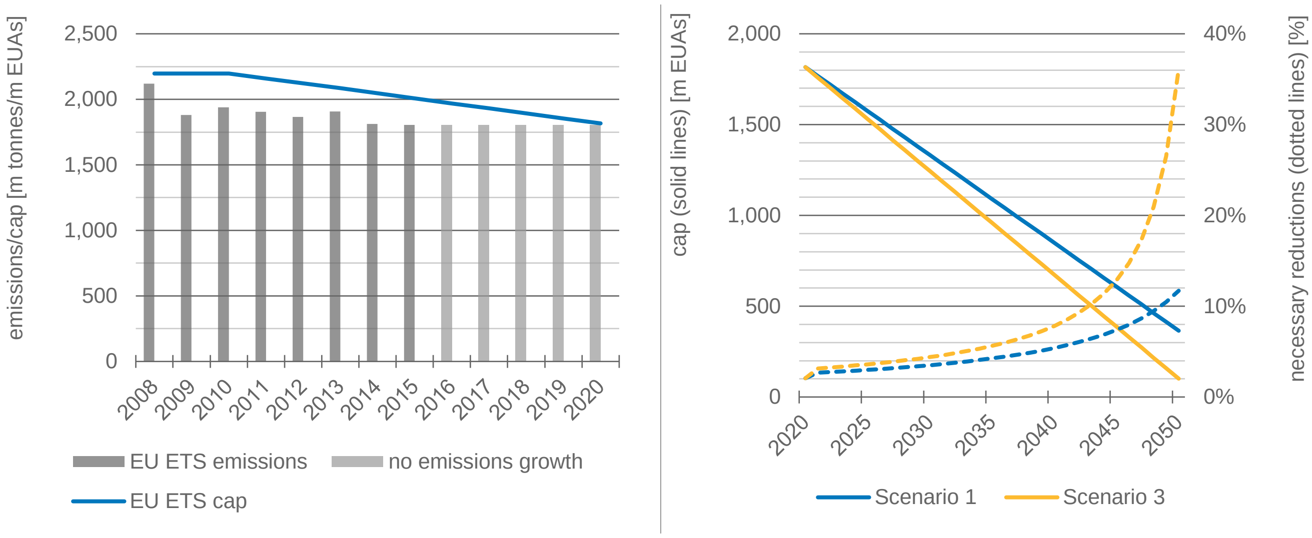
Furthermore, the linear reduction factor is designed in a way that the cap is reduced by the same amount every year. This “linear reduction” leads to the fact that the relative cap reduction, so the necessary relative yearly abatement, increases over time. This leads to the necessary percentage reduction (compared to the cap of the previous year) outlined in the right graph of Figure 4.2.1. This means that towards 2050 the necessary relative annual abatement exceeds the 10% threshold.

Due to this development it would make sense to reduce emissions faster in the early stages of the system and save allowances to put them back on the market towards 2050 when the necessary relative reductions increases. This can be done by the MSR as this is a reserve which only brings volumes back to the market in later years and can be used as a buffer to save allowances while preserving the integrity of the cap.

While in all MSR scenarios the standard Commission proposal for post-2020 is assumed, several options to adjust the MSR were analysed:

- Scenario 5: Increasing the intake rate to 24% for the years 2019-2021 while keeping the 833m upper and 300m lower threshold untouched
- Scenario 6: Leaving the intake rate at 12%, but lowering the thresholds to 600m upper and 300m lower threshold
- Scenario 7: Changing both, the intake rate to 24% for 2019-2021 and lowering the thresholds to 600m upper and 300m lower
- Scenario 8: As a sensitivity analysis (only limited coverage); 24% intake rate for 2019-2030 combined with 833m upper and 400m lower threshold

Figure 4.2.1: Emissions and cap development (left graph), cap and necessary reductions (right graph)

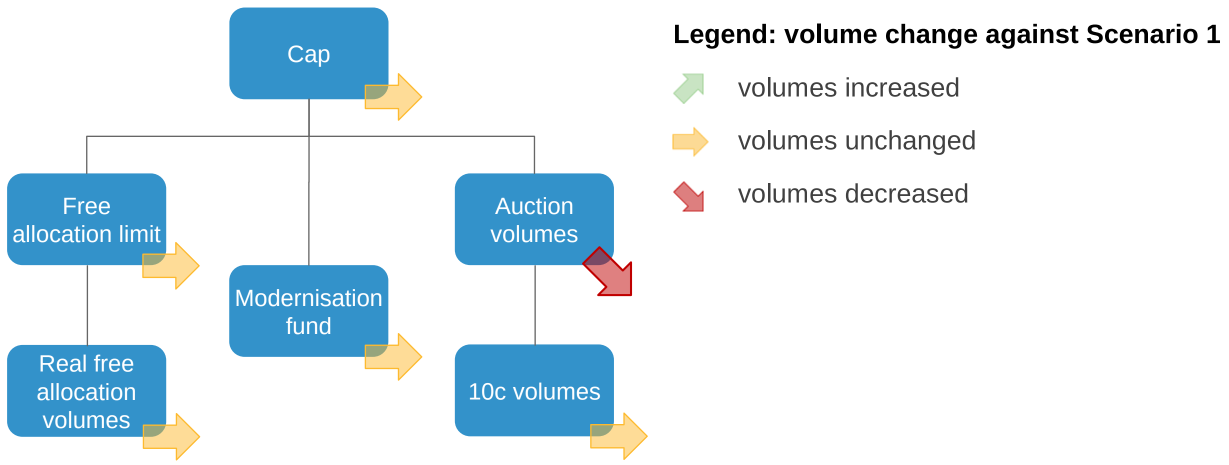


Source: ICIS Tschach Solutions

Effect on fundamental supply volumes

The effects on the fundamental supply volumes of adjusting the MSR are rather limited. As the cap is not changed, the single affected volumes are the auction volumes.

Figure 4.2.2: Affected fundamental volumes by adjusting the MSR



Source: ICIS Tschach Solutions

Effect on price developments

The five MSR designs analysed in this study have different effects on the price developments in the EU ETS, as can be seen in Figure 4.2.3.

A higher intake rate generally increases the ambition immediately and prices already rise above the current MSR design scenario in 2019. The doubling of the intake rate cuts the auction supply short immediately and drives prices only in three (2018-2021) years from €5.00/tonne above the €20.00/tonne mark.

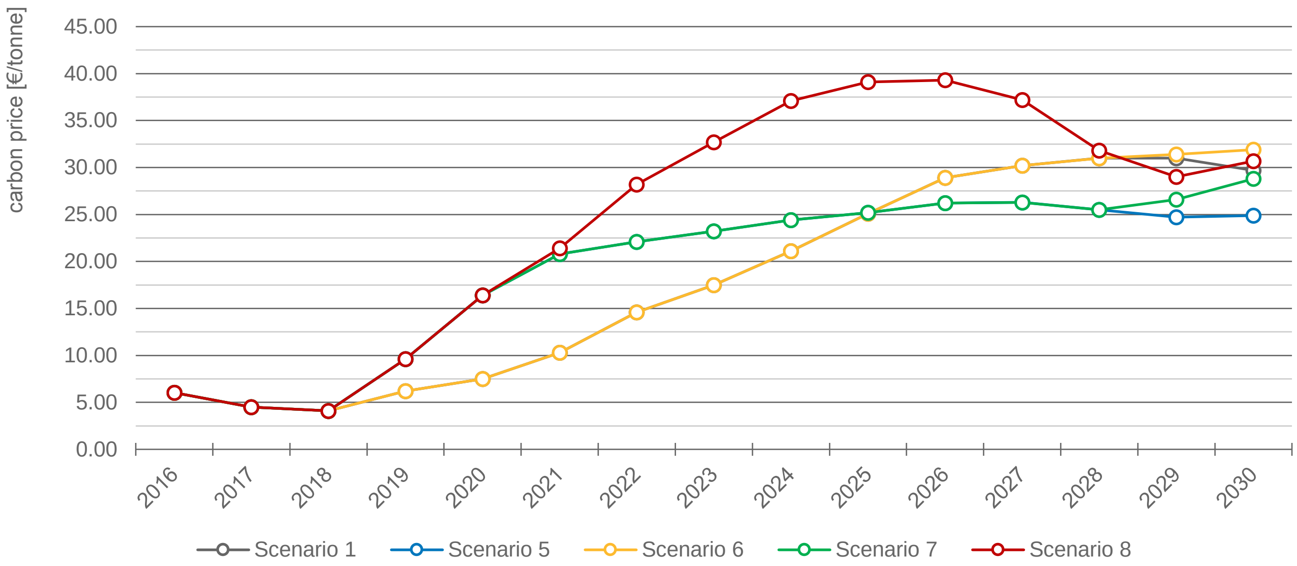
However, as the intake rate in Scenario 5 is only increased for 3 years, prices flatten out between 2021 and 2030. This is the case, because the overall supply environment, meaning the cap, does not provide sufficient incentive to reduce emissions further after the MSR took for three years aggressively allowances out of the market.

For Scenario 6 it gets apparent that changing the thresholds would only have an effect late in the fourth trading period as the MSR would also be triggered in the earlier years with the current thresholds.

In Scenario 7 the higher intake rate affects prices immediately, but still, prices would plateau between 2021 and 2028 before starting to increase again as the lower thresholds would constantly trigger the MSR, also in the later phase of the fourth trading period.

In Scenario 8 the MSR would cut the auction volumes drastically in the early phase of TP4. Prices would consequently increase to nearly €40.00/tonne in 2026 before starting to decline to levels around €30.00/tonne. This is because the MSR would only slightly affect the market from 2027-2029 before being triggered again in full force in 2030.

4.2.3: EUA price developments subject to various MSR designs



€/tonne (real values)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Scenario 1	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.20	31.00	31.00	29.70
Scenario 5	4.10	9.60	16.40	20.80	22.10	23.20	24.40	25.20	26.20	26.30	25.50	24.70	24.90
Scenario 6	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.20	31.00	31.40	31.90
Scenario 7	4.10	9.60	16.40	20.80	22.10	23.20	24.40	25.20	26.20	26.30	25.50	26.60	28.80
Scenario 8	4.10	9.60	16.40	21.40	28.20	32.70	37.10	39.10	39.30	37.20	31.80	29.00	30.70

Source: ICIS Tschach Solutions

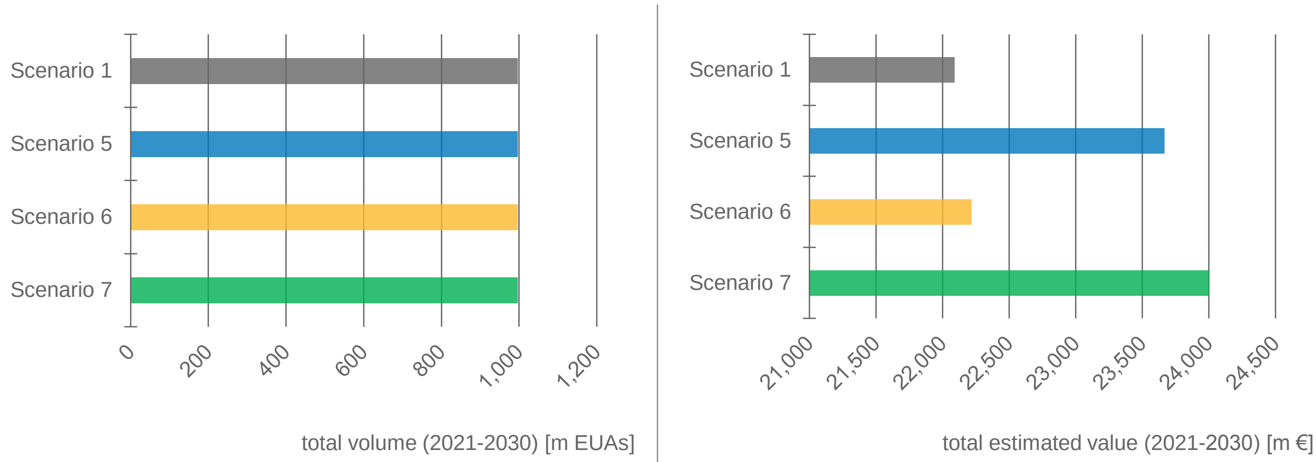
Effect on compensation mechanisms

As the volumes of the compensation mechanisms are not affected by an adjustment of the MSR, this section solely concentrates on the estimated value of the compensation mechanisms. Since carbon price are higher in all calculated MSR design scenarios, the total value of the compensation mechanisms over TP4 also increases. The respective numbers can be found in Figure 4.2.4.

In Scenario 5 the increase adds up to approx. €1,600m which translates into a 7.1% increase compared to the standard MSR design. For Scenario 6 this increase is much smaller as only in the two years the price forecast diverges from the base case – €130m or 0.6%. The biggest growth of the total value of the compensation mechanism is forecasted for Scenario 7 with €1,900m or 8.6%.

As Scenario 8 is only a sensitivity scenario the value of the compensation mechanisms is not calculated.

