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THE ROLE OF THE EU ETS IN INCREASING EU CLIMATE AMBITION

Assessment of policy options

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The role of the EU ETS in increasing EU climate ambition: Assessment of policy options.

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Foreword

Climate change poses the greatest threat to humanity. At present, the EU is aiming to reduce its greenhouse gas emissions to 40% below 1990 levels by 2030, but evidence shows that emissions need to be reduced quicker. There are growing discussions over an enhanced 2030 target and EU member states have been debating a "net zero" greenhouse gas emission target by 2050.

The current 2030 target not only falls short of meeting the Paris Agreement target but also hampers the 2050 climate neutrality target. It implies that the reduction in emissions would have to happen twice as fast after 2030 compared to the period 2010-2030 and therefore places a heavy burden on the post-2030 era. In addition, the rapid depletion of our global carbon budget provides a great motivation for reducing emissions urgently.

The EU emissions trading system is at the core of European climate policy. It plays a major role in reducing the continent's emissions cost-effectively but still falls short of its potential to help the EU meet climate targets aligned with the Paris Agreement. With the current rules the EU ETS is unlikely to meet the current target, let alone an enhanced one. The expectations for the EU ETS are nevertheless high and many proposals for strengthening European climate policy focus on improving the ETS. This study contributes to this discussion by analysing a new target for the EU ETS, aligned with enhanced ambition, and by offering a tangible plan for the future.

Adjusting what is a complex system is not an easy task. Finding political will alone is a major challenge. Another issue is finding measures whose implementation is feasible for delivering the targeted emission reductions. Despite the magnitude of the challenge, we must increase our efforts to improve the EU ETS. With this study, Sitra and the Öko-Institut aim to increase our understanding of the possible options, their emission-reduction potential and their political feasibility.

We believe this report covers the key options for improving the stationary EU ETS and presents their potential in a realistic manner. This study takes important steps for establishing the required policy reform and we hope action will follow. We need more ambitious climate targets, we need a more ambitious emissions trading system to deliver the emission reductions, and we need to act now.

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Abbreviations

EEA	European Environment Agency
EEX	European Energy Exchange AG
ESR	Effort Sharing Regulation
EU ETS	EU emissions Trading Scheme
EUA	European Emission Allowance
GHG	Greenhouse Gas
GVA	Gross Value Added
IMO	International Maritime Organisation
LRF	Linear Reduction Factor
LULUCF	Land Use, Land-Use Change and Forestry
MMR	Monitoring Mechanism Regulation
MS	Member State
MSR	Market Stability Reserve
NDC	Nationally Determined Contribution under the Paris Agreement
UNFCCC	United Nations Framework Convention on Climate Change
WEM	With Existing Measures

Executive summary

In light of the Paris Agreement and its target of limiting global warming to well below 2°C and pursuing efforts to limit the temperature increase to no more than 1.5 °C a large majority of member states have been calling for EU-wide climate neutrality by 2050 (European Council 2019). To achieve climate neutrality within 30 years urgent action is necessary. The EU's current greenhouse gas (GHG) target, a reduction of 40% below 1990 levels by 2030, would only leave two decades for reducing the remaining 60%. In contrast, in the 20-year period between the first commitment period of the Kyoto Protocol and 2030 the EU only aims to reduce emissions by 32% of the 1990 base-year level. Delaying action also means that the remaining carbon budget for achieving the temperature goals will be used up quickly and leave very little room for emissions afterwards. Various actors, including the Finnish Government and the EU Parliament, have therefore demanded greater ambition for the period until 2030 to ensure a smoother transition to a decarbonised economy and to steer the EU along a path towards achieving climate neutrality.

This report studies the role of the EU Emission Trading Scheme (ETS) in delivering an EU wide 2030 target of 55 to 60% below 1990 levels. The EU ETS started operating in 2005 and is a key mechanism for delivering cost-efficient emissions reductions in the EU. Under the current target of 40% below the 1990 level, the ETS is set to achieve a reduction of 43% below 2005 levels.

Various options to reform the EU ETS

The Council, the European Parliament and the Commission have significantly strengthened the ETS for the fourth trading period, 2021–2030. Despite this, it is already clear that the EU ETS needs to be enhanced further to ensure its operation under the adopted targets for energy efficiency and renewable energy: the achievement of these targets alone would lead to a new structural surplus in the EU ETS. An overall GHG target of 55–60% below 1990 levels requires a reduction of the emissions covered by the EU ETS of 61–65% below 2005. Such an enhanced EU ETS target can be implemented through a **1) strengthening of the cap** (higher linear reduction factor, rebasing of the cap), **2) enhancing the resilience** of the system (improving the market stability reserve (MSR)), boosting unilateral cancellation (due to measures in the electricity sector) and **3) by introducing a carbon price floor** (surrender charge, auction reserve price).

Various actors, including the Finnish Government and the EU Parliament, have therefore demanded greater ambition for the period until 2030.

1) Strengthening the cap. Rebasing the cap means reducing the cap once to close a gap between actual emissions and the cap. This is necessary if the cap has been set too high and the ETS is not setting a real limit on emissions.

The linear reduction factor (LRF) sets the annual reduction of GHG emissions, i.e. the rate at which the cap decreases and how fast operators need to reduce their emissions. Applying a higher LRF would decrease the cap, and therefore emissions, faster.

2) Enhancing resilience. Unexpected developments (such as an economic crisis or political interventions like the phasing out of coal), which are not foreseen in the determination of the cap, can create market imbalances in the ETS. The **market stability reserve** (MSR) is a safety mechanism: it removes excess allowances from the system, if there is a significant surplus, and returns these allowances if there is not enough liquidity in the market. The MSR can react quickly to such imbalances and rebasing the cap (see above) should be used to solve an underlying structural imbalance. **Voluntary (or unilateral) cancellation** of allowances under Article 12(4) in cases of national measures in the electricity sector is another mechanism that reflects the impact of a policy intervention: member states can decrease the quantity of allowances they auction if they have closed power plants.

A combination of policy options – a reform package – will therefore be necessary to ensure both short-term and long-term emission reductions and meeting the enhanced EU ETS targets for 2030.

3) Introducing a carbon price floor. A minimum carbon price ensures that there is a sufficient cost for emitting greenhouse gases. It could be implemented through an **auction reserve price and/or a surrender charge.** A minimum price for auctions would increase the carbon price for the whole system whereas a surrender charge could be targeted to individual sectors and/or countries.

In addition, the ETS could be further strengthened by **increasing the scope** to more sectors/activities and by applying **a tiered approach to free allocation** for industry.

Available measures differ in their emissions reduction potential and political feasibility

An evaluation of these policy options based on their abatement potential, political feasibility and how quickly they would lead to further emission reductions in the EU ETS is shown in Table 1. Options that are either linked to an existing review process in the next few years or could be implemented on a voluntary basis by interested member states have a high political feasibility. Out of these, only the measure to increase the intake rate of the MSR and the unilateral cancellation of allowances would also have high abatement potential. Other options with high abatement potential include the strengthening of the cap and an EU-wide auction reserve price. Extending the scope of the ETS to maritime transport, road transport and heating, as well as introducing a tiered approach to free allocation, would only have a small impact on emissions and would also be more difficult to adopt. Options which address the cap often take some time to become effective. Unless drastic changes are made the impact of a lower cap is only felt by market participants after some years. The options which enhance the resilience of the system, especially the MSR, would impact emissions quickly but – by themselves – would not be enough to achieve higher targets in 2030.

A comprehensive reform package is needed to meet the enhanced targets

A combination of policy options – a reform package – will therefore be necessary to ensure both short-term and long-term emission reductions and meeting the enhanced EU ETS targets for 2030. **Improving the MSR is the most crucial short-term change necessary to ensure the functioning of the EU ETS independent of whether enhanced targets are**

adopted or not. This is a no-regret action: the MSR is only activated when there is a market imbalance. Emission projections suggest that the adopted energy targets will lead to a new surplus of allowances. On the other hand, if the expected surplus does not materialise the MSR will lie dormant.

Based on these considerations the following **reform package** is recommended to ensure that the EU ETS is resilient to unexpected developments and fit to contribute to enhanced GHG reduction targets.

- A strengthened cap in line with enhanced climate targets:
  - Rebasing of the cap by 205 million allowances (based on the historical difference between emissions and cap in the third trading period) as early as possible and by 2026 at the latest.
  - An LRF in line with the overall 60% GHG reduction target for 2030 (increasing from 2.2% to 3.63% from 2021 onwards or to 5.07% from 2026 onwards).
- An enhanced MSR able to absorb past and future surplus of emission allowances:
  - Intake rate of at least 24% after 2023 (up from 12%).
  - Application of the LRF is applied to the thresholds and the outflow from 2021 onwards. This would ensure that the triggers, under which the MSR becomes active, are consistent with the declining cap of the ETS. Under current rules these triggers are constant whereas the cap deceases annually.
- A group of countries taking the lead to strengthen the system:
  - A surrender charge implemented by a group of countries by 2023 to ensure a minimum price (minimum price starting with at least €25-30/t CO_2 and reaching €40-45/t CO_2 in 2030).
  - Unilateral cancellation: withdrawing the maximum number of allowances allowed from auctioning when power plants are closed because of national measures.

In the absence of the other proposed changes the intake rate of the MSR would need to be set at 36% to ensure that the EU ETS will deliver the current climate target as a minimum, i.e. an emission reduction of 43% below 2005 levels.

The implementation needs to start immediately

This study provides concrete proposals, which are also politically feasible, to strengthen the EU ETS and to achieve an enhanced target in line with the necessary reductions required by the Paris Agreement. Doing so will only be possible if there is sufficient political will in the European Parliament, the member states and the European Commission. A group of frontrunners could quickly agree to set a minimum price and apply unilateral cancellation to the maximum level allowed by the ETS Directive. The review of the MSR is due by 2021 and the discussions around it have already started. The elements proposed in this study could provide useful insight for the review. If the decision-makers take advantage of the review process, the MSR reform can be agreed in time for the implementation. The discussion and adoption of the politically most challenging part – strengthening the cap through rebasing and application of a higher annual reduction rate – should also start as quickly as possible. This would provide

This study provides concrete proposals, which are also politically feasible, to strengthen the EU ETS.

predictability and transparency for the regulated entities under the EU ETS who need time to prepare for an enhanced level of climate ambition.

The new European Commission will be appointed for the period of 2019-2024 and, without doubt, climate change will be high on the agenda. Initiating the political process necessary to adopt higher GHG targets for the EU under the UNFCCC and adopting new rules for the ETS would demonstrate and reclaim the EU's leadership on climate change.

Table 1. Evaluation of abatement potential, political feasibility and timing of the policy options

		Abatement potential	Political feasibility	Timing of the impact
Strengthening the cap	Higher LRF	High	Medium	Medium- and long-term
	Rebasing	High	Medium	Medium-term
	Rebasing and higher LRF	High	Medium	Medium- and long-term
Enhancing resilience	Enhanced MSR (24% intake rate)	Medium	High	Short-term
	Enhanced MSR (36% intake rate)	High	High	Short-term
	Unilateral cancellation	High	High	Short- and medium-term
Carbon price floor	Surrender charge on electricity by group of countries/Nordic surrender charge on all ETS sectors	Medium	High	Medium-term
	Surrender charge on electricity EU-wide	Medium	Medium	Long-term
	Auction reserve price	High	Low	Long-term
Other	Extension of the scope to cover maritime transport	Low	Medium	Long-term
	Extension of the scope to cover road transport/decentralised heating	Low	Low	Long-term
	Tiered approach to free allocation	Low	Low	Long-term

Tiivistelmä suomeksi

Pariisin ilmastosopimuksen mukaan ilmaston lämpeneminen tulee rajata selvästi alle kahteen asteeseen suhteessa esiteolliseen aikaan ja pyrkiä toimiin, joilla lämpeneminen saataisiin rajattua alle 1,5 asteen. Jotta tähän päästäisiin, monet Euroopan unionin jäsenvaltiot ovat vaatineet EU:ta asettamaan EU:n ilmastoneutraaliustavoitteen vuodelle 2050 (Euroopan neuvosto 2019).