Figure 4.2.4: Total volume (left graph) and total estimated value of compensation mechanisms (right graph) in TP4 subject to various MSR designs



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Volume [m EUAs]										
Scenario 1	113.7	110.6	107.5	104.4	101.2	98.1	95.0	91.9	88.8	85.7
Scenario 5	113.7	110.6	107.5	104.4	101.2	98.1	95.0	91.9	88.8	85.7
Scenario 6	113.7	110.6	107.5	104.4	101.2	98.1	95.0	91.9	88.8	85.7
Scenario 7	113.7	110.6	107.5	104.4	101.2	98.1	95.0	91.9	88.8	85.7
Estimated value [m €]										
Scenario 1	1,012	1,377	1,725	2,014	2,339	2,650	2,808	2,813	2,753	2,601
Scenario 5	2,115	2,372	2,434	2,484	2,511	2,522	2,494	2,381	2,229	2,125
Scenario 6	1,012	1,377	1,725	2,014	2,339	2,650	2,808	2,813	2,771	2,712
Scenario 7	2,115	2,372	2,434	2,484	2,511	2,522	2,494	2,381	2,313	2,374

Source: ICIS Tschach Solutions

Effects on the cumulative fundamental balance, the MSR and overall abatement

While the auction volume is the only parameter which changes in the scenarios of this group, the forecasted effects vary in the different scenarios. The effects on the cumulative fundamental balance as well as the regular transfer to the MSR can be seen in Figure 4.2.5.

In Scenario 5, the cumulative fundamental balance decreases faster in the early period of TP4 compared to Scenario 1. However, it flattens in the later years and is only 26m lower in 2030. The higher intake rate increases the amount of allowances transferred into the MSR in the first years drastically (doubled in 2019). This is the main factor for the faster reduction of the cumulative fundamental balance. However, as the surplus is reduced quicker, the MSR is also triggered one year less in Scenario 5.

Scenario 6 equals nearly the base case Scenario 1, as only the thresholds of the MSR would be changed. The cumulative fundamental balance develops exactly the same, except in 2029-2030. As in Scenario 1, the surplus falls below the upper threshold of the MSR in 2028-2030, the MSR does not take volumes out of the market as of September 2029. If the thresholds are lowered, the MSR takes volumes out of the market throughout the entire trading period. This consequently brings the surplus in the market further down to below 700m in 2030.

Scenario 7 is a combination of Scenario 6 and 8. The MSR consequently takes volumes out aggressively in the beginning of TP4 while, due to the lower thresholds, still reduces volumes in 2029-2030. The cumulative fundamental balance also approaches 700m.

In Scenario 8 the continuously higher intake rate reduces the surplus even faster than in Scenario 5. As the thresholds are not lowered, the MSR would not be triggered for the first time in 2028. As the surplus is increasing when the MSR is not triggered the MSR would slightly kick in again in 2029 and more significantly in 2030.

Figure 4.2.5: Cumulative fundamental balance and regular MSR transfer subject to various MSR designs

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cumulative fundamental balance [m EUAs]													
Scenario 1	1,745	1,589	1,490	1,316	1,108	1,066	1,046	1,014	958	882	798	742	803
Scenario 5	1,745	1,382	1,091	1,041	1,015	994	962	917	856	800	751	772	777
Scenario 6	1,745	1,589	1,490	1,316	1,108	1,066	1,046	1,014	958	882	798	723	689
Scenario 7	1,745	1,382	1,091	1,041	1,015	994	962	917	856	800	749	715	702
Scenario 8	1,745	1,382	1,091	1,041	1,015	973	921	851	763	760	942	1,069	1,000
MSR – regular transfer [m EUAs]													
Scenario 1	0	207	205	188	174	152	132	127	125	120	113	79	0
Scenario 5	0	414	397	314	129	124	121	118	114	108	77	0	0
Scenario 6	0	207	205	188	174	152	132	127	125	120	113	103	94
Scenario 7	0	414	397	314	129	124	121	118	114	108	101	94	89
Scenario 8	0	414	397	314	259	248	241	230	217	153	0	57	234

Source: ICIS Tschach Solutions

All scenarios trigger more emission reductions compared to the base case Scenario 1. However, the timing and the magnitude of these additional reductions vary in the different scenarios. In Figure 4.2.6 the effects on the additional emission reductions are shown.

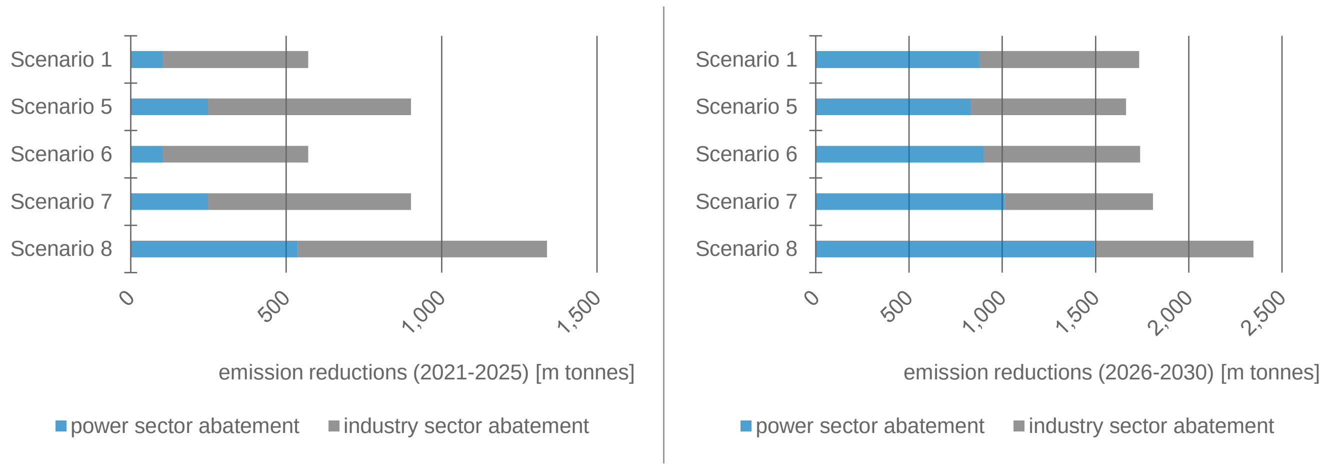
For Scenario 5 emission reductions occur especially in the first half of TP4 (left graph). This effects cumulates to 330m less emissions from 2021-2025 or 58% more additional emissions reductions compared to Scenario 1. However, in the later phase of TP4 this dynamic actually turns around and 69m more emissions are observed in Scenario 5.

When changing solely the thresholds of the MSR – Scenario 6 – the effects are less extreme: No changes to additional emission reductions can be expected in the first half of TP4, while slightly more reductions, -5m emissions or 0% more reductions.

In Scenario 7, the combination of Scenario 5 and 6, the effect is exactly the combination of the two, significantly more reductions from 2021-2025, while only slightly more reductions from 2026-2030.

The more extreme Scenario 8 predicts even less emission in 2021-2025 compared to Scenario 5 and 7, namely 768m less emissions or 134% more reductions. As the intake rate is changed over the entire TP4, even in the second half, 5612m less emissions and 35% more reductions would take place compared to Scenario 1.

Figure 4.2.6: Emission reductions per sector in 2021-2025 (left graph) and 2026-2030 (right graph) subject to various MSR designs



Source: ICIS Tschach Solutions

Effects on compliance costs

Based on the sectoral fundamental emission reductions modelled by ICIS Tschach Solutions, EURELECTRIC made an additional assessment about how such reform would translates into compliance costs for the power sector.

As a tighter MSR results in higher carbon prices, compliance costs for the power and the industrial sectors increase. While the increase of compliance cost is only marginal if only the thresholds of the MSR are changed, +0.2% for Scenario 6, the increase is more severe for a higher intake rate. Scenario 5 and 7, both assuming a 24% intake rate from 2019-2021 would result in 6.0% respectively 5.1% higher compliance costs over TP4.

Figure 4.2.6: Total compliance costs in the power sector from 2021-2030 subject to various MSR designs

m € (real values)	Total compliance costs				Increase compared to Commission proposal		
	Scenario 1	Scenario 5	Scenario 6	Scenario 7	Scenario 5	Scenario 6	Scenario 7
Bulgaria	-6,677	-6,938	-6,678	-6,998	3.9%	0.0%	4.8%
Croatia	-912	-906	-912	-914	-0.7%	0.0%	0.3%
Czech Republic	-9,031	-9,545	-9,070	-9,094	5.7%	0.4%	0.7%
Estonia	-2,093	-2,213	-2,097	-2,191	5.7%	0.2%	4.7%
Hungary	-1,898	-2,408	-1,899	-2,415	26.8%	0.0%	27.2%
Lithuania	-42	-46	-42	-46	8.7%	0.0%	9.7%
Latvia	-328	-339	-328	-340	3.2%	0.1%	3.7%
Poland	-29,642	-31,603	-29,674	-31,481	6.6%	0.1%	6.2%
Romania	-2,156	-2,229	-2,155	-2,260	3.4%	-0.1%	4.8%
Slovakia	-1,548	-1,414	-1,559	-1,316	-8.7%	0.7%	-15.0%
Total (incl. all MS)	**-170783,**	**-181,105**	**-171,063**	**-179,471**	**6.0%**	**0.2%**	**5.1%**

Source: EURELECTRIC

The net compliance costs after deducting the estimated value of the compensation mechanisms can be found in Figure 4.2.7.

The compensation mechanisms have a mitigating effect on the compliance costs for the eligible member states. As outlined before, the volumes of the compensation mechanisms are not affected when tightening the MSR, but as the carbon price increases their value surges.

The differences to Scenario 1 can be compared on a member state basis by comparing the percentages in Figure 4.2.6 and Figure 4.2.7.

Figure 4.2.7: Compliance costs after compensation mechanisms for 2021-2030 subject to various MSR designs

m € (real values)	Total balance of compliance costs vs compensation value				Increase compared to Commission proposal		
	Scenario 1	Scenario 5	Scenario 6	Scenario 7	Scenario 5	Scenario 6	Scenario 7
Bulgaria	-5,044	-5,188	-5,035	-5,223	2.9%	-0.2%	3.6%
Croatia	-420	-379	-417	-380	-9.8%	-0.6%	-9.5%
Czech Republic	-5,298	-5,546	-5,316	-5,039	4.7%	0.3%	-4.9%
Estonia	-1,483	-1,558	-1,483	-1,528	5.1%	0.0%	3.0%
Hungary	-583	-998	-575	-986	71.4%	-1.3%	69.2%
Lithuania	342	366	345	371	6.9%	0.7%	8.5%
Latvia	-139	-136	-138	-134	-2.2%	-0.7%	-3.0%
Poland	-20,136	-21,419	-20,113	-21,154	6.4%	-0.1%	5.1%
Romania	856	998	875	1,012	16.6%	2.2%	18.3%
Slovakia	-334	-113	-338	3	-66.2%	1.1%	-101.0%
Total	-32,237	-33,973	-32,194	-33,056	5.4%	-0.1%	2.5%

Source: EURELECTRIC

Conclusions

A tightening of the MSR through increasing the intake rate would create immediate ambition in the EU ETS and increase the incentive to reduce emissions as of 2019. Consequently, the traffic light for emission reductions is green for the period 2016-2025. Companies might even anticipate the more aggressive functioning of the MSR and start to reduce emissions pre-2019. As can be seen in the abatement section of this study, such a reform would only incentivise significant additional reduction in the period 2025-2030 if the intake rate is permanently increased or the thresholds would be reduced downwards. Because of this the red-yellow traffic light for this time horizon needs to be seen in context of the analysis. It could be brought to yellow-green, but only with a far reaching reform of the MSR would be implemented. As more emissions are reduced in the early years, but less in the period 2026-2030, a lot of reductions are still needed post-2030. Thus the traffic light is green.

Regarding cost-efficiency in the short-term, the traffic light is only yellow as a more aggressive MSR artificially increases the costs to reach the 43% reduction target. However, the yellow light in the short-term also translates into a yellow light in the long-term. This is because early emission reductions are triggered in such a reform (if the intake rate is increased) which is inter-temporal cost-efficient.

Regarding the affected sectors, the industrial sectors are only slightly impacted as the free allocation volumes would not be amended by a reform of the MSR. As only the 10% most-efficient industry installations receive 100% free allocation (in the case they are carbon leakage exposed), the 90% less efficient installations have to buy allowances on the market and are consequently affected by higher carbon prices. The power sector, on the other hand, would be significantly impacted as their primary supply source are auction volumes, which would be severely reduced.

The system would not gain more predictability for the long-term as the EU ETS would still not be in line with the long-term 2050 target and would need an additional cap increase post-2030. Furthermore, if scarcity in the system should be steered by the MSR, a frequent adjustment of the MSR to align it to the market environment is absolutely necessary.

As a last point, the effect on the compensation mechanisms is green as the volumes are not reduced, but the higher carbon prices increase the estimated value of the mechanisms.

Altogether, the analysis suggests that a tightening of the MSR can create early ambition in the EU ETS. Furthermore, it would be advisable to increase not only the intake rate, but also decrease the thresholds to retain the ambition in the second half of TP4.

A more aggressive MSR would also create a safety buffer which could be used in future years to mitigate possible extreme effects once emissions are reduced further. However, steering the EU ETS alone with amending the MSR, creates also more political uncertainty – as ambition would be subject to MSR reform – and does not send the long-term investment signal a higher target can deliver.

Measure	Ambition (emission reductions)			Cost-efficiency		Affected sectors		Predictability	Effect on compensation mechanisms
	2016-2025	2025-2030	2030-2050	Short-term	Long-term	Power	Industry		
Tighter MSR	grey / grey / green	red / yellow / grey	grey / grey / green	grey / yellow / grey	grey / yellow / grey	grey / yellow / grey	grey / yellow / green	red / yellow / grey	grey / grey / green

3.3 Scenario group 3: Combination of higher target and tighter MSR

The two previous sections of this study outlined that changing the target would increase ambition only late during the fourth trading period, while a tightening of the MSR creates early ambition. In order to fulfil the two-target function of the EU ETS – reduce emissions cost-efficiently – more ambition over the whole period 2016-2030 is necessary.

This means, a reform is needed that incentivises early abatement (2016-2025) while at the same time ensures abatement between 2025 and 2030 to deliver long-term economic viability for low carbon investment. Second, by changing the cap, such a reform could also deliver long-term predictability by putting the cap on track to reach the long-term envisaged EU ETS reduction target of 92% brought forward in the *2050 Energy Roadmap*.

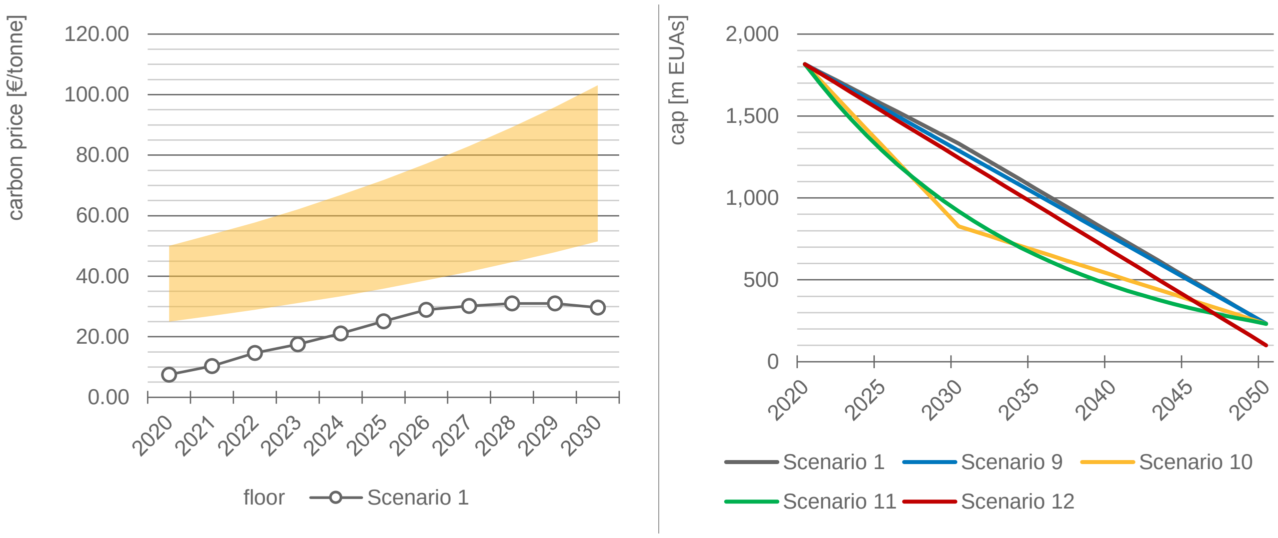
As a combination of both previous scenario groups seem necessary, the study assesses the effects such a combination would have on the EU ETS.

Furthermore, this combination of a higher target and a tighter MSR is modelled to try to reach the price corridor brought forward in the *Mestrallet-Canfin-Grandjean* report (link) – the corridor can be seen in Figure 4.3.1 (left graph).

The following combinations are modelled – the respective caps can be found in Figure 4.3.1 (right graph):

- Scenario 9: 2.4% LRF combined with 24% MSR intake rate from 2019-2030 and the 400m respectively 833m threshold
- Scenario 10: 4.5% LRF[3] combined with 24% MSR intake rate from 2019-2021 and the 300m respectively 600m threshold
- Scenario 11: 6.6% RF[4] combined with 24% MSR intake rate from 2019-2021 and the 300m respectively 600m threshold
- Scenario 12: 2.6% LRF combined with 3-year-reviewed[5] MSR. This is a sensitivity scenario and has only limited coverage of results

Figure 4.3.1: Mestrallet-Canfin-Grandjean price corridor (left graph) and cap developments under various combination scenarios



Source: ICIS Tschach Solutions

Effect on fundamental volumes

As in all scenarios the cap in TP4 is decreased, all fundamental supply volumes are affected.

The influence on the free allocation limit, the modernisation fund, and the auction volumes (and also the 10c volumes) is relatively straightforward as the auction/free allocation shares are kept constant at 57% (43% respectively).

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[3] The 4.5% LRF would over-achieve the 2050 target if it is further applied post-2030. Consequently, the LRF is adjusted to 1.35% post-2030 to reach 90% reduction in 2050. This LRF would lead to a 64% reduction target in 2030.

[4] The reduction factor assumes a fixed reduction factor so that the 2050 reduction target of 90% is reached by reducing the cap by a fixed percentage (6.6%) of the previous year cap. This RF would lead to a 60% reduction target in 2030. This would mean that the absolute reduction is not linear, but decreases exponentially towards 2050

[5] In this scenario the MSR is reviewed on a three-year basis:

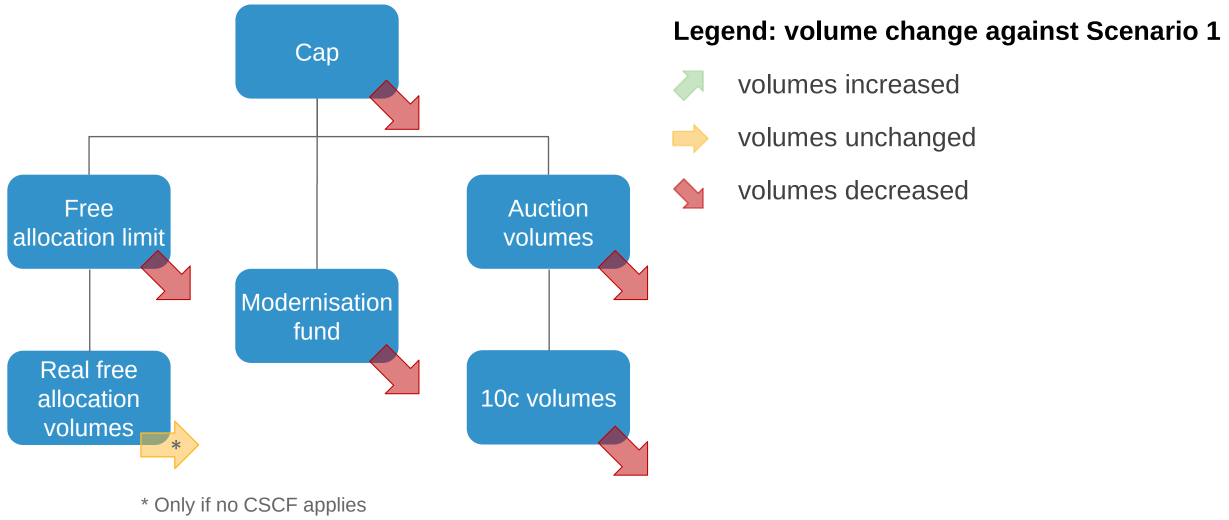
- 2019-2021 24% intake rate and 400m respectively 833m thresholds
- 2022-2024 28% intake rate and 400m respectively 700m thresholds
- 2025-2027 32% intake rate and 300m respectively 600m thresholds
- 2028-2030 36% intake rate and 300m respectively 500m thresholds

On the “real” free allocation volumes, meaning the transferred free allocation to installations, the effects are more complex due to the application of the CSCF. The CSCF analysis has to be seen in context with the assumptions taken on benchmark adjustment brought forward out before in this study.

While in Scenario 9 no CSCF would apply during TP4, a quite extreme CSCF would be observable in Scenario 10 and 11 – resulting in an average CSCF of 86% over TP4 in both scenarios. In the sensitivity Scenario 12, also no CSCF would apply in TP4.

This means that in Scenario 9 and 12 no effect on free allocation can be assumed, while in Scenario 10 and 11 a significant reduction of free allocation volumes would occur.

Figure 4.3.2: Effect on fundamental volumes of combination scenarios



Source: ICIS Tschach Solutions

Effect on price developments

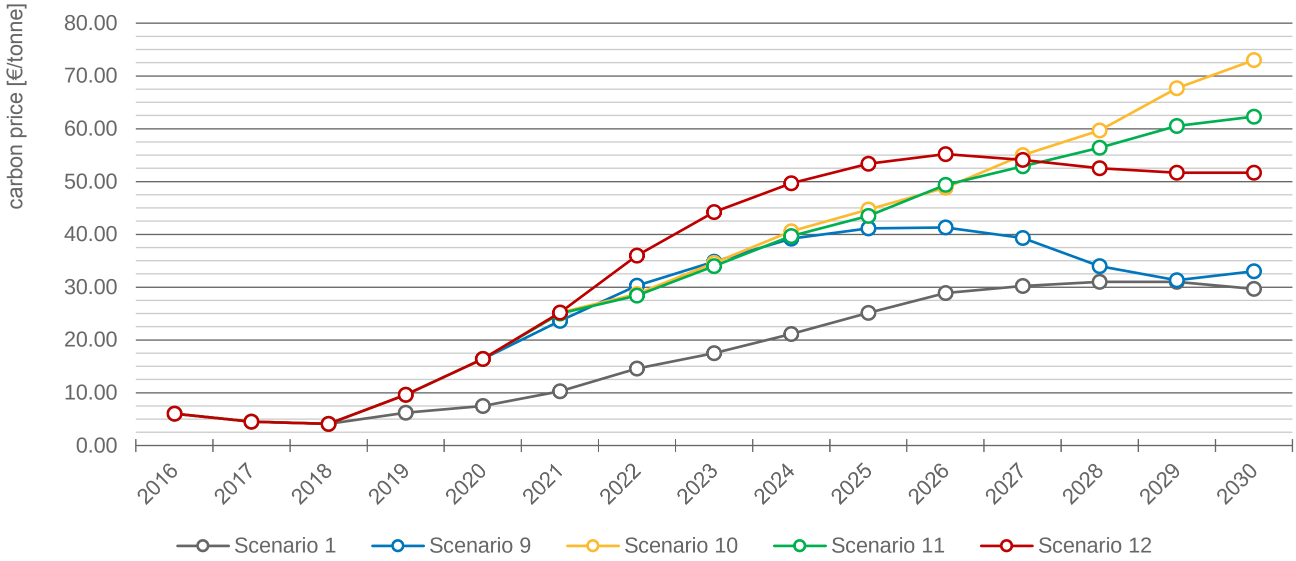
In this scenario group the price development of the different scenarios differs significantly. This is because quite extreme changes are assumed for volume-based reforms which would push carbon prices into the *Mestrallet-Canfin-Grandjean* price corridor.

For Scenario 9 a similar price development as for Scenario 8 is observable: Prices increase quickly after 2019 as the intake rate of the MSR is doubled to 24%. As the thresholds of the MSR are not changed, prices drop back to €31.00 in 2029 after reaching the highest price of around €40.00/tonne in 2026. In Scenario 8 – which assumes the same MSR, but a 2.2% LRF – this price drop is even more severe to below €30.00/tonne.

In Scenario 10 and 11 price developments are quite extreme with prices surpassing the €50.00/tonne mark in 2027. Prices constantly increase in these two scenarios as the 2030 target is significantly increased.

For Scenario 12, a very ambitious MSR is assumed. Prices increase even faster than in Scenario 10 and 11 and reach levels over €50.00 in 2025. However, prices also flatten out and even decrease slightly post-2026 as the cap is not set high enough to consistently deliver the ambition needed for a sustainable increase in prices.

Figure 4.3.3: EUA price developments under various combination scenarios



€/tonne (real values)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Scenario 1	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.20	31.00	31.00	29.70
Scenario 9	4.10	9.60	16.40	23.60	30.30	34.80	39.20	41.10	41.30	39.30	34.00	31.30	33.00
Scenario 10	4.10	9.60	16.40	25.20	28.70	34.60	40.60	44.70	48.80	55.00	59.70	67.70	73.00
Scenario 11	4.10	9.60	16.40	25.00	28.40	34.00	39.70	43.50	49.40	52.90	56.40	60.50	62.30
Scenario 12	4.10	9.60	16.40	25.20	36.00	44.20	49.70	53.40	55.20	54.10	52.50	51.70	51.70

Source: ICIS Tschach Solutions

Effect on compensation mechanisms

For the compensation mechanisms, such a combined reform would have a depressing effect on volumes as the cap would be lower compared to the base case scenario – Figure 4.3.4.