Ilmastoneutraaliuden saavuttaminen seuraavan 30 vuoden kuluessa edellyttää nopeita toimia. EU:n nykyinen kasvihuonekaasupäästöjen vähennystavoite on vähentää päästöjä 40 prosenttia vuoden 1990 tasosta vuoteen 2030 mennessä. Tämä tarkoittaa, että jäljelle jäävän 60 prosentin vähennyksen saavuttamiseen jäisi vain kaksi vuosikymmentä. Vertailun vuoksi Kioton pöytäkirjan ensimmäisen sitoumuskauden ja vuoden 2030 välillä – eli 20 vuodessa – EU pyrkii vähentämään päästöjä 32 prosenttia vuoden 1990 tasosta.

Viivästyminen päästöjen vähentämisessä tarkoittaa lisäksi, että käytettävissä oleva hiilibudjetti kulutetaan nopeasti loppuun. Se jättää hyvin rajalliset mahdollisuudet tulevaisuudessa päästää lainkaan kasvihuonekaasuja ilmakehään. Eri toimijat EU:ssa, mukaan lukien Suomen hallitus ja Europan parlamentti, ovat siksi vaatineet kunnianhimon tason nostoa vuodelle 2030, jotta varmistettaisiin sujuvampi siirtyminen päästöttömään talouteen ja ohjattaisiin EU hiilineutraaliuden polulle.

Jo päätetyistä toimenpiteistä huolimatta päästökauppaa on kehitettävä entisestään, jotta sen toiminnan tehokkuus voidaan varmistaa EU:n uusien energiatehokkuus- ja uusiutuvan energian tavoitteiden rinnalla.

Tämä selvitys tarkastelee EU:n päästökaupan roolia tilanteessa, jossa koko EU:n päästövähennystavoite nostettaisiin 55–60 prosenttiin vuoden 1990 tasoon verrattuna. Päästökauppa otettiin käyttöön vuonna 2005 ja se on keskeinen ohjauskeino EU:n päästöjen vähentämisessä kustannustehokkaasti. Nykyisen 40 prosentin päästövähennystavoitteen puitteissa EU:n päästökauppasektorilla tavoitellaan 43 prosentin vähennyksiä vuoden 2005 tasosta.

Päästökaupan uudistamiseksi on monia keinoja

Päästökauppaa on EU parlamentin ja komission toimesta tuntuvasti vahvistettu vuonna 2021 alkavalle ja vuoteen 2030 ulottuvalle neljännelle päästökauppakaudelle. Jo päätetyistä toimenpiteistä huolimatta päästökauppaa on kehitettävä entisestään, jotta sen toiminnan tehokkuus voidaan varmistaa EU:n uusien energiatehokkuus- ja uusiutuvan energian tavoitteiden rinnalla. Näiden erillisten tavoitteiden toteutuminen lisäisi päästöoikeuksien rakenteellista ylijäämää. Uusi, koko EU:n laajuinen 55–60 prosentin päästövähennystavoite vaatisi päästökaupan piiriin kuuluvien päästöjen vähentämistä 61–65 prosentilla vuoden 2005 tasosta. Tämänkaltainen tavoitetason nosto voidaan toteuttaa 1) **kiristämällä päästökattoa** (korkeampi päästövähennyskerroin tai päästökaton uudelleenasettaminen), 2) **lisäämällä päästökaupan resilienssiä** ulkoisia tekijöitä vastaan (markkinavakausvarannon kehittäminen, päästöoikeuksien mitätöinti kansallisten sähkömarkkinatoimenpiteiden vuoksi) tai 3) ottamalla käyttöön **päästöoikeuksien lattiahinta** (luovutusmaksu, huutokaupan reservihinta).

1. Päästökaton kiristäminen. Päästökaton uudelleenasettamisella tarkoitetaan päästökaton laskemista kertaluonteisesti niin, että se vastaa paremmin toteutuneita päästöjä. Tällä hetkellä toteutuneet päästöt ovat systemaattisesti olleet huomattavasti

päästökattoa matalammalla. Päästökaton uudelleenasettaminen on tarpeen, jos se on asetettu liian korkealle eikä todellisuudessa rajoita päästöjä, kuten EU:n päästökaupassa on käynyt. Lineaarinen **päästövähennyskerroin** määrää kuinka paljon päästöoikeuksien määrä vähenee vuosittain, eli kuinka paljon päästökattoa lasketaan. Kerroin määrää täten sen, kuinka nopeasti päästökaupan alaisten toimijoiden on yhteenlaskettuna vähennettävä päästöjään. Kertoimen kiristäminen laskisi kattoa ja vähentäisi päästöjä nopeammin vuositasolla.

2. Resilienssin lisääminen. Ulkoiset tekijät, kuten taloudellinen taantuma tai poliittiset päätökset hiilivoiman ajamiseksi alas, saattavat heikentää päästökaupan toimivuutta. Tämänkaltaisia tilanteita on vaikea ennakoida päästökattoa asetettaessa. **Markkinavakausvaranto** (market stability reserve, MSR) on häiriöitä vastaan kehitetty turvajärjestelmä, joka merkittävän ylijäämän vallitessa poistaa liiallisia päästöoikeuksia markkinoilta. Toisaalta mekanismi palauttaa oikeuksia takaisin markkinoille, jos markkinoiden likviditeetti heikentyy. Markkinavakausvaranto on suunniteltu siten, että se pystyy reagoimaan verrattain nopeasti markkinoiden epätasapainoon. Rakenteellisen ylijäämän poistamiseksi on kuitenkin järkevämpää hyödyntää päästökaton uudelleenasettamista kuin markkinavakausvarantoa. **Päästöoikeuksien vapaaehtoisesta mitätöinnistä** säädetään päästökauppadirektiivin 12 artiklan 4 kohdassa. Se antaa jäsenvaltiolle mahdollisuuden vapaaehtoisesti poistaa markkinoilta huutokaupattavia päästöoikeuksia, jos kansallisten toimien seurauksena jäsenmaan kasvihuonekaasupäästöt päästökauppasektorilla vähenevät. Näin voi tapahtua esimerkiksi silloin, jos jäsenvaltio päättää luopua kivihiilen käytöstä poliittisella päätöksellä. Vapaaehtoinen mitätöinti siis ehkäisee päästöoikeuksien ylijäämän kertymistä kansallisten toimien seurauksena.

3. Päästöoikeuden lattiahinta. Määräohjauksen lisäksi päästökaupan päästöjä vähentävää vaikutusta voidaan vahvistaa hintaohjauksella. Päästöjen vähentämisestä voidaan tehdä taloudellisesti kannattavampaa esimerkiksi asettamalla päästöoikeuksille vähimmäishinta. Tämä voidaan toteuttaa asettamalla päästöoikeuksien huutokaupalle reservihinta tai määrittämällä luovutusmaksu. Luovutusmaksussa markkinatoimijat maksavat päästöoikeuden markkinahinnan lisäksi ennalta määritellyn maksun. Huutokaupan reservihinta nostaisi huutokaupattavien oikeuksien hintaa koko järjestelmän tasolla, kun taas luovutusmaksu voitaisiin kohdistaa yksittäisille sektoreille tai jäsenvaltioille.

Näiden lisäksi päästökauppaa voitaisiin tehostaa laajentamalla järjestelmä kattamaan uusia sektoreita ja toimialoja tai soveltamalla porrastettua lähestymistapaa päästöoikeuksien ilmaisjaossa.

Toimenpiteiden päästövähennyspotentiaalissa ja poliittisessa toteutettavuudessa eroja

Taulukossa 1 esitetään arvio edellä mainituista toimienpidevaihtoehdoista niiden päästövähennyspotentiaalin ja poliittisen toteutettavuuden perusteella sekä arvioidaan, kuinka nopeasti ne johtaisivat päästövähennyksiin päästökauppajärjestelmässä. Joillekin toimenpiteille on jo tulevina vuosina ennalta määritetty ajankohta, jolloin niiden toimintaa tarkastellaan ja tarpeen mukaan muokataan. Toiset toimenpiteet puolestaan vaativat ainoastaan yksittäisten jäsenvaltioiden vapaaehtoisuuteen perustuvia päätöksiä. Tällaiset toimenpiteet on arvioitu helpoimmiksi poliittisen toteutettavuuden kannalta.

Poliittisesti helpoiten toteutettavimmista keinoista ainoastaan markkinavakausvarannon tehostaminen ja päästöoikeuksien vapaaehtoinen mitätöinti ovat toimenpiteitä, joilla on myös korkea päästövähennyspotentiaali. Muita korkean vähennyspotentiaalin toimenpiteitä ovat päästökaton kiristämiseen tähtäävät keinot sekä koko EU:n laajuinen päästöoikeuksien huutokaupan reservihinta. Päästökauppajärjestelmän laajentamisella meriliikenteeseen, maantiekuljetuksiin ja lämmitykseen sekä ilmaisjaon porrastetun lähestymistavan käyttöönotolla olisi vain pieni vaikutus päästöihin neljännellä päästökauppakaudella, ja niiden toteuttaminen on myös poliittisesti haastavampaa.

Päästökattoon liittyvät toimenpiteet vaativat usein aikaa ennen kuin vaikutukset näkyvät. Esimerkiksi päästökaton laskeminen vaikuttaisi markkinatoimijoihin vasta muutaman vuoden viiveellä. Päästökaupan resilienssin lisääminen sen sijaan vaikuttaa nopeallakin aikavälillä, mutta se ei yksinään riitä korkeampien päästövähennystavoitteiden saavuttamiseen vuonna 2030.

Vain laaja-alainen politiikkapaketti varmistaa tavoitteiden saavuttamisen

Tästä syystä päästövähennysten tehostaminen sekä lyhyellä että pitkällä aikavälillä sekä vuoden 2030 kunnianhimoisemman tavoitteen saavuttaminen edellyttävät päästökaupan osalta useamman toimenpiteen yhtäaikaista soveltamista eli politiikkapakettia. **Markkinavakausvarannon parantaminen on kaikkein keskeisin lyhyen aikavälin toimenpide, joka tarvitaan päästökaupan toiminnan varmistamiseksi, riippumatta siitä, astuvatko tiukemmat tavoitteet voimaan vai eivät.** Markkinavakausvarannon kiristämiseen ei liity riskejä, sillä se aktivoituu ainoastaan, jos markkinoilla on huomattavaa ylitarjontaa. Esimerkiksi energiasektorille asetettujen uusiutuvan energian tavoitteiden ennakoidaan luovan uutta rakenteellista ylijäämää päästöoikeusmarkkinoille. Jos tätä ei kuitenkaan tapahdu, ei mekanismikaan aktivoidu.

Edellä esitettyjen havaintojen pohjalta selvityksessä esitetään seuraavaa politiikkapakettia, jolla varmistetaan EU:n päästökaupan resilienssi toimia erilaisissa olosuhteissa, kuten vaihtelevissa taloustilanteissa, sekä sen mahdollisuudet vähentää kasvihuonekaasupäästöjä Pariisin sopimuksen tavoitteiden mukaisesti.

- Päästökattoa kiristetään niin, että se on linjassa uusien, tiukempien päästötavoitteiden kanssa:
  - Päästökattoa lasketaan kertaluontoisesti 205 miljoonalla oikeudella niin pian kuin mahdollista, mutta viimeistään vuoteen 2026 mennessä. Pudotuksen määrä perustuu keskimääräiseen päästökaton ja toteutuneiden päästöjen väliseen erotukseen kolmannella päästökauppakaudella.
  - Päästökattoa vuosittain laskeva lineaarinen päästövähennyskerroin asetetaan niin, että se on linjassa 60 prosentin kokonaispäästövähennystavoitteen kanssa vuodelle 2030. Tämä tarkoittaa sitä, että kerrointa nostetaan jo päätetystä 2,2 prosentista 3,63 prosenttiin vuonna 2021 tai vaihtoehtoisesti 5,07 prosenttiin vuonna 2026.

- Markkinavakausvarantoa tehostetaan vähentämään päästöoikeuksien ylijäämää:
  - Markkinavakausvarannon markkinoilta oikeuksia poistavaa määrää (ns. sisäänsiirto-osuus) nostetaan vähintään 24 prosenttiin aiemmin päätetystä 12 prosentista vuoden 2023 jälkeen. Tällä hetkellä varantoon lisätään vuosittain oikeuksia ennalta määritellyn kaavan mukaan: niin kauan kuin kierrossa olevien päästöoikeuksien määrä ylittää 833 miljoonaa kappaletta, vuoteen 2023 asti 24 prosenttia ja siitä eteenpäin 12 prosenttia kierrossa olevista oikeuksista siirretään varantoon huutokauppaamisen sijaan.

— Lineaarista päästövähennyskerrointa sovelletaan myös markkinavakausvarannon raja-arvoihin sekä mekanismin markkinoille palauttamaan päästöoikeuksien määrään ylijäämän alittaessa alemman raja-arvon. Tämä varmistaa, että raja-arvot ja palautusmäärä olisivat linjassa laskevan päästökaton kanssa. Nykyisten sääntöjen mukaan ne pysyvät kiinteinä päästökaton laskiessa vuosittain.

— Ryhmä edelläkävijämaita näyttää esimerkkiä järjestelmän vahvistamisessa:
  — Ryhmä maita ottaa käyttöön luovutusmaksun, jolla varmistetaan päästöoikeuden minimihinta vuodesta 2023 eteenpäin. Luovutusmaksu asetetaan niin, että se aloitusvuonna varmistaa vähintään 25–30 € ja vuonna 2030 vähintään 40–45 € hinnan päästöoikeudelle.
  — Maat mitätöivät vapaaehtoisesti maksimimäärän päästöoikeuksia tehdessään kansallisia päätöksiä, jotka ajavat alas fossiilisilla polttoaineilla toimivia voimalaitoksia.

Jos ehdotetut toimenpiteet eivät toteudu eikä niitä oteta käyttöön, markkinavakausvarannon markkinoilta päästöoikeuksia poistavaa määrää on nostettava 36 prosenttiin kierrossa olevien päästöoikeuksien määrästä. Näin taataan, että päästökauppa saavuttaa sille nykyisellään asetetut minimitavoitteet eli päästöjen vähentämisen 43 prosentilla vuoden 2005 tasosta.

Uudistustyö aloitettava välittömästi

Tämä selvitys tarjoaa konkreettisia toimenpide-ehdotuksia, jotka ovat poliittisesti toteutettavissa, ja joiden avulla voidaan vahvistaa EU:n päästökauppaa niin, että se on linjassa Pariisin sopimuksen kanssa. Toimenpiteiden toteutuminen vaatii kuitenkin vahvaa poliittista tahtotilaa niin Euroopan parlamentilta, jäsenvaltioilta kuin komissioltakin. Ryhmä edelläkävijämaita voisi nopeasti päättää luovutusmaksun asettamisesta ja lisäksi mitätöidä oikeuksia vapaaehtoisesti päästökauppadirektiivissä säädetyn maksimimäärän mukaisesti.

Markkinavakausvarannon toimintaa on päätetty arvioida vuonna 2021 ja keskustelu arvioinnin tavoitteista on jo käynnissä. Tämän selvityksen ehdotuksista on mahdollista ammentaa tietoa ja näkökulmia tulevaan arviointiin. Markkinavakausvarannon arviointiprosessin hyödyntäminen mahdollistaisi sen, että muutokset astuisivat voimaan ennen niille ehdotettua aloitusvuotta. Myös poliittisen tahtotilan kannalta vaativampiin uudistuksiin, eli päästökaton laskuun ja korkeamman päästövähennyskertoimen soveltamiseen liittyvä keskustelu tulisi myös aloittaa mahdollisimman pian. Tämä lisäisi päästökauppajärjestelmän läpinäkyvyyttä ja ennustettavuutta ja parantaisi markkinatoimijoiden mahdollisuutta varautua tuleviin muutoksiin.

Uusi Euroopan komissio nimitetään kaudelle 2019–2024 ja ilmastonmuutos tulee varmasti olemaan vahvasti esillä komission työohjelmassa. EU:lla on mahdollisuus lunastaa takaisin johtajuus ilmastonmuutoksen vastaisessa taistelussa nostamalla päästövähennystavoitteitaan sekä päivittämällä päästökauppaa niiden mukaiseksi.

Taulukko 1. Arvio toimien vaikuttavuudesta, toteutettavuudesta sekä vaikutusten ajoituksesta.

		Päästövähennyspotentiaali	Poliittinen toteutettavuus	Vaikutuksen aikaväli
Päästökaton kiristäminen	Korkeampi päästövähennyskerroin (LRF)	Korkea	Keskiverto	Keskipitkä ja pitkä aikaväli
	Katon uudelleenasettaminen (rebasing the cap)	Korkea	Keskiverto	Keskipitkä aikaväli
	Katon uudelleenasettaminen ja korkeampi vähennyskerroin	Korkea	Keskiverto	Keskipitkä ja pitkä aikaväli
Resilienssin lisääminen	Markkinavakausvarannon (MSR) vahvistaminen (24 % poistovauhti)	Keskiverto	Korkea	Lyhyt aikaväli
	Markkinavakausvarannon (MSR) vahvistaminen (36 % poistovauhti)	Korkea	Korkea	Lyhyt aikaväli
	Päästöoikeuksien vapaaehtoinen mitätöinti	Korkea	Korkea	Lyhyt ja keskipitkä aikaväli
Päästöoikeuden lattiahinta	Luovutusmaksu sähköntuotantosektorin päästöille, ryhmä maita / Luovutusmaksu koko ETS-sektorin päästöille, Pohjoismaat	Keskiverto	Korkea	Keskipitkä aikaväli
	EU:n laajuinen luovutusmaksu sähköntuotantosektorin päästöille	Keskiverto	Keskiverto	Pitkä aikaväli
	Huutokaupan reservihinta	Korkea	Matala	Pitkä aikaväli
Muut	Päästökaupan laajentaminen meriliikenteeseen	Matala	Keskiverto	Pitkä aikaväli
	Päästökaupan laajentaminen tieliikenteeseen / hajautettuun lämmöntuotantoon	Matala	Matala	Pitkä aikaväli
	Päästöoikeuksien ilmaisjaon porrastaminen	Matala	Matala	Pitkä aikaväli

Sammanfattning på svenska

Enligt Parisavtalet bör höjningen av jordens medeltemperatur begränsas till klart under två grader i förhållande till den förindustriella tiden och man bör sträva efter åtgärder för att begränsa uppvärmningen till under 1,5 grader. För att uppnå det har många medlemsstater i Europeiska unionen krävt att EU ska sätta upp ett mål om att bli klimatneutralt år 2050 (Europarådet 2019).

För att bli klimatneutralt krävs det snabba åtgärder under de närmaste 30 åren. EU:s nuvarande mål för minskning av utsläppen av växthusgaser är en minskning med 40 procent från 1990 års nivå fram till år 2030. Det innebär att det endast är två decennier kvar tills den återstående minskningen på 60 procent ska nås. Som jämförelse kan man nämna att EU strävade efter att mellan Kyotoprotokollets första förbindelseperiod och 2030 – det vill säga under en period på 20 år – minska utsläppen med 32 procent jämfört med 1990 års nivå.

Att minskningen av utsläppen dröjer innebär dessutom att den befintliga kolbudgeten snabbt håller på att tömmas ut. Det ger mycket begränsade möjligheter att släppa ut växthusgaser i atmosfären i framtiden över huvud taget. Olika aktörer inom EU, inbegripet Finlands regering och Europaparlamentet, har därför krävt att ambitionsnivån höjs fram till år 2030, för att säkerställa en smidigare övergång till en utsläppsfri ekonomi och styra in EU mot att bli koldioxidneutralt.

Denna utredning granskar EU:s utsläppshandels roll i en situation där målet för utsläppsminskningen för hela EU skulle höjas till 55–60 procent jämfört med nivån år 1990. Utsläppshandeln infördes år 2005 och det är ett centralt styrmedel för att minska EU:s utsläpp på ett kostnadseffektivt sätt. Inom ramen för det nuvarande målet för utsläppsminskningen på 40 procent siktar man inom EU:s utsläppshandelssektor på en minskning på 43 procent jämfört med 2005 års nivå.

Många sätt att reformera utsläppshandeln

Utsläppshandeln har på Europaparlamentets och kommissionens initiativ stärkts betydligt för den fjärde utsläppshandelsperioden som börjar 2021 och sträcker sig fram till 2030. Oberoende av de åtgärder som man redan beslutat om måste utsläppshandeln utvecklas så att dess effektivitet kan säkerställas parallellt med EU:s nya mål för energieffektivitet och förnybar energi. Genom att nå dessa särskilda mål ökar det strukturella överskottet av utsläppsrätter. Det nya målet för utsläppsminskningar för hela EU på 55–60 procent skulle kräva en minskning av de utsläpp som ingår i utsläppshandeln med 61–65 procent jämfört med 2005 års nivå. En sådan ökning av målet kan göras genom att 1) **sänka utsläppstaket** (högre utsläppsminskningskoefficient eller att sätta ett nytt tak), 2) **öka resiliensen i utsläppshandeln** mot yttre faktorer (utveckla marknadsstabilitetsreserven, annullera utsläppsrätter på grund av åtgärder på elmarknaden) eller 3) införa ett **golvpris för utsläppsrätter** (överlåtelseavgift, reservpris för auktioner).

1. Sänka utsläppstaket. Att sätta ett nytt tak innebär att sänka utsläppstaket en gång för alla så att det är mer i linje med de verkliga utsläppen. Som det är nu har de verkliga utsläppen systematiskt varit betydligt lägre än utsläppstaket. Man måste sätta ett nytt tak om man har satt taket för högt och i verkligheten inte begränsar utsläppen, vilket är det som har hänt med EU:s utsläppshandel. Den linjära **utsläppsminskningskoefficienten** anger i vilken grad antalet utsläppsrätter minskar varje år, det vill säga hur man räknar ut utsläppstaket. Koefficienten anger därmed hur snabbt aktörerna som deltar i utsläppshandeln sammanlagt måste minska sina utsläpp. Genom att strama åt koefficienten skulle taket sjunka, vilket skulle ge snabbare utsläppsminskningar på årsbasis.