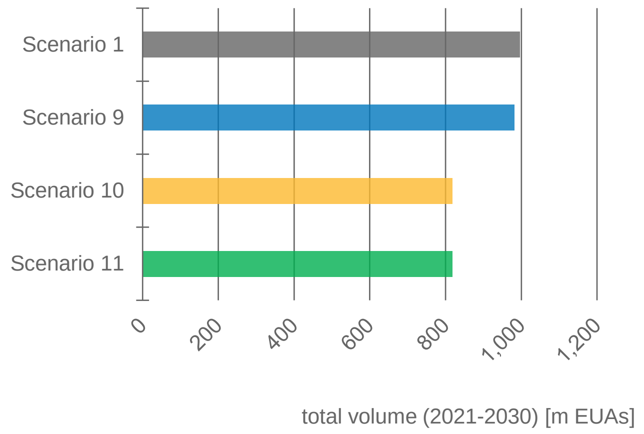
While in Scenario 9 this effect is marginal in Scenario 10 and 11 the volumes of the compensation mechanisms are significantly lower.

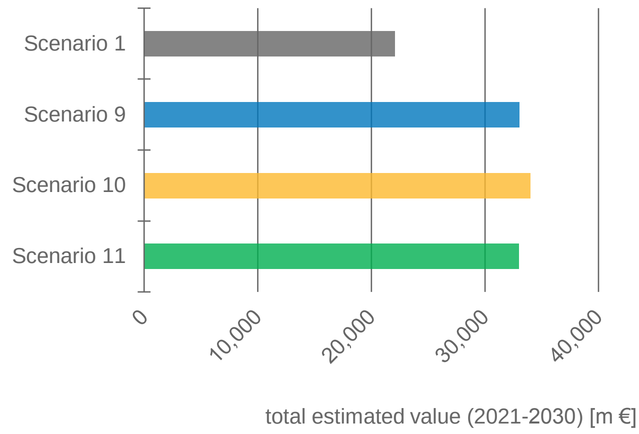
However, as prices increase in all scenarios of this scenario group, the carbon price effect mitigates the volume effect. Consequently, in all scenarios the estimated total monetary value of the compensation mechanisms increases by 50-55% or €10-12bn compared to the base case scenario.

As Scenario 12 is only a sensitivity scenario the monetary value of the compensation mechanisms is not calculated.

The yearly volumes and estimated value can also be found in Figure 4.3.4.

Figure 4.3.4: Volume (left graph) and estimated value of compensation mechanisms (right graph)





	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Volume [m EUAs]										
Scenario 1	114	111	107	104	101	98	95	92	89	86
Scenario 9	113	110	107	103	100	96	93	90	86	83
Scenario 10	110	104	98	91	85	79	72	66	60	53
Scenario 11	109	102	95	89	83	78	72	68	63	59
Estimated value [m €]										
Scenario 1	1,012	1,377	1,725	2,014	2,339	2,650	2,808	2,813	2,753	2,601
Scenario 9	2,268	2,965	3,471	3,819	4,008	3,973	3,750	3,286	2,816	2,664
Scenario 10	2,297	2,805	3,093	3,435	3,625	3,676	3,750	3,779	3,792	3,740
Scenario 11	2,258	2,721	2,969	3,275	3,454	3,602	3,704	3,697	3,693	3,623

Source: ICIS Tschach Solutions

Effects on the cumulative fundamental balance, the MSR and overall abatement

As the changes to the system are very substantial in some of the scenario in this group, the effects on the cumulative fundamental balance as well as the MSR are also quite extreme.

While for Scenario 9 the cumulative fundamental balance decreases very quickly as of 2019 due to the higher intake rate of the MSR, the effect flattens over TP4. This is because the MSR is not triggered anymore based on the surplus in 2026 and 2027. This increases the cumulative fundamental balance as of 2028-2029. In the last two years of TP4, the MSR again reduces auction volumes.

In Scenario 10 and 11 the effects on the cumulative fundamental balance are extreme: It can be seen that these developments are not solely based in the MSR, but mainly on the higher targets implemented in 2030. In both scenarios the cumulative fundamental balance would end up below 450m in 2030.

Figure 4.3.5: Cumulative fundamental balance and regular MSR transfer

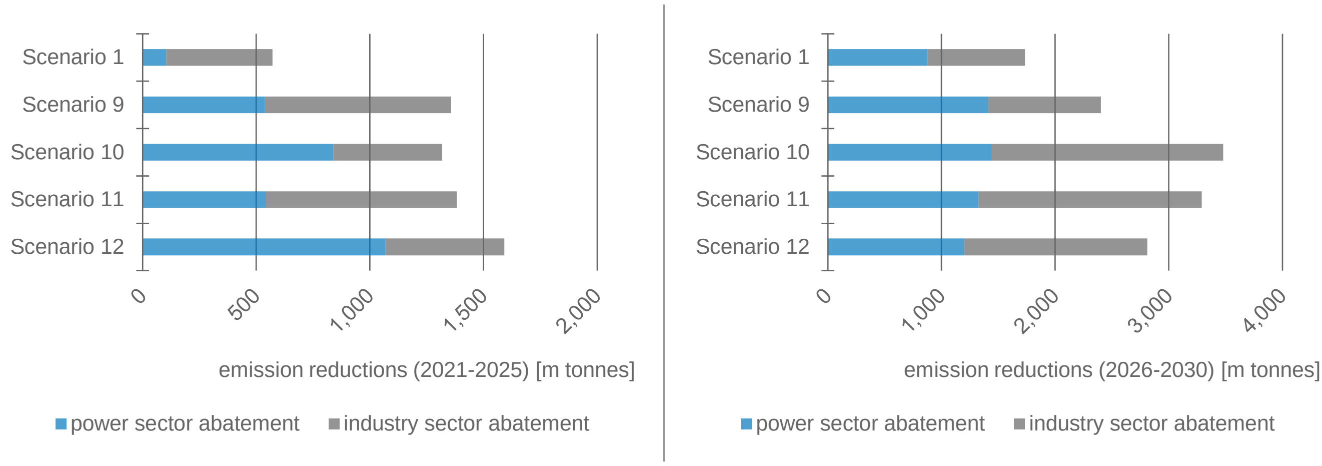
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Cumulative fundamental balance [m EUAs]													
Scenario 1	1,745	1,589	1,490	1,316	1,108	1,066	1,046	1,014	958	882	798	742	803
Scenario 9	1,745	1,382	1,091	1,041	1,015	972	918	847	755	746	922	1,043	971
Scenario 10	1,745	1,382	1,091	1,044	1,020	993	952	888	805	712	608	515	430
Scenario 11	1,745	1,382	1,091	1,044	1,012	980	932	865	774	669	564	475	402
Scenario 12	1,745	1,382	1,091	1,042	1,014	963	900	818	710	644	631	651	662
MSR – regular transfer [m EUAs]													
Scenario 1	0	207	205	188	174	152	132	127	125	120	113	79	0
Scenario 9	0	414	397	314	259	248	241	230	216	152	0	55	229
Scenario 10	0	414	397	314	130	125	122	118	112	104	94	82	55
Scenario 11	0	414	397	314	130	124	120	116	110	101	90	60	0
Scenario 12	0	414	397	314	302	290	280	303	281	253	250	231	229

Source: ICIS Tschach Solutions

When analysing the emission reductions which are triggered by the scenarios in this group, it is apparent that all four scenarios result in earlier emissions reductions (2016-2025) than in Scenario 1. In all scenarios the reductions more than double (-740m to -1000m) in this time horizon.

Regarding emission reductions in the second half of TP4, the scenarios vary. While Scenario 9 achieves 39% (669m less emissions) more reductions than Scenario 1, Scenario 10 and 11 keep the ambition of the system very high and reduce between 90-100% (1,500n to 1,800m less emissions) more emissions compared to Scenario 1. Scenario 12 is with 62% (1,070m less emissions) more reduction in the middle of the other scenarios.

Figure 4.3.6: Emission reductions per sector in 2021-2025 (left graph) and 2026-2030 (right graph)



Source: ICIS Tschach Solutions

Effects on compliance costs

Based on the sectoral fundamental emission reductions modelled by ICIS Tschach Solutions, EURELECTRIC made an additional assessment about how this translates into compliance costs – see Figure 4.3.7.

All scenarios of this group result in higher compliance costs for the power sector. While there are some exceptions on a member state basis, in total compliance costs increase by 34-67% in these scenarios.

For Scenario 9 the increase is with 34% at the lower end of the group. This development is mainly driven by the higher allowance prices which can be expected under this scenario.

For Scenario 10 and 11 the effect on compliance costs is much more extreme. These results have to be seen in context with the significantly lower emissions of these scenarios. The decrease of emissions cannot mitigate the effect of higher carbon prices and consequently compliance costs would increase by over 65% in both scenarios.

Figure 4.3.7: Total compliance costs in the power sector from 2021-2030

m € (real values)	Total compliance costs				Increase compared to Commission proposal		
	Scenario 1	Scenario 9	Scenario 10	Scenario 11	Scenario 9	Scenario 10	Scenario 11
Bulgaria	-6,677	-8,762	-9,170	-9,354	31.2%	37.3%	40.1%
Croatia	-912	-1,093	-1,332	-1,361	19.9%	46.1%	49.3%
Czech Republic	-9,031	-12,739	-17,963	-17,779	41.1%	98.9%	96.9%
Estonia	-2,093	-3,138	-4,421	-4,434	49.9%	111.2%	111.8%
Hungary	-1,898	-2,620	-2,974	-3,101	38.0%	56.7%	63.3%
Lithuania	-42	-53	-66	-67	26.6%	56.7%	59.3%
Latvia	-328	-418	-471	-480	27.4%	43.5%	46.4%
Poland	-29,642	-40,821	-44,009	-44,575	37.7%	48.5%	50.4%
Romania	-2,156	-2,685	-3,622	-3,807	24.5%	68.0%	76.5%
Slovakia	-1,548	-1,909	-3,132	-3,052	23.3%	102.3%	97.1%
Total (incl. all MS)	-170,783	-228,900	-284,075	-286,055	34.0%	66.3%	67.5%

Source: EURELECTRIC

As outlined in the chapters before the higher compliance costs can be partly mitigated by the compensation mechanisms. As not all member states are eligible for the compensation mechanisms, the mitigating effect only applies for eligible member states. A comparison for the eligible member states can be drawn by comparing Figure 4.3.7 and 4.3.8.

While the mitigating effect is observable in general for all member states, the comparison with Scenario 1 shows a mixed picture – for some member states the mitigating effect (in %) is bigger, for others smaller.

Figure 4.3.8: Compliance costs after compensation mechanisms for 2021-2030

m € (real values)	Total balance of compliance costs vs compensation value				Increase compared to Commission proposal		
	Scenario 1	Scenario 9	Scenario 10	Scenario 11	Scenario 9	Scenario 10	Scenario 11
Bulgaria	-5,044	-6,321	-6,656	-6,914	25.3%	32.0%	37.1%
Croatia	-420	-358	-575	-627	-14.8%	37.0%	49.3%
Czech Republic	-5,298	-7,160	-12,220	-12,204	35.1%	130.6%	130.3%
Estonia	-1,483	-2,225	-3,481	-3,522	50.1%	134.8%	137.5%
Hungary	-583	-654	-950	-1,136	12.2%	63.0%	94.9%
Lithuania	342	521	525	507	52.3%	53.5%	48.1%
Latvia	-139	-135	-179	-197	-2.7%	29.3%	42.4%
Poland	-20,136	-26,611	-29,382	-30,376	32.2%	45.9%	50.9%
Romania	856	1,817	1,013	692	112.4%	18.3%	-19.1%
Slovakia	-334	-94	-1,263	-1,237	-71.9%	278.5%	270.7%
Total	-31,636	-40,306	-52,341	-54,076	27.4%	65.4%	70.9%

Source: EURELECTRIC

Conclusions

While the combination scenarios are quite diverse and extreme in this study, some common impacts can be overserved.

Regarding emission reductions, all scenarios deliver significant reductions early, meaning between 2016 and 2025. Dependent on the scenario, the level of reductions between 2026 and 2030 vary. However, all scenarios deliver significantly more reductions than the base case scenario. Consequently, the traffic lights for both time horizons are green. As emission are significantly reduced by 2030, less reductions are necessary post-2030. While the absolute level is different in the single scenarios, the trend is the same – therefore, the traffic light turns yellow-red.