2. Ökad resiliens. Yttre faktorer, som exempelvis ekonomisk recession eller politiska beslut om att minska kolkraften, kan göra utsläppshandeln mindre effektiv. Det är svårt att förutse sådana situationer när man fastställer utsläppstaket. **Marknadsstabilitetsreserven** (market

stability reserve, MSR) har utvecklat ett säkerhetssystem mot störningar som tar bort utsläppsrätter från marknaden om det blir ett överskott. Omvänt släpper mekanismen tillbaka utsläppsrätter på marknaden om likviditeten på marknaden minskar. Marknadsstabilitetsreserven är utformad så att den reagerar relativt snabbt på obalans på marknaden. För att avlägsna det strukturella överskottet vore det dock vettigare att sätta ett nytt tak än att använda marknadsstabilitetsreserven. **Frivillig annullering av utsläppsrätter** regleras enligt artikel 12 punkt 4 i direktivet om utsläppshandel. Det ger medlemsstater en möjlighet att frivilligt ta bort utsläppsrätter för utauktionering från marknaden om medlemsstatens utsläpp av växthusgaser minskar till följd av nationella åtgärder. Det kan hända exempelvis om medlemsstaten beslutar om att upphöra med användning av stenkol efter ett politiskt beslut. Frivillig annullering förhindrar alltså att det ackumuleras ett överskott av utsläppsrätter till följd av nationella åtgärder.

Olika aktörer inom EU, inbegripet Finlands regering och Europaparlamentet, har krävt att ambitionsnivån höjs fram till år 2030.

3. Golvpris för utsläppsrätter. Den minskning av utsläppen inom utsläppshandeln som mängdstyrningen leder till kan förstärkas genom prisstyrning. Man kan göra minskningen av utsläppen mer ekonomiskt hållbar genom att exempelvis sätta ett minimipris på utsläppsrätter. Det kan göras genom att sätta ett reservpris på utsläppsrätterna till auktion eller införa en överlåtelseavgift. En överlåtelseavgift skulle innebära att marknadsaktörerna utöver marknadspriset även betalar en avgift för utsläppsrätten som fastställts på förhand. Ett reservpris för auktionering skulle höja priset på de rättigheter som auktioneras ut i hela systemet, medan en överlåtelseavgift skulle kunna riktas mot enskilda sektorer eller medlemsstater.

Utöver dessa metoder skulle man kunna effektivisera utsläppshandeln genom att utvidga systemet så att det omfattar nya sektorer och branscher eller tillämpa ett graderingssystem vid fördelningen av fria utsläppsrätter.

Skillnader i utsläppsminskningspotentialen för åtgärderna och möjligheterna att genomföra dem politiskt

I tabell 1 presenteras en utvärdering av ovan nämnda alternativ på åtgärder utifrån deras utsläppsminskningspotential och möjligheterna att genomföra dem politiskt samt en utvärdering av hur snabbt de skulle leda till utsläppsminskningar i systemet med handel med utsläppsrätter. Några av åtgärderna har en fastställd tidpunkt under de kommande åren då man tittar på deras effektivitet och ändrar dem vid behov. Andra åtgärder kräver endast beslut från enskilda medlemsstater baserat på frivillighet. Den här typen av åtgärder har bedömts vara lättare att genomföra politiskt.

Av de metoder som är lättast att genomföra politiskt är det endast effektivering av marknadsstabilitetsreserven och frivillig annullering av utsläppsrätter som är åtgärder som även har hög utsläppsminskningspotential. Andra åtgärder med hög potential att minska utsläppen är metoder för att sänka utsläppstaket och att införa ett reservpris för auktionering av utsläppsrätter på EU-nivå. En utvidgning av systemet med handel med utsläppsrätter till sjöfart, landvägstransporter och uppvärmning samt införandet av ett graderingssystem vid fördelningen av fria utsläppsrätter skulle endast ha en liten effekt på utsläppen under den fjärde handelsperioden och det skulle också vara mer politiskt utmanande att genomföra dessa åtgärder.

Åtgärder i anslutning till utsläppstaket kräver ofta tid innan man ser effekterna. Att exempelvis sänka utsläppstaket skulle först påverka marknadsaktörerna efter några år. Ökad

resiliens i utsläppshandeln skulle däremot ha en snabb inverkan, men det räcker inte i sig för att uppnå de högre utsläppsminskningsmålen fram till 2030.

Endast ett brett politiskt reformpaket kan säkerställa att målen nås

Av den anledningen krävs det att man inför flera åtgärder inom utsläppshandeln på samma gång, med andra ord ett politiskt reformpaket, för att effektivera utsläppsminskningarna både på kort och lång sikt samt nå det ambitiösa målet fram till 2030. **Att förbättra marknads-stabilitetsreserven är den allra mest centrala åtgärden på kort sikt som behövs för att säkra en fungerande utsläppshandel, oberoende av om de strängare målen införs eller inte.** En åtstramning av marknadsstabilitetsreserven är inte förknippad med några risker, eftersom den endast aktiveras om det finns ett betydande överutbud på marknaden. Exempelvis målen för förnybar energi som satts upp för energisektorn väntas skapa ett nytt strukturellt överskott på marknaden för utsläppsrätter. Om så ända inte skulle ske aktiveras inte mekanismen.

Med utgångspunkt i de observationer vi redogjort för ovan presenteras i utredningen följande politiska reformpaket för att säkerställa att EU:s utsläppshandel har resiliens nog att fungera i olika förhållanden, exempelvis i olika ekonomiska lägen, samt dess möjligheter och minska utsläppen av växthusgaser i enlighet med målen i Parisavtalet.

- Utsläppstaket sänks så att det är i linje med de nya, strängare utsläppsmålen:
  - Utsläppstaket beräknas en gång med 205 miljoner rättigheter så snart som möjligt, men senast fram till år 2026. Hur mycket det ska sänkas beror på differensen mellan det genomsnittliga utsläppstaket och de verkliga utsläppen under den tredje utsläppshandelsperioden.
  - Den linjära utsläppsminskningskoefficienten för utsläppstaket som sänks varje år fastställs så att den är i linje med det totala utsläppsminskningsmålet på 60 procent fram till 2030. Det innebär att koefficienten höjs från det redan beslutade 2,2 procent till 3,63 procent år 2021 eller alternativt till 5,07 procent år 2026.

- Marknadsstabilitetsreserven effektiviseras genom att minska överskottet på utsläppsrätter:
  - Det antal rättigheter som tas bort från marknadsstabilitetsreservens marknad (den andel som ska överföras) ökar med minst 24 procent från tidigare bestämda 12 procent efter år 2023. För närvarande lägger man till rättigheter i reserven varje år enligt en modell som bestämts på förhand: så länge som antalet utsläppsrätter i omlopp överstiger 833 miljoner överförs 24 procent fram till 2023 och efter det överförs 12 procent av de utsläppsrätter som är i omlopp till reserven istället för att auktioneras ut.
  - Den linjära utsläppsminskningskoefficienten tillämpas också på marknadsstabilitetsreservens gränsvärden samt om det överskott på utsläppsrätter som överlämnas till marknaden av mekanismen understiger det lägre gränsvärdet. På det sättet säkerställer man att gränsvärdena och antalet som överlämnas är i linje med det sjunkande utsläppstaket. Enligt de nuvarande reglerna är de fortfarande fasta när utsläppstaket beräknas varje år.

- En grupp föregångarländer är ett föredöme när det gäller att stärka systemet:
  - En grupp länder inför en överlåtelseavgift för att säkerställa minimipriset på utsläppsrätter från år 2023 och framåt. Överlåtelseavgiften sätts så att man får ett pris på en utsläppsrätt på minst 25–30 € startåret och på minst 40–45 € år 2030.
  - Länderna annullerar frivilligt max antal utsläppsrätter via nationella beslut, som stänger ner kraftverk som använder fossila bränslen.

Om de föreslagna åtgärderna inte blir av och inte vidtas måste antalet utsläppsrätter på marknaden för marknadsstabilitetsreserven öka till 36 procent från det antal utsläppsrätter som är i omlopp. På det sättet säkerställer man att utsläppshandeln uppnår de nuvarande minimimålen, det vill säga en minskning av utsläppen med 43 procent jämfört med 2005 års nivå.

Reformarbetet måste börja omedelbart

Den här utredningen erbjuder konkreta åtgärdsförslag som är politiskt genomförbara och som kan bidra till att stärka EU:s utsläppshandel så att den är i linje med Parisavtalet. För att genomföra åtgärderna krävs det dock en stark politisk vilja såväl i Europaparlamentet som i medlemsstaterna och kommissionen. En grupp föregångarländer skulle snabbt kunna besluta om att införa en överföringsavgift och dessutom annullera rättigheter frivilligt enligt det maxantal som fastställs i direktivet om utsläppshandel.

Man har beslutat att utvärdera marknadsstabilitetsreservens verksamhet år 2021 och en diskussion om målen för utvärderingen pågår redan. Bland förslagen i denna utredning kan man inhämta kunskap och perspektiv inför den framtida utvärderingen. Det skulle göra det lättare att dra nytta av processen med att utvärdera marknadsstabilitetsreserven om ändringarna trädde i kraft tidigare än det föreslagna startåret. Man bör även påbörja en diskussion om de reformer som är mer krävande med tanke på den politiska viljan, det vill säga en sänkning av utsläppstaket och tillämpning av en högre utsläppsminskningskoefficient, så snart som möjligt. Det skulle öka genomsynligheten och förutsägbarheten i systemet med handel med utsläppsrätter och öka marknadsaktörernas möjligheter att förbereda sig inför kommande förändringar.

En ny kommission utses för perioden 2019–2024 och klimatförändringarna kommer säkert att vara en het fråga i kommissionens arbetsprogram. EU har möjlighet att återta ledarskapet i kampen mot klimatförändringarna genom att öka sina utsläppsminskningsmål och uppdatera utsläppshandeln i enlighet med dem.

Tabell 1. Uppskattning av åtgärdernas effekter och genomförbarhet samt av effekternas tidssättning.

		Utsläpps-minsknings-potential	Politisk genom-förbarhet	Påverkans-period
Sänkning av utsläppstaket	Högre utsläppsminskningskoefficient (LRF)	Hög	Genomsnittlig	Medellång och lång sikt
	Sätta ett nytt tak (rebasing the cap)	Hög	Genomsnittlig	Medellång sikt
	Sätta ett nytt tak och högre utsläppsminskningskoefficient	Hög	Genomsnittlig	Medellång och lång sikt
Ökad resiliens	Stärka marknadsstabilitetsreserven (MSR) (24 % borttagningstakt)	Genomsnittlig	Hög	Kort sikt
	Stärka marknadsstabilitetsreserven (MSR) (36 % borttagningstakt)	Hög	Hög	Kort sikt
	Frivillig annullering av utsläppsrätter	Hög	Hög	Kort och medellång sikt
Golvpris för utsläppsrätter	Överlåtelseavgift för utsläpp inom elproduktions-sektorn, grupp länder/ Överlåtelseavgift för utsläpp inom hela ETS-sektorn, Norden	Genomsnittlig	Hög	Medellång sikt
	Överlåtelseavgift för utsläpp inom elproduktionssektorn i hela EU	Genomsnittlig	Genomsnittlig	Lång sikt
	Reservpris för auktionering	Hög	Låg	Lång sikt
Övrigt	Utvidga utsläppshandeln till sjöfarten	Låg	Genomsnittlig	Lång sikt
	Utvidga utsläppshandeln till vägtrafiken/ den decentraliserade värmeproduktionen	Låg	Låg	Lång sikt
	Graderingssystem vid fördelning av fria utsläppsrätter	Låg	Låg	Lång sikt

1. Introduction and background

The European Union has committed to reducing its greenhouse gas emissions by at least 40% compared to 1990 levels up to the year 2030. The three pillars for achieving this headline target are the EU Emissions Trading System (EU ETS), the Effort Sharing Regulation (ESR) and the Regulation on Land Use, Land-Use Change and Forestry (LULUCF).