The short-term cost-efficiency is negatively impacted compared to the base case scenario, because of the tightened MSR: It drives compliance costs higher than necessary to achieve the envisaged 2030 target. This is because the MSR reduces the amount of allowances given out in TP4 below levels envisaged by the cap. The long-term cost-efficiency is, however, improved in all scenarios. As much more reductions are triggered in the early years, the inter-temporal efficiency is significantly increased. Furthermore, the MSR is able to provide a stock of allowances towards 2050 in order to mitigate extreme effects in later decades.

It is obvious that both sectors, power and industry, would be highly affected by such a reform. Dependent on the magnitude of the LRF change, the CSCF would either apply or not. If the CSCF would not apply the impact on the industrial sectors would be considerably lower and, therefore, the traffic light stays yellow. The power sector would face less supply through auctions, so that the traffic light tilts towards red.

From a predictability standpoint such a reform could be used to set the system on track to reach the long-term 2050 target. Consequently, no additional reform would be necessary in later years if the EU sticks to its long-term ambition.

Last, the effect on the compensation mechanisms is twofold: While the volumes decrease, the estimated monetary value increases. As the mitigating effect of the compensation mechanisms varies for the different scenarios, the traffic light is yellow.

To sum up, the analysis of the combination scenarios suggests that more ambition over the entire fourth trading period can be achieved by such a reform. It would be advisable to increase the LRF compared to the

Commission proposal to set the system on track to reach its envisaged 2050 target while at the same time create immediate ambition as of 2019 through a tightening the MSR.

As for the single MSR adjustment scenarios, it would also be advisable to decrease the thresholds alongside an increase of the intake rate of the MSR, to keep the MSR effective towards the end of TP4. Furthermore, the more aggressive MSR would create a safety buffer of allowances which can be used in the following decades to mitigate extreme effects.

Measure	Ambition (emission reductions)			Cost-efficiency		Affected sectors		Predictability	Effect on compensation mechanisms
	2016-2025	2025-2030	2030-2050	Short-term	Long-term	Power	Industry		
Combination of higher LRF and tighter MSR	⚪⚪🟢	⚪⚪🟢	🔴🟡⚪	⚪🟡⚪	⚪⚪🟢	🔴🟡⚪	⚪🟡⚪	⚪⚪🟢	⚪🟡⚪

3.4 Scenario group 4: Over-lapping policies

More and more discussions in the last years revolve around over-lapping policies. It is clear that other energy related policies have a decisive effect on the EU ETS. These policies are wide ranging: from EU wide energy efficiency or renewable energy targets to national measures on renewable energy subsidies or fossil-fuel specific policies, e.g. coal phase-outs or fuel taxes.

The aim of this section of the study is to show the impacts of such measures on the EU ETS, by modelling some explanatory over-lapping policies and discuss whether additional ambition could be reach by the implementation of such policies.

Three measures are modelled:

- Scenario 13 and 14: As a national measure a hypothetical organised German coal phase-out is implemented
- Scenario 15 and 16: A combination of several national measures, higher renewable energy subsidies in single member states so that all member states reach the high renewable energy scheme (RES) capacity assumptions
- Scenario 17 and 18: As an EU wide measure, a 35% energy efficiency target in 2030 is assumed

For all measure two scenarios exist. Scenario 13, 15 and 17 assume no EU ETS adjustment if the additional over-lapping measure is taken. Scenario 14, 16 and 18 assume that the EU ETS is adjusted by shifting the volumes – corresponding to the demand reduction in the EU ETS due to the implementation of the respective over-lapping policy – from auctions to the MSR.

Detailed scenario explanation

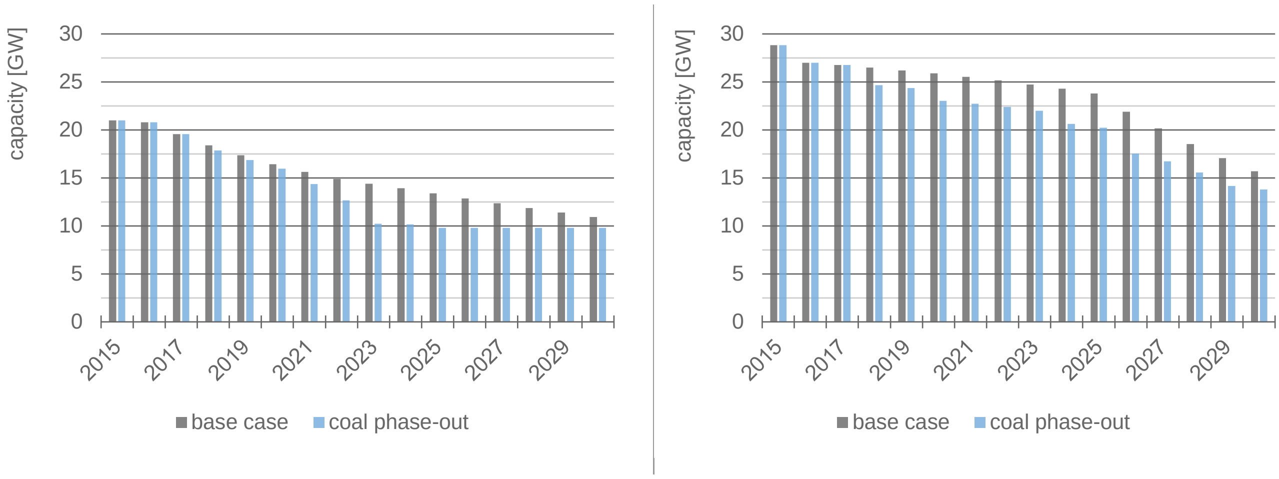
To assess the possible impact of unilateral measures on EUA demand and the MSR, we modelled a **phase-out of lignite and hard coal power plants in Germany**.

Agora Energiewende – a Berlin-based think tank – proposed in its report *Eleven Principles for a Consensus on Coal* in January 2016 (*link*) the implementation of a gradual coal phase-out in Germany. Similar to the ongoing German nuclear phase-out, the proposal suggests to define binding decommissioning dates for coal-fired power plants until 2040.

The German coal phase-out plan modelled in this scenario does not use the absolute Agora numbers, but the base case coal-fired power plant capacities used in the ICIS TIM were rather adapted with the same (negative) growth rates as seen in Agora's proposal.

It can be seen in Figure 4.4.1 that the total decrease of both German lignite and hard coal capacities start earlier compared to our base case scenario, but the overall ambition is not significantly higher. The base case assumptions are derived from Entso-E's *Scenario Outlook & Adequacy Forecast* (SOAF).

Figure 4.4.1: Lignite (left graph) and hard coal (right graph) capacities in Germany subject to ICIS base case and coal phase-out scenario



Source: ICIS Tschach Solutions, Agora Energiewende

To visualize the impact of above-expectation **renewable capacity growth** driven by higher subsidies or other measures, the study utilises Entso-E's best case SOAF scenario to determine the renewable energy power generation capacities until 2030.

This scenario takes into account capacity increases and decreases on three levels:

1. Commissioning of current power generation assets under construction (both renewable and conventional) which can be considered "certain" according to investors, involved companies and transmission system operators, are included.
2. Future power generation assets of which commissioning is considered as "reasonably credible" by national transmission system operators according to the available national information are included.
3. Decommissioning dates of assets are taken into account if shut downs are already announced by authorities and/or companies or if the theoretical technical lifetime will be reached during the reviewed period.

As a third over-lapping policy a higher than currently planned **energy efficiency target** – 35% – is assumed on EU level.

A comprehensive implementation of measures in all sectors would also have vast impacts on non-EU ETS emissions (e.g. less emissions from residential heating due to improved heating systems and thermal insulation). The impact on EU ETS sectors though, would be mainly visible in the power sector. The (in most cases) easiest, quickest and cheapest way to implement energy efficiency measures is to reduce power demand. This directly impacts the emissions of the power sector as less fossil-fuelled generation is needed to meet power demand after utilising renewable and nuclear energy sources.

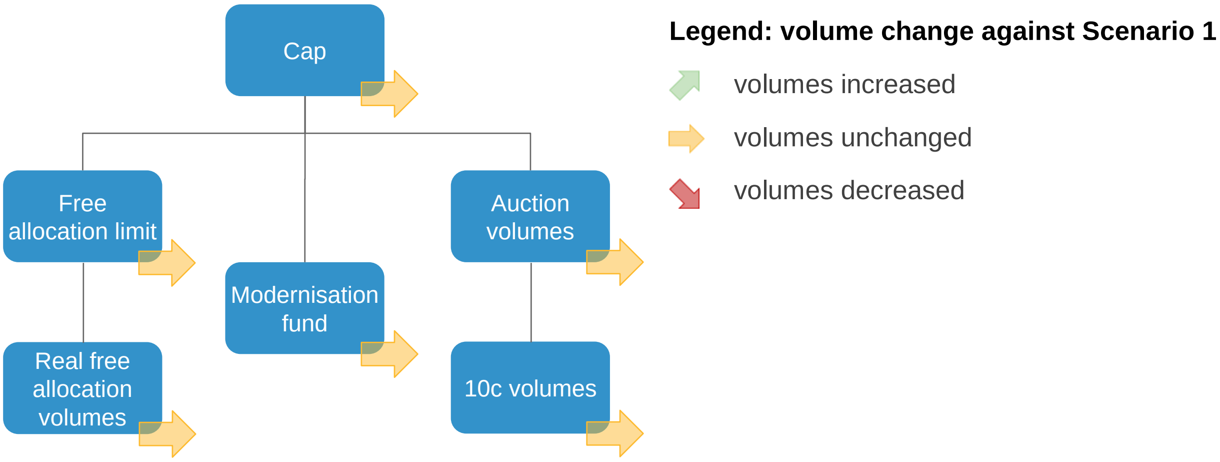
To model the respective impact, an annual power demand decrease of 1% as of 2021 compared to our base case scenario was assumed. Consequently, the power demand per member state in 2030 equals 90% of the power demand in the base case scenario. Different trajectories due to varying national priorities to implement such measures were not taken into account. In addition, higher energy efficiency improvements in the industrial sectors, which further reduces emissions compared to the base case, were assumed.

Effect on fundamental supply volumes

While over-lapping policies have only an effect on the demand side of the EU ETS, Figure 4.4.2 illustrates that no EU ETS supply volumes would be affected.

However, as outlined before all three scenarios are also assessed with an adjustment of the EU ETS, via shifting volumes to the MSR, according to the demand impact of the over-lapping policies.

Figure 4.4.2: Impact on fundamental supply of over-lapping policies



Source: ICIS Tschach Solutions

Effect on price developments

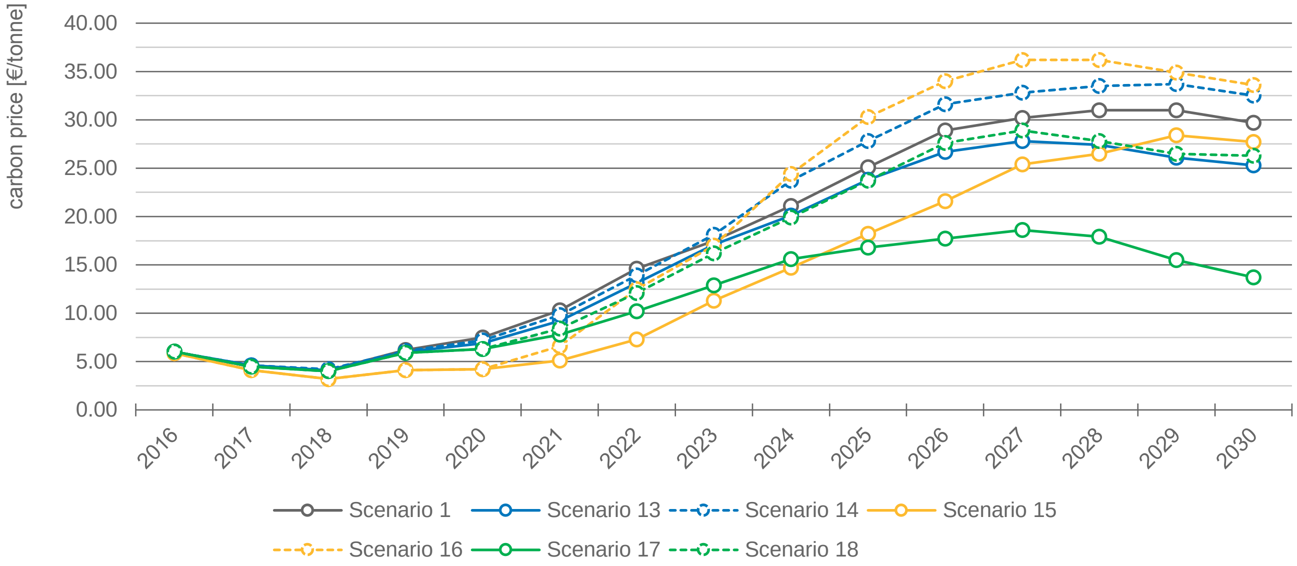
As the three modelled over-lapping policies affect demand in the EU ETS to different magnitudes the impact on price development varies.

The modelled German coal phase-out (w/o adjusting the MSR accordingly) reduces prices only marginally in the early years of TP4. As of 2025 this effect increases and price are approx. €5.00/tonne lower in 2030 compared to Scenario 1. If, however, the EU ETS is adjusted and the respective volumes are shifted to the MSR prices would actually increase compared to Scenario 1. The shape of the two curves would be similar, but Scenario 14 would end up €2.00-3.00/tonne higher in 2030.

In Scenario 15 (increase of renewable energy capacities to high case with no adjustment of MSR) prices are depressed throughout TP4. The average TP4 prices would be €5.30/tonne lower in the high RES case compared to Scenario 1. If the auction supply would be adjusted to mitigate the effect on the EU ETS, prices would end up higher than in Scenario 1, on average €2.60/tonne in TP4.

For Scenario 17 (35% EE target in 2030 with no adjustment of the EU ETS), prices are significantly lower throughout TP4. Especially after 2020 prices tail off and would not surpass the €20.00/tonne mark. Towards 2030, prices would even fall below the €15.00/tonne mark as the MSR would not be sufficient to take the over-supply out of the market. When adjusting the EU ETS for the reduced demand caused by the higher EE target, prices would develop differently and increase as of 2027 to end €3.50/tonne below Scenario 1. This is because the MSR is not triggered anymore in Scenario 18 as of 2028 due to less hedging demand which itself is the result form the lower emissions in the power sector. A downward adjustment of the thresholds of the MSR would also mitigate this impact late in TP4.

Figure 4.4.3: EUA price developments under various over-lapping policy scenarios



€/tonne (real values)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Scenario 1	4.10	6.20	7.50	10.30	14.60	17.50	21.10	25.10	28.90	30.20	31.00	31.00	29.70
Scenario 13	4.10	6.00	6.90	9.20	13.10	17.10	20.10	23.80	26.70	27.80	27.40	26.10	25.30
Scenario 14	4.20	6.10	7.20	9.80	13.90	18.10	23.70	27.80	31.60	32.80	33.50	33.70	32.50
Scenario 15	3.20	4.10	4.20	5.10	7.30	11.30	14.70	18.20	21.60	25.40	26.50	28.40	27.70
Scenario 16	3.20	4.10	4.20	6.60	12.50	17.00	24.40	30.30	34.00	36.20	36.20	34.90	33.60
Scenario 17	4.00	5.90	6.30	7.80	10.20	12.90	15.60	16.80	17.70	18.60	17.90	15.50	13.70
Scenario 18	4.00	5.90	6.30	8.40	12.10	16.20	19.90	23.70	27.60	28.90	27.80	26.50	26.30

Source: ICIS Tschach Solutions

As, however, all three measures reduce the demand for risk management and consequently the "healthy over-supply" in the system, the regular transfer to the MSR is affected for most scenarios (Figure 4.4.5) in the way that the MSR stops earlier to take out volumes from auction supply.

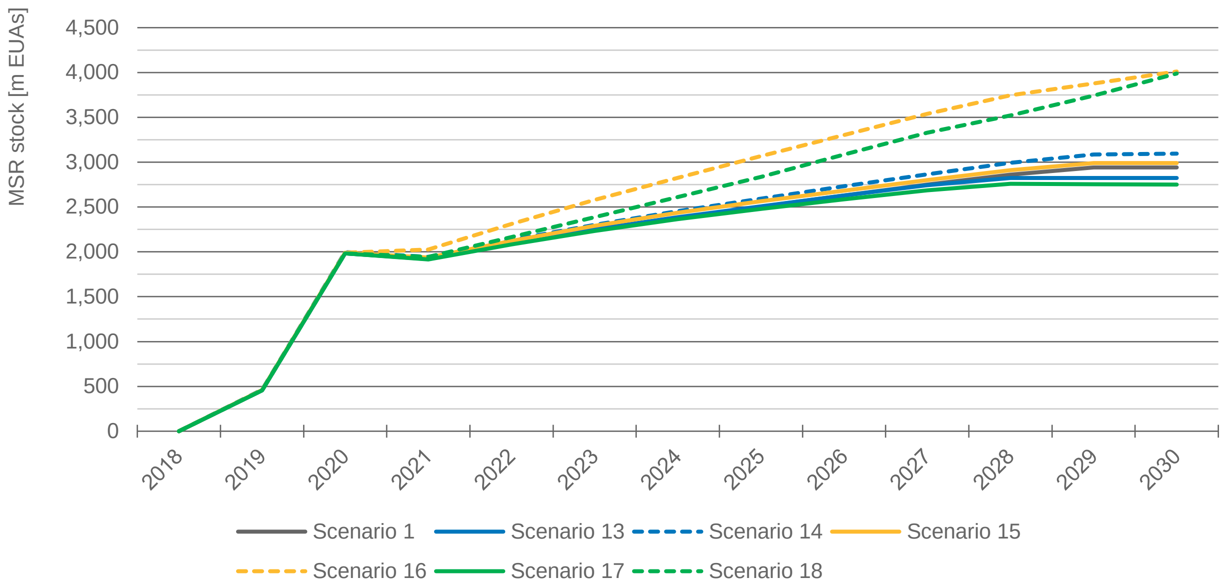
Figure 4.4.5: regular MSR transfers from auctions under various over-lapping policy scenarios

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
MSR – regular transfer [m EUAs]													
Scenario 1	0	-207	-205	-188	-174	-152	-132	-127	-125	-120	-113	-79	0
Scenario 13	0	-207	-205	-189	-175	-155	-134	-123	-120	-114	-81	0	0
Scenario 14	0	-207	-205	-188	-174	-152	-131	-123	-121	-117	-110	-77	0
Scenario 15	0	-209	-210	-196	-186	-168	-147	-127	-119	-117	-111	-80	0
Scenario 16	0	-209	-210	-196	-183	-154	-127	-117	-114	-108	-77	0	0
Scenario 17	0	-207	-205	-188	-174	-156	-136	-119	-111	-107	-76	0	0
Scenario 18	0	-207	-205	-188	-174	-152	-128	-113	-109	-78	0	0	0

Source: ICIS Tschach Solutions

Especially in the scenarios with an adjustment of the EU ETS via the MSR, the stock of the MSR is affected drastically and increases much more than in the base scenario. The respective MSR stocks can be seen in Figure 4.4.6.

Figure 4.4.6: MSR stock under various over-lapping policy scenarios



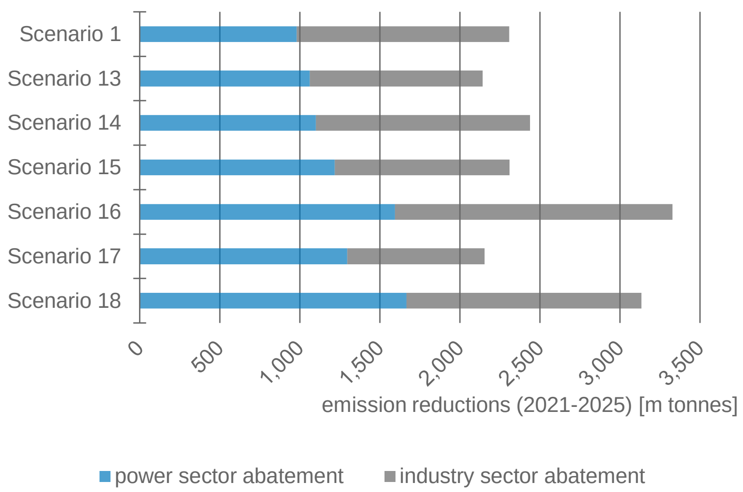
Source: ICIS Tschach Solutions

Regarding emission reductions, it is interesting to cluster the different scenarios into groups dependent on whether the EU ETS is adjusted or not.

For Scenarios 13, 15, and 17 the reductions through TP4 are nearly identical with the reductions in the base case scenario. In the context of the lower carbon prices in these scenarios, it seems that the same reductions are achieved at lower costs. However, the costs associated with these reductions are not visible in the carbon prices as the over-lapping policy and not the carbon prices incentivised the reductions.

In the scenarios where an adjustment takes place – Scenario 14, 16, and 18 – reductions are increased compared to the base case. This means that the over-lapping policies reduce already emissions, but as the supply is adjusted in the EU ETS accordingly, the carbon prices incentivises further cost-efficient reductions.

Figure 4.4.7: Emission reductions per sector in 2021-2030 under various over-lapping policies



Source: ICIS Tschach Solutions

Conclusions

By analysing the effects of various over-lapping policies on the EU ETS, the study clearly shows that over-lapping policies suppress carbon prices if implemented without a respective adjustment of the EU ETS. However, this is not the only effect. Furthermore, by comparing the triggered reductions it can be observed that over-lapping policies do not increase the ambition of emissions reductions if the EU ETS is not adjusted accordingly. The only effect is that reductions are not triggered by carbon prices, but by additional legislation. As the most cost-efficient solutions should be found through the carbon market, such over-lapping policies reduce the cost-efficiency of emission reductions.

However, as over-lapping policies will also play a role in the future, the study analysed the impact on the carbon market if supply is adjusted according to the implemented over-lapping policies. The analysis suggest that over-lapping policies are not a problem for the EU ETS per-se, but only if no adjustment takes place. When reducing auction volumes accordingly, the carbon price incentivises further emissions reductions at least possible costs.

4. Additional sensitivities

Next to the scenarios modelled in the chapter before, additional parameters could potentially influence the market in the coming years. However, not all parameters analysed in this study can be determined by the post-2020 reform or by the legislator in general.

First, this chapter outlines two additional sensitivities around the post-2020 reform:

- Greece being eligible for the compensation mechanisms
- A reduced auction share to 52%

In addition, two more sensitivities are modelled whereas one is linked to policy and shows the impact of an EU ETS exit of the UK after leaving the European Union. The second one is not linked to policy and shows the impact of a change in hedging behaviour of the Central European power sector.

4.1 Greece eligible for compensation

In the current Commission proposal, the selection criteria for whether a member state is eligible for the compensation mechanisms is based on the GDP in 2013. If a member state's GDP is below 60% of the EU average, this member state would be eligible for the compensation mechanisms. According to the Hellenic Electricity Association, the Greek GDP was 61.8% of the EU average in 2013 while below the 60% threshold in 2014 and 2015.

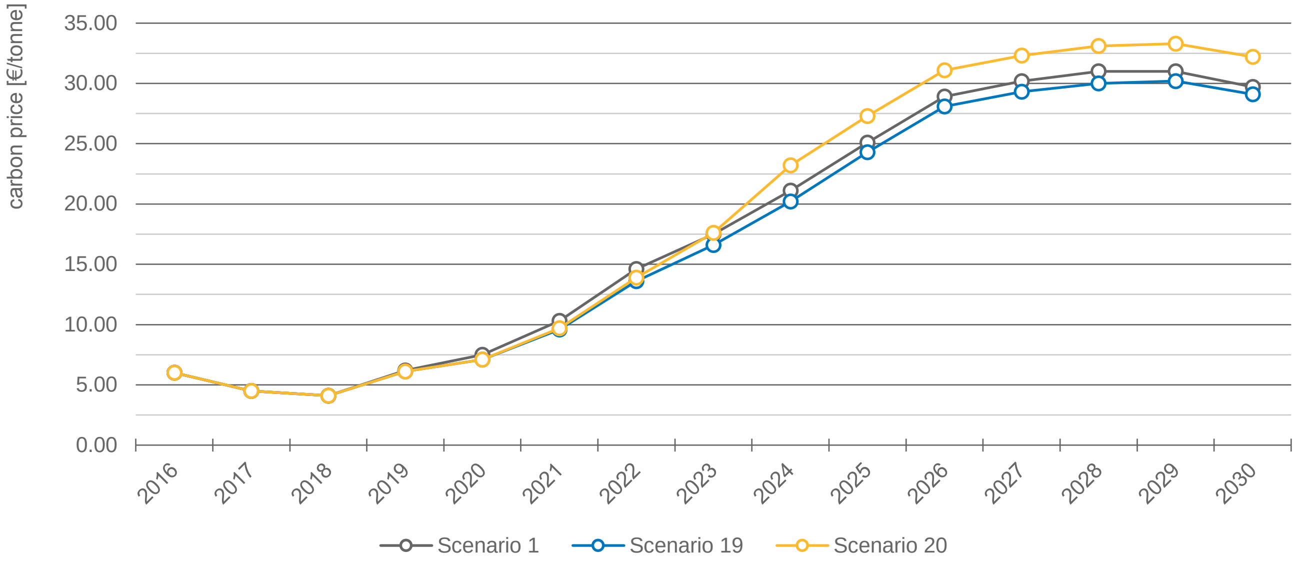
This section assumes that the base year for the calculation is shifted to 2014 and, consequently, Greece would be eligible for the compensation mechanisms.

Two scenarios to increase the modernisation fund are assessed so that the other member states are only slightly affected by such a change. The first possibility is to increase the modernisation fund to 2.32% of the cap to account for the Greek share – Scenario 19. The second possibility is to fund the Greek share of the modernisation fund by the MSR – Scenario 20.