The EU ETS covers more than 12 000 installations in the energy and industry sector as well as intra-EU aviation. There are no national targets for emissions covered by the EU ETS, only an EU-wide cap. The target for the ETS is a reduction of 43% below 2005 levels until 2030 (EC 2019a). The Effort Sharing Regulation (Effort Sharing Decision in the period 2013 2020) sets national targets for most emissions not covered by the EU ETS, mainly transport, the residential sector, agriculture, waste disposal and small installations below the minimum thresholds in the EU ETS. In total, the national targets are set to achieve a reduction of 30% below 2005 levels until 2030. Under the LULUCF Regulation, member states need to ensure that the land-use sector is not a net source of emissions under the accounting rules (no-debit rule). There is some flexibility between the three pillars, but they remain relatively independent of each other.

Overall, the EU ETS and ESR targets are set in a way to achieve a reduction of 40% below 1990 levels. This has also been set as the EU's Nationally Determined Contribution (NDC) under the Paris Agreement (European Council 2014). In 2017, total GHG emissions in the EU were 22% below 1990 levels. Emissions covered by the stationary ETS were 26% and emissions in the ESR 10% below 2005 levels.

There are several reasons why the EU can and should step up its climate ambition and commit to a higher target in 2030.

— Countries agreed in Paris to limit the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. A recent analysis suggests that the sum of pledges under the Paris Agreement is not ambitious enough to reach this goal and parties need to strengthen their national contributions towards this goal (UNEP 2018). The same is true for the EU: the current target shows an ambition leading to 3 °C warming (CAT 2019).
— The EU agreed to strengthen the renewables and energy-efficiency goals after the 2030 GHG target was set. These goals contribute to reaching the emission-reduction target. The Commission expects that when "the agreed EU legislation is fully implemented, total greenhouse gas emission reductions are estimated to reach around 45% by 2030" (Euractiv)[1].
— Member states have undertaken additional actions to accelerate the decarbonisation of the power sector. For example, the Finnish Parliament decided on 27 February 2019 to phase out coal by 2029. A number of European countries have joined the Power Past Coal alliance and have pledged to phase out coal during the fourth trading period of the EU ETS.[2] This will lead to a faster and deeper emission cut than anticipated when setting the GHG targets.
— The EU Commission has published a long-term strategy in order to reach carbon neutrality in 2050. The current 2030 target implies that greenhouse gas reductions would have to happen twice as fast after 2030 compared to the period

2010-2030; the current 2030 target lies well above a linear target path.
— Postponing the action to later years increases the cost of action especially for investments with a long lifespan, such as investments in the power sector.

Against this background, eight parties in the Finnish Parliament agreed on unified climate policy goals in December 2018. The agreement includes the objective to increase the EU climate target for 2030 to 55% compared to 1990 levels.[3] The newly formed Finnish Government coalition included this demand in its programme (Government of Finland 2019). This is in line with many studies that find a target of 55-60% to be appropriate for the EU (e.g. New Climate Institute et al. 2018). In a resolution in March 2019 the European Parliament called for raising the EU's target to 55% below 1990 levels (EP 2019). In her candidacy as president for the European Commission, Ursula von der Leyen also called for raising climate ambition to at least 50% by 2030 (Ursula von der Leyen 2019).

One key instrument for reaching the EU climate target is the EU Emissions Trading Scheme (EU ETS). The contribution of the EU ETS towards the EU climate target was set based on the cost-effective reduction potential of the covered sectors compared to those sectors not covered. The EU ETS was expected to deliver 43% emission reduction by 2030 compared to 2005 emissions levels (EC 2019a). If the overall emission-reduction goal is more ambitious, the EU ETS target needs revision as well (see Chapter 2).

Currently the EU ETS is falling short of its potential. The historic surplus of allowances has led to fluctuating and sometimes weak CO_2 prices. A stable and strong carbon price is a prerequisite for triggering emission-reduction incentives in the long term. The ETS reform for the fourth trading period (2021-2030) and the introduction of the market stability reserve (MSR) in particular have tackled the market imbalance, and prices have risen to around 25 EUR/t CO_2. These revisions were based on an ETS target for the stationary sector of 43% below 2005 levels. In order to achieve more ambitious climate targets and to avoid a new market imbalance, the EU ETS needs to be revised again.

This study builds an analytical framework to compare available options for reforming the stationary EU ETS in line with the 1.5-degree temperature target and provides concrete recommendations for the way forward. The report is structured as follows. In Chapter 2, the enhanced stationary ETS target for 2030 is discussed in more detail. In Chapter 3, the options for increasing ambition in the EU ETS are presented. In Chapter 4, their abatement potential, interaction and political feasibility are evaluated. The chapter concludes with a set of recommendations to policymakers on how to improve the stationary EU ETS in order to deliver a climate target compatible with a 1.5-degree warming goal. Recommendations and conclusions are included in Chapter 5.

1 Euractiv
2 The following countries have announced a coal-phase out by 2030 at the latest: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Netherlands, Portugal, Slovakia, Sweden and the United Kingdom. In Germany, a government commission proposed an end date for coal of 2038; the results were welcomed by Chancellor Mer-kel, but are not transposed into law yet (Europe Beyond Coal 2019b).
3 https://vnk.fi/artikkeli/-/asset_publisher/kahdeksan-eduskuntapuoluetta-paatti-yhteisista-ilmastopolitiikan-tavoitteista (link in Finnish).

2. An EU ETS target for 2030 compatible with the Paris Agreement

The current EU climate target of 40% reduction compared to 1990 levels in 2030 is not in line with the objectives of the Paris Agreement. Many studies have found a target of 55-60% to be appropriate for the EU. As a first step in this study, the reduction of 55 and 60% compared to 1990 is quantified and the coverage, in terms of sectors and countries, is clarified (see Chapter 2.1).

The EU ETS covers approximately 40% of the total EU emissions (EEA 2018a, 2018b). The stationary EU ETS regulates emissions from power plants and large industrial facilities such as refineries, the production of iron and steel, cement, lime, glass, metals and chemicals. Aviation on routes within and between countries covered by the EU ETS is included, too. This study focuses on the stationary ETS, because the scope of aviation emissions covered by the EU ETS is due for review in the light of the market based measure being developed under the International Civil Aviation Organisation (ICAO). In the past the reduction target for the ETS sector has been more stringent than for the sectors covered by the Effort Sharing Regulation such as agriculture, transport, waste and decentralised heating. In Section 2.1, a new EU-wide target, in line with the increased ambition, is defined for the whole economy. In Section 2.2 a GHG reduction target for the stationary EU ETS in 2030 is derived.

Based on the new EU ETS target and projected emission developments, the required additional effort by the ETS in the stationary sector is identified in Section 2.3.

2.1 EU climate target for the whole economy in 2030

For the purposes of this study a value of 5 720 Mt CO_2e will be used for the 1990 base-year emissions against which the 2030 targets are calculated (EEA 2018a). Thus, a reduction of 55% corresponds to no more than 2 575 Mt CO_2e of GHG emissions in 2030, and a 60% target to 2 290 Mt CO_2e. These values are based on the following assumptions.

- **Land Use, Land-Use Change and Forestry (LULUCF): LULUCF** is excluded from the scope of the target.
- **International aviation:** All emissions from domestic and international aviation, as defined under the United Nations Framework Convention on Climate Change (UNFCCC), are included in the scope of the target. In effect this means that all fuel sales to the aviation sector within the EU are included; this is very similar to emissions from all flights departing from an EU airport.
- **International shipping:** Emissions from international shipping are excluded from the scope; this also excludes shipping between EU member states. Only domestic shipping is part of the analysis.
- **United Kingdom/Brexit:** The analysis is based on the EU28 including the United Kingdom.
- See Annex 7.1 for an explanation of these assumptions and a more detailed assessment of the implications on the overall emission budget as well as the 2030 target.

2.2 Targets for the stationary EU ETS in 2030

As with the current targets, both the ETS and the ESR sectors need to contribute to any enhanced target. Several approaches are possible to determine the relationship between the two policy regimes under the enhanced target. The current targets were based on a cost-optimal split and were expected to lead to a common marginal abatement cost (EC 2014). For this study the split between the ESR and ETS emissions in 2030 is based on the 2050 long-term strategy proposed by the European Commission (EC 2018). The strategy includes six pathways which aim at limiting global warming to well below 2 °C as well as three pathways aiming at no more than 1.5 °C. The pathway "1.5LIFE-LB" has been used to interpolate an ETS share of 35% of the remaining emissions in 2030. This pathway aims at limiting global warming to 1.5 °C while relying less on negative emissions through carbon capture and storage (CCS) and on biomass use. Large scale deployment of CCS is not yet realistic in the next decade and therefore it is less relevant when assessing ETS emissions in 2030.[4]

This pathway has been chosen because it represents a high ambition for the ETS: emissions in the trading sectors would need to decline faster than in the sectors covered by the ESR. This reflects the fact that the abatement options in the ESR sectors tend to be more difficult to achieve, especially in the short term. This is supported by recent studies estimating carbon costs under the ESR to be much higher than under the ETS (Agora Energiewende & Agora Verkehrswende 2018; Graichen 2018). Following this approach, the target for the stationary ETS in 2030 would be 913 Mt CO2e or 61% below the 2005 level for the 55% overall reduction target. For the 60% overall reduction target the values are 812 Mt CO_2e or 65% below 2005 (Figure 1, option "high ETS effort"). With these targets the stationary ETS would need to achieve approximately half of the additional reduction effort; i.e. the increase from the 40% target to the 55%/60% target. The aviation sector will need to contribute to the enhanced targets as well but this not further discussed in this report. This is because a significant share of aviation emissions is not covered by the EU ETS and secondly, different policy measures are required to address the aviation emissions under the ETS compared to the stationary sector.

The targeted ETS emissions in 2030 (i.e. 812-913 Mt CO_2e) lie well within the range of possible ETS emissions based on alternative approaches. Splitting the additional emission reductions (from 40% to 55/60%) equally between the ETS and ESR sectors would lead to ETS emissions of 949 Mt CO_2e (55% reduction target) or 806 Mt (60% reduction target) in 2030 (option "equal add. effort").

The upper end of the possible range of ETS emissions in 2030 is based upon the relationship between emissions covered by the ETS and by the ESR. Under current emissions as well as the current 2030 target the ETS has a share of approximately 40% of the total GHG emissions. Using this share for the higher target would lead to ETS emissions of 1 038 Mt (55%) and 922 Mt (60% target) ETS (option "constant ETS/ESR share"). The lower end of the range of the ETS emissions in 2030 is determined by an approach based on the non-CO_2 emissions. The non-CO_2 emissions are mainly associated with industrial processes and agriculture and tend to be the most difficult to mitigate. Interpolating between current emissions and the ETS share of the non-CO_2 emissions in 2050, as included in the EU long-term strategy, leads to ETS emissions of 811 Mt (55%) or 721 Mt (60% target) in 2030 (option "non-CO_2 approach").

4 Regarding the scenarios aiming at well below 2°C, the pathway with the lowest share of ETS emissions ("Circular Economy") would also lead to an ETS share of 35% of the remaining emissions in 2030.

Figure 1. Historic and projected emissions for the EU ETS and ETS target options under the en-hanced targets

Source: EEA (2018c), Sandbag (2019), Authors
Notes: for an explanation of the different target options and the selected projections see the text above the figure.

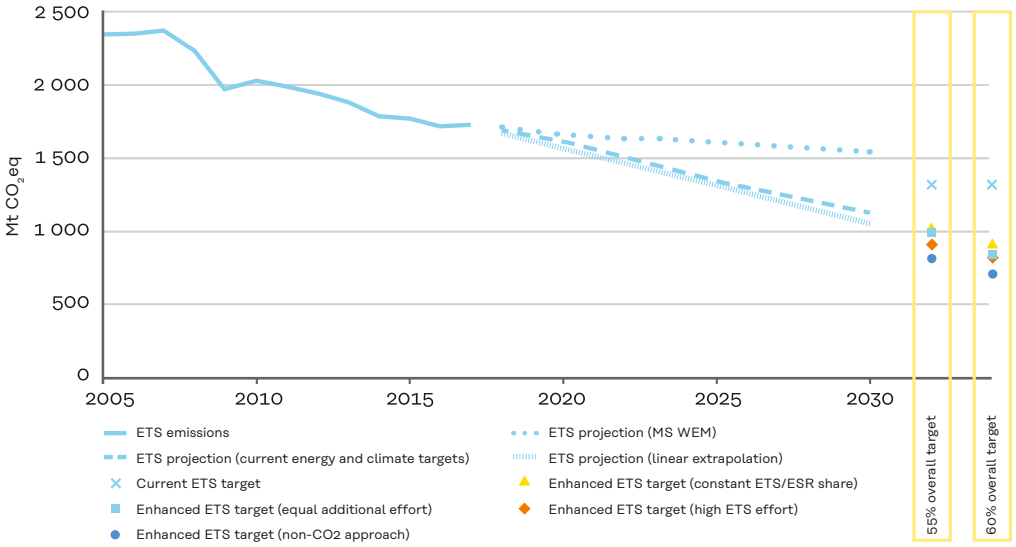


Figure 1 also presents three different projections for the development of the ETS emissions until 2030.

— *MS WEM.* Member states need to report emission projections with existing measures every two years under the Monitoring and Reporting Regulation (MMR) (MS WEM). These projections had to be reported in 2017 and are mainly based on the measures and targets adopted in 2015, i.e. before the agreement of the 2030 energy and climate framework.

— *Current energy and climate targets.* This projection captures the impact of the adopted energy and climate targets as well as the already agreed coal phase-out plans in member states[5] (Sandbag 2019). For member states without an agreed coal phase-out it assumes that all coal power stations close down by 2040.

— *Linear Extrapolation.* Emissions are extrapolated using the trend since 2005.

5 The report uses Cambridge Economics' E3ME model originally developed under the European Commission's re-search framework programmes.

2.3 Gap between required and projected emission levels

To assess the required additional emission reductions by the stationary ETS, the enhanced 2030 targets following the "high ETS effort" approach need to be compared to the current ETS target and emission projections (Figure 1).

Current targets vs enhanced targets

For the overall 55% reduction target the ETS will need to reduce emissions by 420 Mt CO_2e additionally compared to the current target (from 1 333 to 913 CO_2e). For the 60% overall target, the ETS will need to reduce 521 Mt CO_2e by 2030 compared to the current target.

Different baseline projections vs enhanced targets

The latest member state projections published by the EEA were produced mainly in 2015/2016 and, therefore, do not include the energy efficiency and renewable energy targets adopted by the EU. They also do not include the coal phase-out decided by various member states. These projections are therefore very pessimistic. Comparing the enhanced 55% target to the MS WEM projections, a gap of 629 Mt CO_2e remains. The two other projections (linear extrapolation and current energy and climate targets) suggest much smaller gaps. With the current energy and climate targets projection, the gap to the enhanced 55% overall target is 212 Mt CO_2e, and for the 60% target it is 313 Mt CO_2e. In Chapter 3 the projection based on current energy and climate targets including coal phase-out will be used for the assessment of the policy options (called current emission projection) as this is considered the most up-to-date presentation of the baseline emission development.

Table 2. Gap between different projections and the ETS targets

		40% overall target	55% overall target	60% overall target
ETS emission target		1 333 Mt CO_2e	913 Mt CO_2e	812 Mt CO_2e
Gap towards	MS projections (with existing measures)	209 Mt CO_2e	629 Mt CO_2e	730 Mt CO_2e
	Linear extrapolation	–276 Mt CO_2e	144 Mt CO_2e	245 Mt CO_2e
	Current energy and climate targets (including agreed coal phase-out)	–208 Mt CO_2e	212 Mt CO_2e	313 Mt CO_2e

Source: Authors' calculations based upon EEA (2018c) and Sandbag (2019).
Notes:
- All numbers include stationary ETS as well as Norway, Iceland and Liechtenstein.
- A negative gap signifies that the projection is below the target, i.e. the target is overachieved.
- For more details on the projections see Section 2.2.

The approach used in this study is based on the targeted emission levels in 2030. This is consistent with the formulation of the ETS/ESR targets and the EU's NDC, but it also has some drawbacks. The ETS has annual targets with flexibilities between the years. In other words, the ETS defines an emission budget for the period until 2030, not an annual target. From a climate change perspective the total quantity of CO_2 emissions is the most important driver, not the emission levels in any given year (Meinshausen et al. 2009). Climate policies only focusing on annual targets instead of emission budgets over multiple years could have a significant drawback: the total emissions over a period might be considerably higher if the required reductions only take place shortly before the target year. An extreme example would be to continue with business as usual until 2029 and then close enough coal power plants in 2030 to achieve the target. To avoid such a scenario and ensure a gradual transition, both the ETS and the ESR are based on annual emission limits that decline linearly. At the same time both regimes allow banking and some borrowing of emission quantities between years and therefore cannot guarantee a certain emission level in any given year. High emission reductions early in the period would allow companies or countries to have higher emission levels in 2030 while still complying with their obligations.

From a climate change perspective the total quantity of CO2 emissions is the most important driver, not the emission levels in any given year.

This inherent inconsistency between the single-year target under the NDC and the implementation of the policies through 10-year emission budgets in EU legislation might need to be addressed later in the period if it becomes apparent that the NDC will not be met without further action. In the assessment of the policy options below both the 2030 target achievement (i.e. 2030 emission levels) as well as the overall emission budget for the 2021-2030 period (i.e. sum of the emissions in the period) will be used.

Operators can bank the unused allowances for future use and borrow allowances from the next year if it is in the same trading period. If this happens, emissions in a given year can be above the annual cap. We assume in the calculations that a certain cap for the ETS will be equal to the emission level in that year, i.e. we do not include a safety buffer to compensate for any potential banking/borrowing.

3. Policy options to increase the ambition of the EU ETS

There are different options for increasing the ambition of the EU ETS in order to meet an EU ETS target in line with the Paris Agreement. They can either be applied in isolation or in combination with one another.

The following types of policy options will be assessed.

1. Strengthening the EU ETS cap. Directly adjusting the overall EU ETS cap is an option if the balance between supply of and demand for allowances diverges systematically and there is a risk of a structural surplus endangering the functionality and efficiency of the system. If the surplus is high, CO_2 prices are low and thus firms have little incentive to invest in emission reductions. Also, if the CO_2 price is very volatile, investors are less willing to pay for emission reductions as there is uncertainty as to whether the investment will pay back in the future. The direct adjustment of the cap can be triggered by different factors, such as improved data quality, an increase in ambition or the impact of overlapping policies and measures not taken into account in earlier cap setting. The following policy options are assessed in this study:

- applying a higher linear reduction factor (LRF) to the EU ETS cap;
- rebasing the EU ETS cap.[6]

2. Enhanced resilience. In addition to direct adjustments to the overall EU ETS cap, policy options that respond to more short-term variations (i.e. related to unanticipated changes in economic development or fuel price development) may also indirectly adjust the cap. The following policy options to reduce the number of allowances auctioned will be assessed in this study:

- reform of the market stability reserve (MSR);
- unilateral cancellation of allowances.

3. Carbon price floor. The carbon price is a key driver for incentivising emission abatement. Minimum prices can ensure that these incentives are maintained even in the event of unforeseen developments in the market. Two different options for a carbon price floor are presented:

- surrender charge;
- auction reserve price.

4. Extension to the scope of the EU ETS. The increase of the scope of the EU ETS may lead to a higher overall efficiency, since, in principle, the most cost-effective mitigation measures are implemented first. Such an improvement in efficiency may enable policymakers to further increase emission-reduction targets. This option is discussed regarding sectors, which are currently covered by the Effort Sharing Regulation (ESR) such as building-specific heating and cooling as well as transport. Additionally, the inclusion of international maritime transport is assessed.

5. Tiered approach to free allocation. Industries receive a substantial share of the allowances needed for compliance for free, if they belong to a sector deemed at risk of relocating to countries with less ambitious climate

6 In some policy discussions an ambitious proposal has been suggested to determine a 1.5-degree compliant carbon budget for the whole EU and to align ETS and ESR sectors with the respective overall cap. While this would be valuable in explicitly aligning these mechanisms with the Paris Agreement, it is beyond the scope of this analysis.

policies due to the cost incurred by the EU ETS (carbon leakage). The targeting of free allocation via a tiered approach, so that those most at risk receive a higher share of free allocation than those at medium risk, would lead to a reduction in the number of allowances given out for free, which, if cancelled, could increase the climate ambition of the EU ETS.

Each of the above policy options will be discussed in the following sub-sections detailing how this option can be introduced or, if already implemented in the EU ETS, be improved to increase the climate ambition of the EU ETS.

3.1 Strengthening the EU ETS cap

3.1.1 Applying a higher linear reduction factor (LRF)

a) What is the LRF and how is it currently implemented in the EU ETS?

The overall amount of emission allowances, the cap, is set to achieve the long-term target of emission reductions in the sectors covered by the EU ETS. The EU ETS cap declines annually by an amount defined by the linear reduction factor (LRF). If the GHG reduction target is revised upwards or complementing policies such as renewable energy and energy-efficiency goals are stepped up, a higher LRF is an option to reflect the increase in ambition. The use of an LRF has been applied in the EU ETS since 2013 in order to raise the level of climate ambition and it has been increased once: in the third trading period (2013-2020), the cap declined annually by 1.74% of the average total quantity of allowances issued for the period 2008-2012. From 2021 onwards, the LRF will be increased to 2.2% (EU 2018).