As the 10c/derogation volumes would come from the Greek auction volumes, the eligibility of Greece for this compensation mechanisms do not directly affect the other member states.

The analysis concludes that it has no major impact on the EU ETS if Greece is eligible for the compensation mechanisms or not. As can be seen in Figure 4.1.1, prices diverge only slightly from the base Scenario 1.

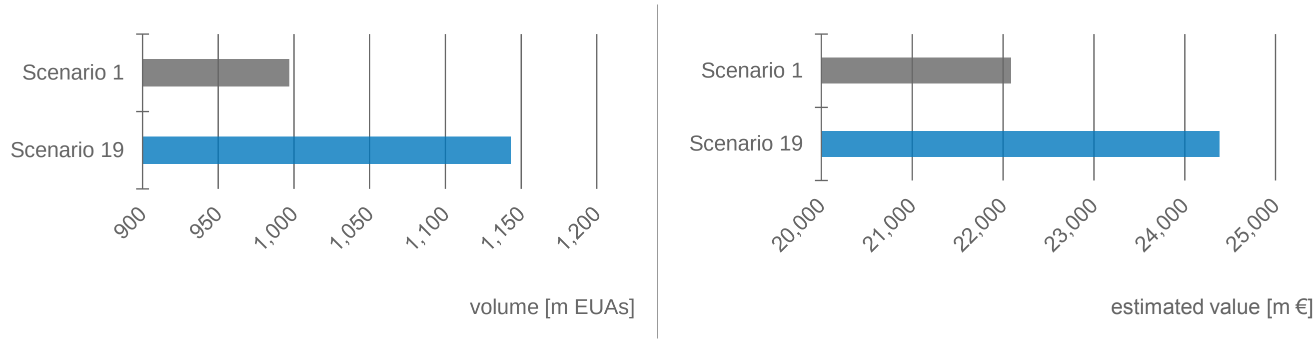
Figure 4.1.1: Price developments if Greece is eligible for compensation mechanisms



Source: ICIS Tschach Solutions

As can be seen in Figure 4.1.2 the volume and consequently the estimated value of the compensation mechanisms increases with Greece being eligible for the compensation mechanisms. This is mainly because of the 10c/derogation volumes, but also due to the increase of the modernisation fund by roughly 50m tonnes over TP4.

Figure 4.1.2: Volume (left graph) and estimated value (right graph) of compensation mechanisms if Greece is eligible for compensation mechanisms



Source: ICIS Tschach Solutions

Overall, it can be said that the sensitivity of this parameter is minor for the overall market. However, for Greece this change is substantial.

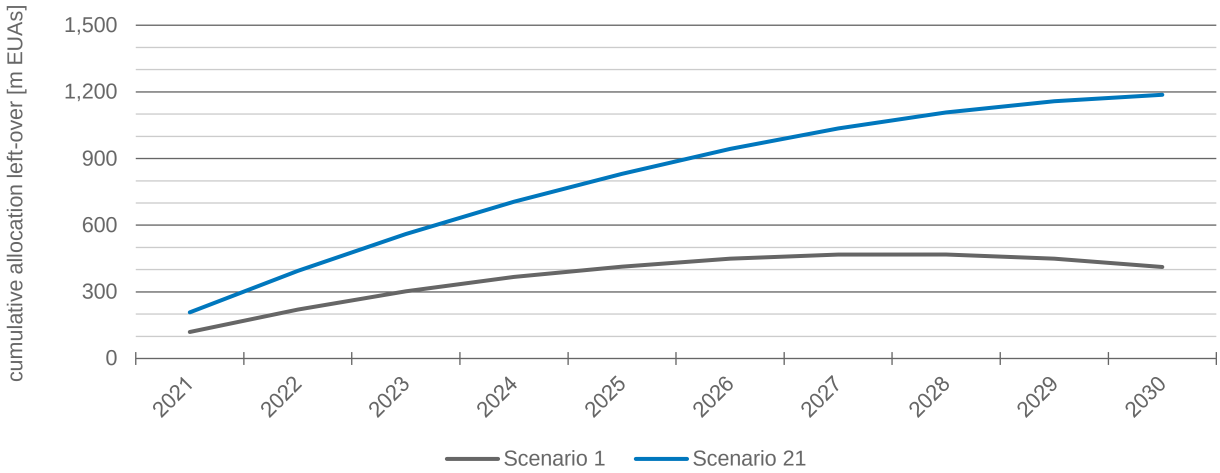
4.2 Auction share

As outlined before this study does not model the details of various scenarios regarding free allocation. However, the sensitivity for a lower auction share (52%), given that all other parameters stay the same, is shown in this part of the study – this scenario is referred to as Scenario 21.

As a flat-rate benchmark adjustment of 1% for all sectors is assumed in this analysis, no CSCF would apply in TP4. Increasing the free allocation share would consequently not increase the volumes given out for free as companies would not be able to apply for more volumes. This is obviously subject to the taken assumptions on the free allocation methodology. If the methodology would change, this would have a significant impact on the results presented in this study.

This means that instead of being auctioned, volumes would end up in a free allocation reserve which would possibly be used in TP4 to mitigate the effect of a potential application of the CSCF. Such a reform would actually create more ambition in TP4 as allowances would enter this "industry safety buffer" and would be shifted to later years. Figure 4.2.1 shows the free allocation reserve in Scenario 21 compared with Scenario 1. It gets clear that a buffer worth more than 1,000m EUAs would be built up compared to slightly over 400m in Scenario 1.

Figure 4.2.1: Free allocation reserve under lower auction share scenario

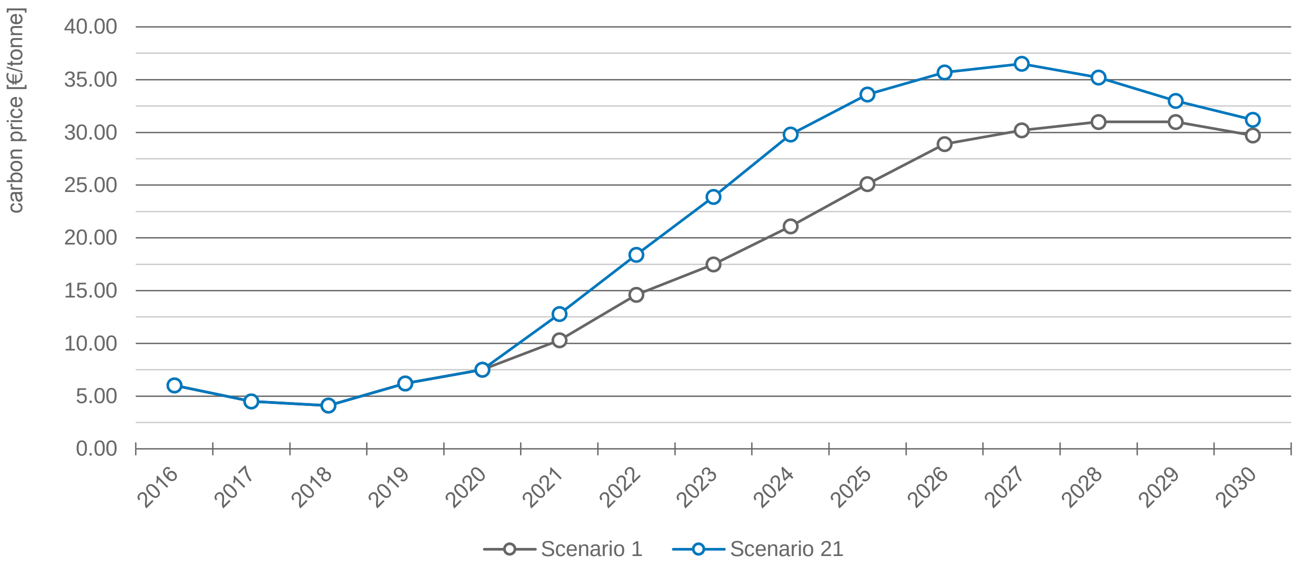


Source: ICIS Tschach Solutions

The additional ambition created by such a reform is also observable in the price developments under such a scenario – see Figure 4.2.2.

Prices in Scenario 21 increase much quicker as of 2021 as less auction supply would be available which would on the other hand not increase the free allocation volumes transferred to installations. Between 2024 and 2025 the difference in the projected prices would surpass the €8.00/tonne mark. However, as the MSR would be triggered one year less in Scenario 21, prices converge towards the end of the fourth trading period.

Figure 4.2.2: Price developments under lower auction share scenario



Source: ICIS Tschach Solutions

To conclude, a lower auction share needs to be seen in context with the free allocation methodology around benchmark adjustments, carbon leakage list, and production baseline.

If the limit of free allocation is not entirely used as no additional free allocation can be handed out due to the free allocation rules, a decrease of the auction share cuts auction volumes short while not increasing the free allocation share.

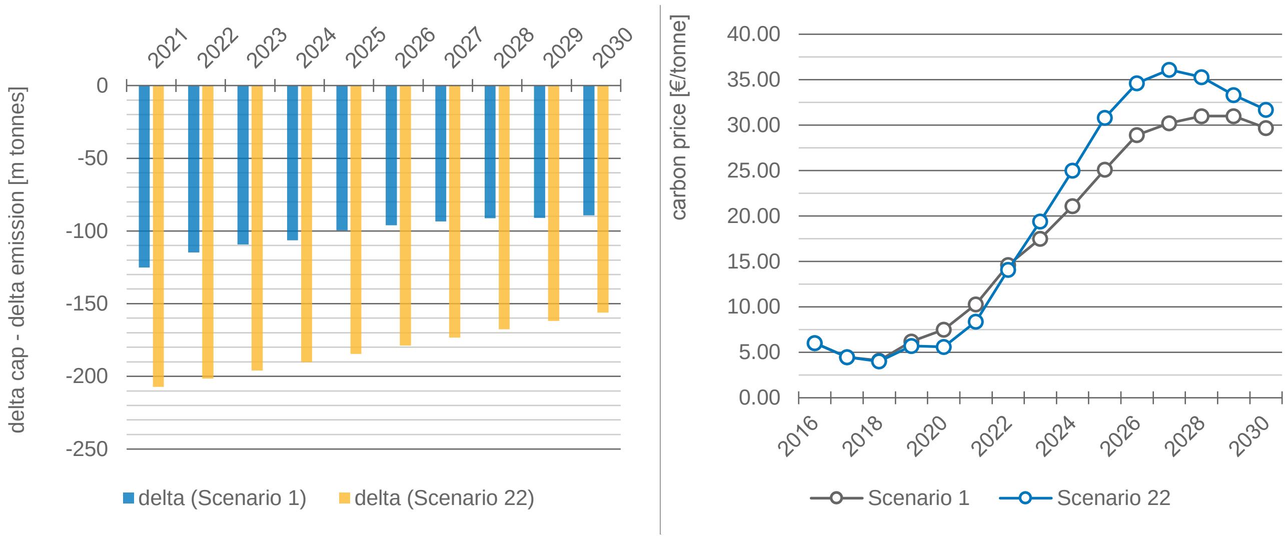
4.3 Brexit

Modelling whether the UK would leave the EU ETS alongside the exit from the European Union requires to re-calculate all supply volumes starting with the cap. For this study the assumption is taken that the UK would leave the EU ETS with the start of the fourth trading period in 2021. This scenario is referred to as Scenario 22.

As it is currently unclear whether the UK would leave the EU ETS or not, showing the sensitivity to put the rest of the study into context is crucial.

Regarding prices, a Brexit from the EU ETS would have a negative impact until 2020 due to a reduction of hedge demand of UK utilities as well as potentially additional sales from UK industrial companies. As it is likely that the reduction of the cap post-2020 would be higher than the reduction in emissions, the long-term effect on the EU ETS would be bullish. Both, price developments and the deltas of the cap and emissions can be found in Figure 4.3.1.

Figure 4.3.1: Delta cap minus delta emissions (left graph) and price developments (right graph) under Brexit from the EU ETS scenario



Source: ICIS Tschach Solutions

4.4 Hedging

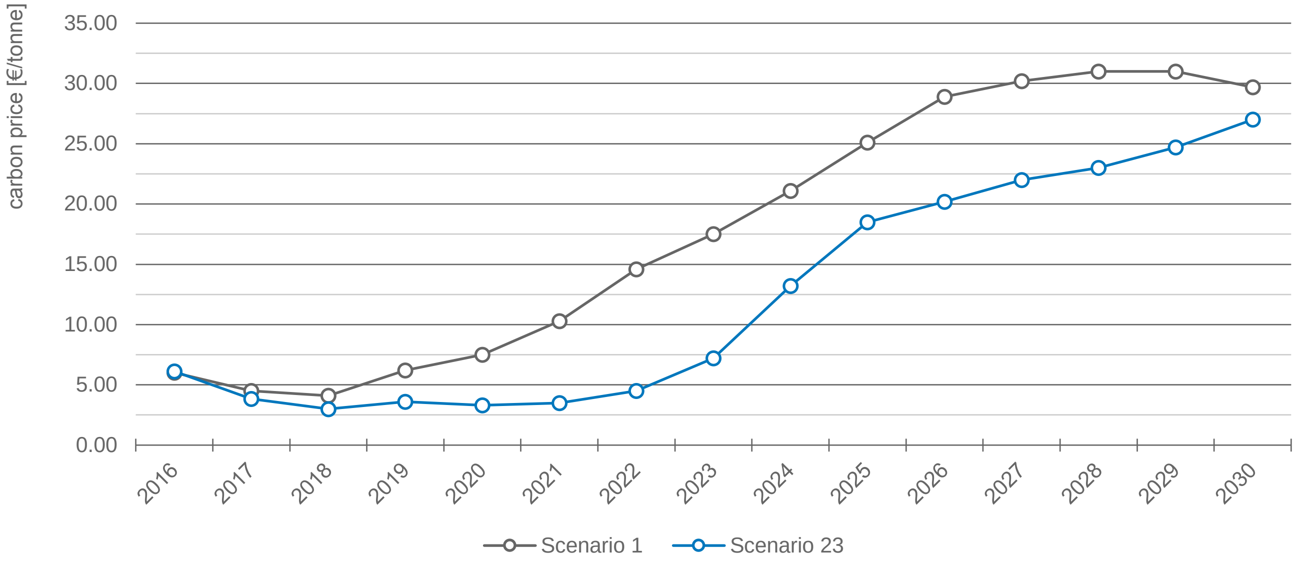
As one key input factor of the utilised ICIS Timing Impact Model is the behaviour of market participants, it is key to show the sensitivities around some of the behavioural parameters.

As the Central European power markets move towards more renewable energy and spread (especially gas-fired) generation, the hedging strategies of Central European utilities might change. Since spread generation is generally hedged closer to the generation of the actual power, this might reduce the hedge horizon of Central European and British utilities significantly.

Because the Nordic power market already has a very high share of renewable power production, this scenario models the impact on the carbon market if the Central and British power agents of the TIM gradually adopt (from 2017-2021) the hedge patterns of the Nordic agent – this scenario is referred to as Scenario 23.

This would mean that utilities hedge more of their power closer to generation which does not affect the overall demand, but the timing for demand. Demand would be shifted backwards in time, which can be seen at the depressed carbon prices between 2018 and 2023. In the second half of TP4 prices would then tend towards the prices forecast for Scenario 1 as demand of utilities would be shifted to later years and not completely disappear. Second, the MSR would need more years to bring the system towards the “heathy oversupply” and incentivise additional emission reductions.

Figure 4.4.1: Price developments for a low hedge scenario



Source: ICIS Tschach Solutions

5. Conclusions

The analysis conducted for this study, examines reform options that increase the ambition of the EU ETS beyond the post-020 reform proposal of the EU Commission.

To create more ambition, the study analyses the effects of four scenario groups:

1. A higher linear reduction factor
2. A tighter MSR
3. A combination a higher LRF and a tighter MSR
4. Effect of over-lapping policies (explanatory examples on national and EU level)

For the first three scenario groups analysed, the study provides a reform success matrix with a traffic light system to visualise the effect of certain measure towards key targets of the EU ETS. The key targets discussed are ambition regarding emission reductions in short-, mid- and long-term, cost-efficiency in two time horizons, volume effect on industry/power sector, predictability of the system as well as the effect on the compensation mechanisms.

When comparing the effects of the first three scenario groups on early emissions abatement, it becomes clear that high emission reductions between 2016 and 2025 are only triggered if the MSR is tightened. A higher MSR intake rate as of 2019 would immediately impact the market in 2019 and would incentivise companies to invest in emission reductions. A tighter target on the other hand does not trigger additional emission reductions in 2016-2025. In order for a tighter MSR to also deliver emission reductions in 2026-2030, not only the intake rate needs to be increased, but also the thresholds need to be lowered. If the thresholds are not touched the MSR would not provide additional incentive to reduce emissions in that time horizon. A higher LRF on the other hand impacts the market especially in the later period of TP4 and would deliver additional emission reductions. A combination of both reforms would actually lead to the highest abatement over TP4 and consequently eases the reduction pressure post-2030.

Regarding cost-efficiency, the three different scenario groups perform differently against short- and long-term cost efficiency: Increasing solely the linear reduction factor would be cost-efficient in the short-term as the envisaged 2030 target would be achieved at lowest cost. On the other side, tightening the MSR would affect the short-term efficiency negatively. This is the fact, as the MSR would reduce auction volumes thus increase prices. Consequently, the implemented 2030 target would be achieved at higher than necessary costs, as the tighter MSR would force the system to over-achieve the 2030 target. When qualitatively analysing the long-term cost-efficiency of the measures, it gets clear that a combination of increasing the LRF and tightening the MSR would be very cost-efficient in the long-term as reductions are triggered constantly over TP4. Secondly, the MSR would built up a safety buffer which could be used to mitigate extreme developments in the later decades of the EU ETS. This effect is partly present if only the MSR would be tightened, as also in this case a significant safety buffer would be created. When only increasing the LRF, the system would not be cost-efficient in the long run as reductions are only triggered late in TP4 and the safety buffer would not be built in the same magnitude as in the other scenarios.

When considering the effects on the different volumes earmarked for industrials and the power sector, tightening the MSR is the more favourable solution for industrials as free allocation volumes would not be affected. For the power sector such a reform would have the bigger implications as auction volumes, which are the primary supply source for the power sector, would be cut significantly.

Regarding predictability, a change of the cap through the LRF would create long-term certainty about the reduction path of the EU ETS. This is because the system can be set directly on a linear path to reach the long-term 2050 target. This would mean that no further adjustments of the cap are necessary in the upcoming ETS reviews or a post-2030 reform. A combination of both scenarios actually delivers the same result. When only changing the MSR, the system would need an additional cap adjustment post-2030 and long-term investment certainty would not be achieved.

The last parameter in the success matrix is the effect of the reform on compensation mechanisms. As changing the MSR would not have a volume effect on the compensation mechanisms, but the estimated monetary value would increase due to higher carbon prices, such a reform would be favourable. In the higher LRF case, indeed the volume of the compensation mechanisms would be reduced, but as the carbon price would increase more, this effect is mitigated. Overall, it can be said that more ambition, either through a higher LRF or a tighter MSR, would increase the monetary value of the compensation mechanisms.

Measure	Ambition (emission reductions)			Cost-efficiency		EU ETS volume effect		Predictability	Effect on compensation mechanisms
	2016-2025	2025-2030	2030-2050	Short-term	Long-term	Power	Industry		
Combination of higher LRF and tighter MSR	grey, grey, green	grey, grey, green	red, yellow, grey	grey, yellow, grey	grey, grey, green	red, yellow, grey	grey, yellow, grey	grey, grey, green	grey, grey, green
Tighter MSR	grey, grey, green	red, yellow, grey	grey, grey, green	grey, yellow, grey	grey, yellow, grey	grey, yellow, grey	grey, yellow, green	red, yellow, grey	grey, yellow, green
Higher LRF	red, grey, grey	grey, yellow, grey	grey, yellow, green	grey, grey, green	red, yellow, grey	grey, yellow, grey	grey, yellow, grey	grey, yellow, green	grey, yellow, green

As outlined before, the study, furthermore, analysed the effect of different explanatory over-lapping policies on the EU ETS. Three policies were assumed with different emission effects. First, an organised German coal phase-out was assumed. Second, higher RES subsidies which lead to a higher capacity of renewable energy throughout Europe and third, a 35% energy efficiency target across the EU was assumed.

The key findings of the study regarding over-lapping policies are that implementing such policies do not impact the emission reductions in the EU ETS significantly. The incentive to implement the reductions are simply shifted to the over-lapping policies and, consequently, less price pressure in the EU ETS occurs. This means that the same reductions, but at lower carbon prices are achieved with over-lapping policies. However, the costs associated with the reductions are simply shifted outside of the EU ETS.

The study furthermore finds that the EU ETS would keep its abatement-incentivising force if the supply side of the EU ETS is adjusted according to potential over-lapping policies which are implemented. The analysis conducted modelled all three over-lapping policies with a parallel adjustment of the auction volumes (shift to MSR) in the magnitude of the emissions-reducing effect within the EU ETS of the respective implemented over-lapping policy. It gets clear that carbon prices would increase and further abatement would be triggered if the EU ETS would be adjusted accordingly.

Last, the study analysed some further sensitivities around making Greece eligible for the compensation mechanisms, a lower auction share, an exit of the UK from the EU ETS in 2021 and a significant change of the hedging behaviour of Central European utilities.

Regarding the eligibility of Greece for the compensation mechanisms, the study finds that no major impact on the EU ETS can be expected if Greece would be eligible for additional support.

The effect of a lower auction share has to be seen in the context with the overall allocation methodology. If no CSCF applies with the current methodology, an increase of the limit of free allocation would only lead to more left-over in the allocation pot and would cut auctions short. To sum up, free allocation volumes would not be increased while auction volumes would be lower. Such a scenario would have a price increasing effect and would also increase emission reductions.

The questions whether the UK will leave the EU ETS has a mixed impact on carbon prices in Europe. While pre-2020 prices would be depressed if the UK would announce to leave, post-2020 such a scenario would be bullish CO_2 prices as the UK is fundamentally long (their share of the cap is higher than their emissions) post-2020.

The last sensitivity analysed is very interesting in the context of a MSR review. If Central European utilities were to decrease their hedge horizons this has a significant decreasing effect on the “healthy oversupply” of the EU ETS. This means that the MSR thresholds would have to be adjusted regularly in order to remain an effective instrument. If Central utilities would change their hedge patterns and the MSR would not be adjusted, this would significantly depress carbon prices over the whole fourth trading period.

Overall, it can be said that more ambition is needed compared to the current Commission proposal to bring the EU ETS on a long-term path to reach the 2050 target as well as doing so in a cost-efficient way. The most favourable solution would be to adjust the linear reduction factor in order to set the system already now on track to reach the 2050 target as well as making the MSR more aggressive in the early years of its application to incentivise emission abatement as early as possible. Furthermore, a more frequent review of the MSR, especially the thresholds, is necessary to ensure long-term effectiveness of the instrument. Such a reform would also increase the predictability of the EU ETS significantly, as the long-term target would be acknowledged in legislation as well as the price signal would clearly incentivise investment in low-carbon technologies.

Annex 1: Scenario list

Name	Target ambition		Market Stability Reserve		Over-lapping policy	Other parameters			
	2030 reduction target	Linear reduction factor	Intake rate	Thresholds		Greece eligible off compensation mechanisms	Auction share	Brexit	Hedge assumptions
Scenario 1	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 2	45%	2021-2030: 2.4%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 3	47%	2021-2030: 2.6%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 4	44%	2021-2025: 2.2% 2026-2030: 2.45%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 5	43%	2021-2030: 2.2%	2019-2021: 24% 2022-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 6	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 600m Lower: 300m	none additional	no	57%	no	regular
Scenario 7	43%	2021-2030: 2.2%	2019-2021: 24% 2022-2030: 12%	Upper: 600m Lower: 300m	none additional	no	57%	no	regular
Scenario 8	43%	2021-2030: 2.2%	2019-2030: 24%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 9	45%	2021-2030: 2.4%	2019-2030: 24%	Upper: 833m Lower: 400m	none additional	no	57%	no	regular
Scenario 10	64%	2021-2030: 4.5%	2019-2021: 24% 2022-2030: 12%	Upper: 600m Lower: 300m	none additional	no	57%	no	regular
Scenario 11	60%	**Reduction factor[6]:** 2021-2030: 6.6%	2019-2021: 24% 2022-2030: 12%	Upper: 600m Lower: 300m	none additional	no	57%	no	regular
Scenario 12	47%	2021-2030: 2.6%	2019-2021: 24% 2022-2024: 28% 2022-2024: 32% 2022-2024: 36%	833m | 400m 700m | 400m 600m | 300m 500m | 300m	none additional	no	57%	no	regular
Scenario 13	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	German coal phase-out	no	57%	no	regular
Scenario 14	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	German coal phase-out	no	57%	no	regular
Scenario 15	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	Additional RES subsidies	no	57%	no	regular
Scenario 16	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	Additional RES subsidies	no	57%	no	regular
Scenario 17	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	35% energy efficiency target	no	57%	no	regular
Scenario 18	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	35% energy efficiency target	no	57%	no	regular
Scenario 19	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	yes, taken from auctions	57%	no	regular
Scenario 20	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	yes, taken from MSR	57%	no	regular
Scenario 21	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	52%	no	regular
Scenario 22	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	yes	regular
Scenario 23	43%	2021-2030: 2.2%	2019-2030: 12%	Upper: 833m Lower: 400m	none additional	no	57%	no	low hedge

[6] The reduction factor assumes a fixed reduction factor so that the 2050 reduction target of 90% is reached by reducing the cap by a fixed percentage (6.6%) of the previous year cap. This RF would lead to a 60% reduction target in 2030. This would mean that the absolute reduction is not linear, but decreases exponentially towards 2050

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