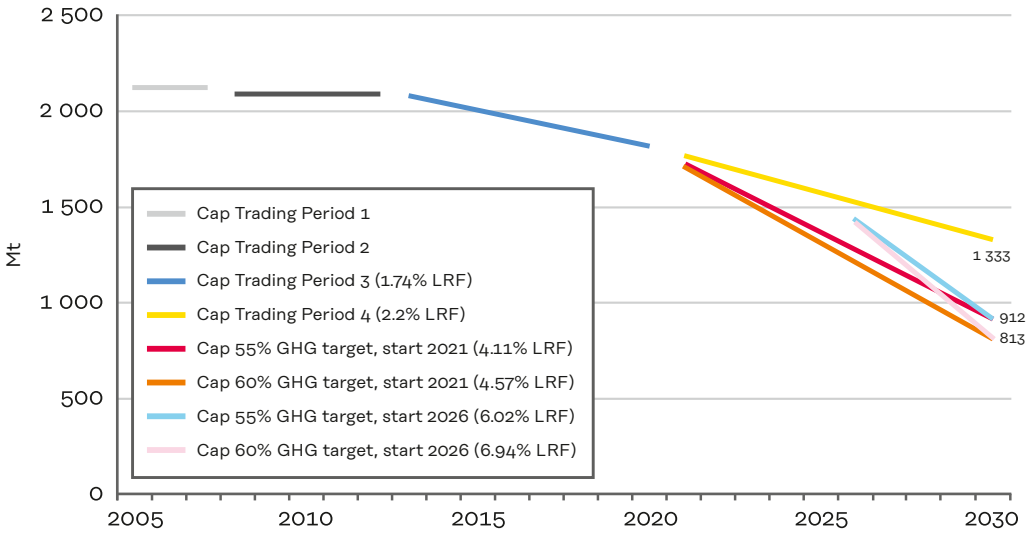
b) How could a higher LRF increase the climate ambition of the EU ETS?

The LRF of 2.2% was set in line with an overall 80% reduction target for the EU in 2050 (Graichen 2016). The application of an LRF of 2.2% between 2021 and 2050 would result in an emissions reduction of 82% relative to 2005 levels, but not deliver the needed ETS contribution to carbon neutrality in 2050 for the EU as put forward in the European Commission's 2050 Long-Term Strategy (EC 2018) as well as in the Finnish government plan and in the majority of EU member states.

Reaching the ETS targets derived in Chapter 2 would require a considerable increase in the LRF. The extent to which the LRF would need to be increased depends upon the timing of implementation. If the LRF is increased from 2021 onwards, an LRF of 4.11% (4.57%) would be sufficient to reach the 55% (60%) overall reduction target (Figure 2). However, if the LRF is only changed after 2026 then a higher LRF of 6.02% (6.94%) would need to be applied to reach the target of 55% (60%) overall GHG reduction.

The new cap proposals are set in such a way that the 2030 caps equal the 2030 targets. But the cap in 2030 alone will not ensure that the emission target is met. Unused allowances can be banked and used in later years for compliance. As there is currently a surplus of allowances in the market, EU ETS emissions in 2030 may exceed the cap. Only if the surplus is eliminated before 2030 will the revised cap ensure that the target is met.

Figure 2.
EU ETS Cap between 2005 and 2030 and LRF required to meet the enhanced EU GHG emission targets of 55% and 60%



Source: EEA (2018c); Authors.

In the first two scenarios in Table 3 the caps start declining faster in 2021 and in the latter two scenarios only in 2026. Even though they all meet the 2030 target, the overall amount available to the EU ETS in the period 2021-2030 differs. Table 3 also presents the associated total cap and the increase in ambition compared to the current cap: the highest increase in ambition is reached when a LRF of 4.57% is applied starting in 2021 – the total cap for the fourth trading period is reduced by nearly 2 900 million allowances, which corresponds to a reduction of the cap by 18%. The total cap only declines by 8% if the cap is adjusted starting in 2026 and is aimed at reaching the 55% overall GHG reduction target.

Table 3.
Total cap in the fourth trading period for different LRF scenarios (in million EUA)

	Total cap 2021-2030	Difference to current cap	Does it reach the enhanced target?
Cap Trading Period 4 (2.2% LRF)	15 504	0	No.
Cap 60% GHG target, start 2021 (4.57% LRF)	12 640	2 864	Yes (60% target), if surplus is eliminated.
Cap 55% GHG target, start 2021 (4.11% LRF)	13 196	2 308	Yes (55% target), if surplus is eliminated.
Cap 60% GHG target, start 2026 (6.94% LRF)	13 942	1 562	Yes (60% target), if surplus is eliminated.
Cap 55% GHG target, start 2026 (6.02% LRF)	14 245	1 259	Yes (55% target), if surplus is eliminated.

Note: Interactions with other policy instruments such as the MSR are not taken into account.
Source: Authors.

The increase in the linear reduction factor from 2.2% to 4.57% starting in 2021 as well as an LRF of 6.94% starting in 2026 drives the cap down to meet the 60% reduction target for the EU. To reach the 55% GHG reduction target an LRF of 4.11% starting in 2021 or 6.02% starting in 2026 would need to be applied. However, the cap equalling the emission target in 2030 cannot guarantee that the actual emissions meet the target, because unused allowances from earlier years can be used for compliance in 2030. Therefore, the surplus of allowances needs to be eliminated by reducing the number of allowances entering the market in the fourth trading period. The options starting in 2021 reduce the total cap more effectively than those starting later: total cap reduction ranges from 1 300 million to 2 900 million allowances, which corresponds to an 8 to 18% reduction of the total cap.

3.1.2 Rebasing the cap

a) What is the rebasing of the cap and how is it implemented?

From the start of the EU ETS, annual caps have been higher than actual emissions. In order to ensure scarcity in the market the cap can be rebased, meaning that the baseline level is adjusted downwards in order to better reflect the actual development of emissions. The EU-wide cap (which started in 2013) has not been rebased, but between the first trading period (2005-2007) and the second (2008-2012) several national caps were rebased when verified annual emissions data from the pilot phase became available. Emission data suggested that emissions had been overestimated and the cap on allowances was subsequently reduced in phase 2 (European Commission, no date). However, the unexpected economic crisis still led to emission reductions greater than expected and resulted in a large surplus of allowances, which undermined the price signal of the EU ETS throughout the second trading period.

From the start of the EU ETS, annual caps have been higher than actual emissions.

b) How could rebasing the cap increase the climate ambition of the EU ETS?

Verified emissions in the EU ETS have continued to be lower than the cap during the third trading period by 205 Mt CO_2 eq. on average annually (Figure 3) and current emission projections based on the energy and climate targets expect this trend to continue into the fourth trading period. This implies that the structural surplus of allowances will endure. The market stability reserve is designed to temporarily absorb a surplus of allowances but is not able to compensate for a cap being structurally too high. Rebasing the cap in 2021 by deducting the average difference between the cap and the verified emissions in the years 2013-2018 (205 Mt CO_2 eq.) would help to assess the structural imbalance. As a result, the rebased cap (assuming an unchanged LRF of 2.2%) would reflect the level of expected emissions.

If the cap is rebased in 2021 to reflect actual historic emissions and the LRF of 2.2% remains unchanged, the resulting cap level in 2030 amounts to 1 128 million allowances. Albeit being more stringent than the current cap, it does not reach the enhanced GHG emission-reduction targets for the EU ETS sector (812/913 Mt CO_2e). Therefore, the option of rebasing the cap would need to be combined with other options, such as increasing the LRF. Taking into account the starting point of the rebased cap in 2021 a significantly lower LRF increase would be required to reach the GHG targets: the 55% overall GHG reduction target can be reached with an LRF of 3.18% (starting in 2021) and the 60% GHG reduction target by an LRF of 3.63%. Without rebasing, the required LRFs amounted to 4.11% and 4.57% respectively. For additional scenarios refer to Table 4.

Figure 3.
Rebasing the EU ETS cap in 2021 to reflect the historic difference between emissions and cap

Source: EEA (2018c); Authors.

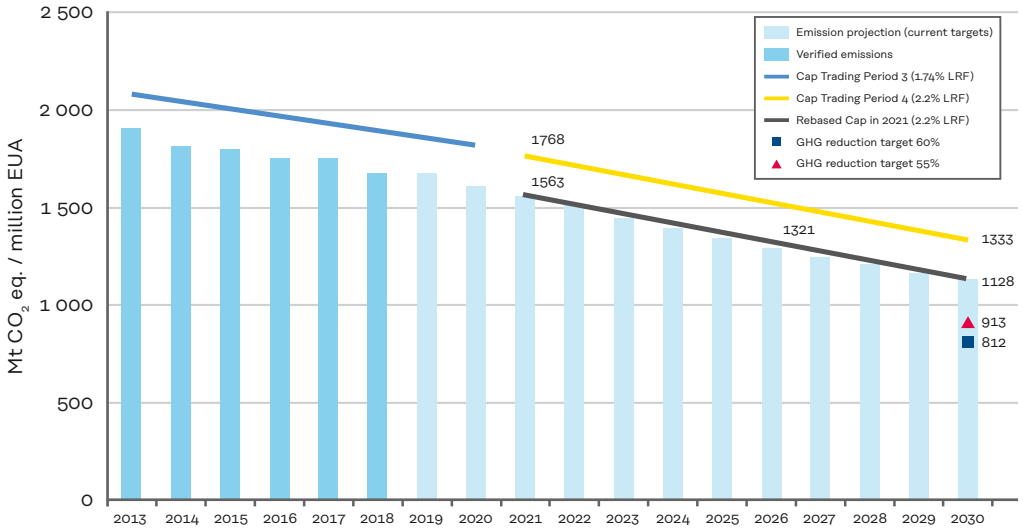


Table 4.
Total cap in the fourth trading period for different LRF scenarios (in m EUA)

Note: Interactions with other policy instruments such as the MSR are not taken into account.
Source: Authors.

	Total cap 2021-2030	Difference to current cap	Does it reach the enhanced target?
Cap Trading Period 4, no rebasing, 2.2% LRF	15 504	0	No.
Rebased cap in 2026, LRF 2.2%	14 480	1 023	No.
Rebased cap in 2021, LRF 2.2%	13 457	2 047	No.
Rebased cap in 2026, LRF 4.16%	13 835	1 668	Yes, 55%, if surplus is eliminated.
Rebased cap in 2026, LRF 5.07%	13 533	1 970	Yes, 60%, if surplus is eliminated.
Rebased cap in 2021, LRF 3.18%	12 273	3 231	Yes, 55%, if surplus is eliminated.
Rebased cap in 2021, LRF 3.63%	11 721	3 782	Yes, 60%, if surplus is eliminated.

Rebasing the cap in the year 2021 reduces the total cap of the fourth trading period by 2 000 million allowances and even if the rebasing is applied only in the second half of the trading period, the total cap is 1 000 million allowances lower. Both trajectories, though, do not reach the enhanced EU ETS targets. The cap can meet the targets if the LRF is additionally strengthened: after 2021, increasing the LRF to 3.18% (3.63%), the cap meets the 55% (60%) GHG reduction goal. If rebasing is applied in 2026, then the required LRFs increase to 4.16% (5.07%). The cap equalling the emission target in 2030 cannot guarantee that the emissions meet the target, because unused allowances from earlier years can be used for compliance in 2030. Therefore, the surplus of allowances needs to be eliminated by reducing the number of allowances entering the market in the fourth trading period.

3.2 Enhanced resilience

3.2.1 Market stability reserve (MSR) reform

a) What is the MSR and how is it implemented in the EU ETS?

Since 2009, a surplus of emission allowances has built up in the market. In the short term the surplus undermines the orderly functioning of the carbon market and, in the long term, it affects the ability of the EU ETS to meet more ambitious climate targets cost-effectively (EC, no date). In 2015, the Council and the European Parliament decided to establish a market stability reserve (EU 2015) in order to reduce the surplus and improve the system's resilience to unforeseen developments, such as macroeconomic fluctuations. The MSR began operating in January 2019. When the surplus of emission allowances is high, fewer allowances will be auctioned and the difference is placed in the reserve. On the other hand, when the market is tight, allowances will be additionally auctioned from the reserve.

Each year, the Commission publishes the total number of allowances in circulation. In 2018 the number of allowances in circulation corresponded to 1 655 million allowances (EC 2019b). This is nearly as high as the total verified emissions in 2018 (1 674 Mt CO_2 eq.). If the number of allowances in circulation for a given year is above the threshold of 833 million, the auctioned amount is reduced by an amount equalling 12% of the allowances in circulation and transferred into the reserve. This intake rate of 12% is doubled to 24% between 2019 and 2023 as defined in Decision (EU) 2015/1814 following the recent revision to the EU ETS Directive (2018/410). Alternatively, if the number of allowances in circulation is below a threshold of 400 Mt, then 100 Mt of allowances will re-enter the market annually. In line with these rules for the MSR, from 1 September 2019 to 31 August 2020, a total of 397 178 358 allowances will be placed in the MSR (EC 2019b). Furthermore, from 2023 onwards, the size of the MSR will be restricted to equal the number of allowances auctioned in the previous year; any additional allowances in the MSR are permanently invalidated.

Figure 4 illustrates how the operation of the MSR from 2019 onwards is expected to affect the number of allowances in circulation up until 2030. The emissions are expected to remain below the cap also in the fourth trading period (based upon the current target emission projection (Sandbag 2019)) and thus the MSR absorbs allowances and reduces the number of allowances in circulation (light orange area).

With the start of the operation of the MSR, the amounts of postponed auctions (known as backloading), as well as unallocated amounts from the third trading period (e.g. the budget for free allocation to new entrants), were transferred to the reserve. In 2021, 488 million allowances will be taken from the MSR in order to feed the new entrants reserve (Article 10a7, EU ETS Directive). In 2023, the amount of allowances in the MSR above the auctioned amount in the previous year (2022) is invalidated and thus the amount in the MSR drops steeply (see Table 6). At the same time, the intake rate of the MSR is reduced to 12% of allowances in circulation. But the intake rate is not high enough: from 2024 onwards more new allowances are released to the market than are needed to cover the projected emissions and the surplus starts to increase again. The amount of new allowances (1 170 million allowances) brought into the market in 2030 is not only higher than projected

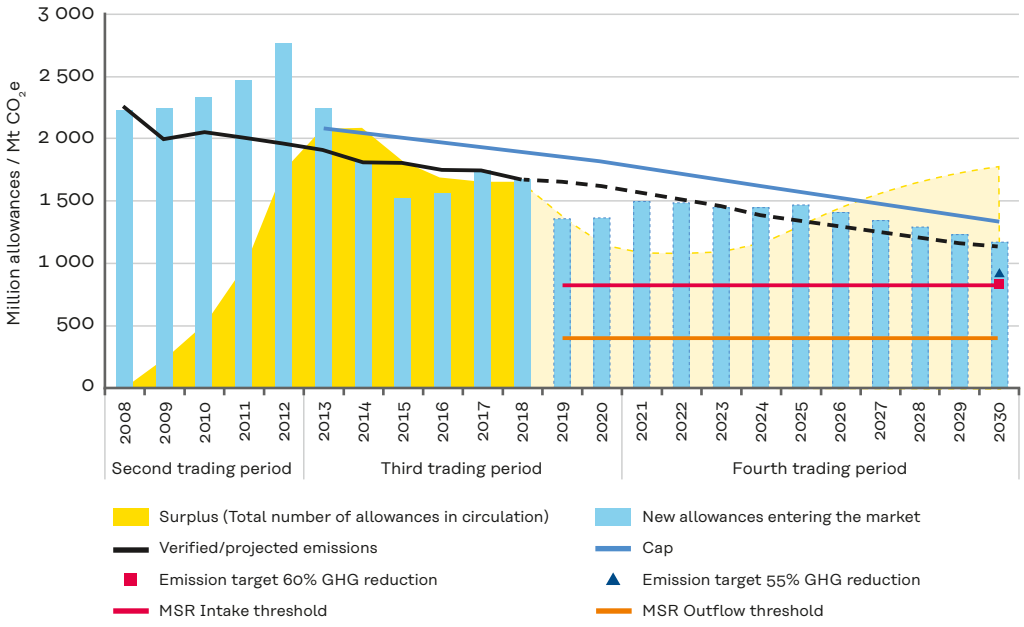
emissions but well above the ETS budget in 2030 under enhanced GHG reduction targets (812/913 Mt CO_2).

The thresholds defining whether there is an intake or outflow of allowances to/from the MSR remain constant over the whole period despite declining emissions and a declining cap. In 2030 the enhanced emission target for the ETS sector of 812 Mt CO_2 is lower than the intake threshold (833 million allowances). Therefore, there could be a situation where the surplus equals the emission target and, despite this, no allowances are absorbed by the MSR. Some surplus might be desirable to ensure the liquidity of the market but a large surplus (for example, exceeding the cap) might compromise the emission target allocated for the EU ETS.

It is estimated that the total amount of allowances invalidated by the MSR amounts to 3 300 million allowances, approximately double the amount of total verified emissions in one year (see Table 6). Whereas allowances in the MSR can still be released and thus cover emissions in the following years, the invalidated allowances increase the ambition of the ETS.

Figure 4. Projection of the MSR under current rules

Source: EEA (2018c); Sandbag (2019); Authors.



b) How could the MSR be reformed to increase the climate ambition of the EU ETS?

Article 3 of Decision (EU) 2015/1814 states that:

> *within three years of the start of the operation of the reserve [i.e. 2021], and at five-year intervals thereafter, the Commission shall, on the basis of an analysis of the orderly functioning of the European carbon market, review the reserve and submit a proposal, where appropriate, to the European Parliament and to the Council (EU 2015).*

The review will in particular pay attention to the following parameters that influence the functioning of the MSR and could therefore each be reformed to increase the ambition of the EU ETS.

— A higher number of allowances could be placed in the reserve when the market is long (i.e. **the intake rate could be increased above the current levels).**

— The MSR should absorb allowances also if the surplus is smaller than under

current rules (i.e. **the thresholds triggering the inflow and outflow of allowances could be adjusted periodically**) reflecting that both the cap and the emissions are declining[7]

— The number of allowances to be released from the reserve **(i.e. the absolute number of allowances that re-enter the market could be reduced).**

Other forms of **cancellation of a larger share of allowances from the MSR than currently planned** could be another important reform of the MSR that would further increase the ambition of the EU ETS. One example is invalidating allowances remaining in the MSR for a long period of time (e.g. allowances older than three years).

Based upon the application of lower thresholds and a higher intake rate in the MSR, the current surplus of allowances could be reduced more rapidly than under current rules (refer to previous chapter, both MSR scenarios are based on the current energy and climate targets emission projection (Sandbag 2019)). The following MSR parameters are applied for two enhanced MSR scenarios.

Using the parameters presented in the table below, the allowances in the MSR (intake rate of 24% continued) decline steadily after 2023 (see Table 6). Also, the projected surplus increases only moderately (light yellow area in Figure 5). The number of allowances invalidated increases compared to the current MSR rules: nearly 4 000 million allowances are invalidated compared to the 3 300 million under the current setting (see Table 6). A variant of the MSR scenario with a higher intake rate (36% from 2024 onwards, see Figure 6) leads to a further increase in invalidation to 4 400 million in total. The projected total number of allowances in circulation does decline with a higher intake rate but remains above 700 million allowances.

In both enhanced MSR scenarios the number of new allowances entering the market in 2030 is about 1 100 million allowances, which is only slightly lower than in the reference scenario and again well above the enhanced GHG reduction targets (812/913 Mt CO_2). Additionally, the significant amount of allowances remaining in the MSR (about 770 million allowances) might come back to the market in the fifth trading period, albeit ambitious climate policies would require further emissions reductions in the period after 2030.

Table 5. Parameters of the MSR scenarios

Source: Authors.

	Current rules	Enhanced MSR (24% intake rate)	Enhanced MSR (36% intake rate)
Intake rate as a percentage of allowances in circulation	12% starting 2024 (24% until 2023)	24%	36% starting 2024 (24% until 2023)
Upper threshold defining whether there is inflow to the MSR	833 million EUA constantly	Declining threshold to 656 million EUA in 2030 by applying the LRF of 2.2% starting in 2021.	
Lower threshold defining whether there is outflow from the MSR	400 million EUA constantly	Declining threshold to 312 million EUA in 2030 by applying the LRF of 2.2% starting in 2021.	
Amount of allowances released from the MSR in case of outflow	100 million EUA constantly	Declining amount to 78 million EUA in 2030 by applying the LRF of 2.2% starting in 2021.	

7 The thresholds defining whether the MSR absorbs or releases allowances were defined in a way to ensure that there is liquidity in the market and that operators may reduce the carbon price risk for contracts covering sever-al years. The so called "hedging" implies that operators committing now to deliver, for example, electricity from their fossil power plant in three years can already now buy allowances needed for compliance under the EU ETS in later years. The need for hedging in absolute terms declines when (electricity) production becomes less CO_2-intense. Therefore, we argue that the intake and outflow thresholds should decline over time.

Figure 5. Enhanced MSR (24% intake rate) to increase climate ambition

Source: EEA (2018c); Sandbag (2019); Authors.

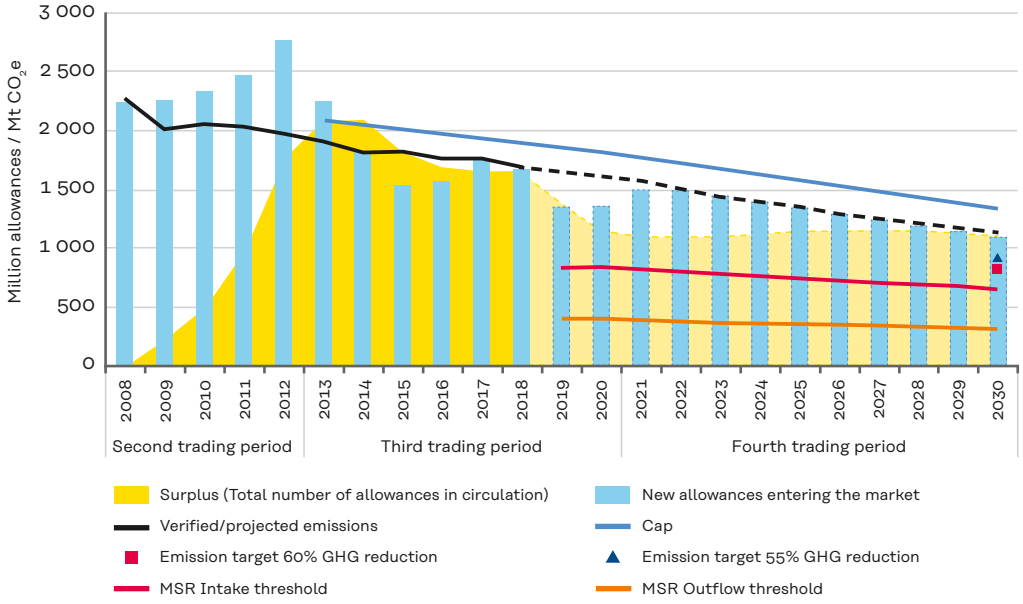
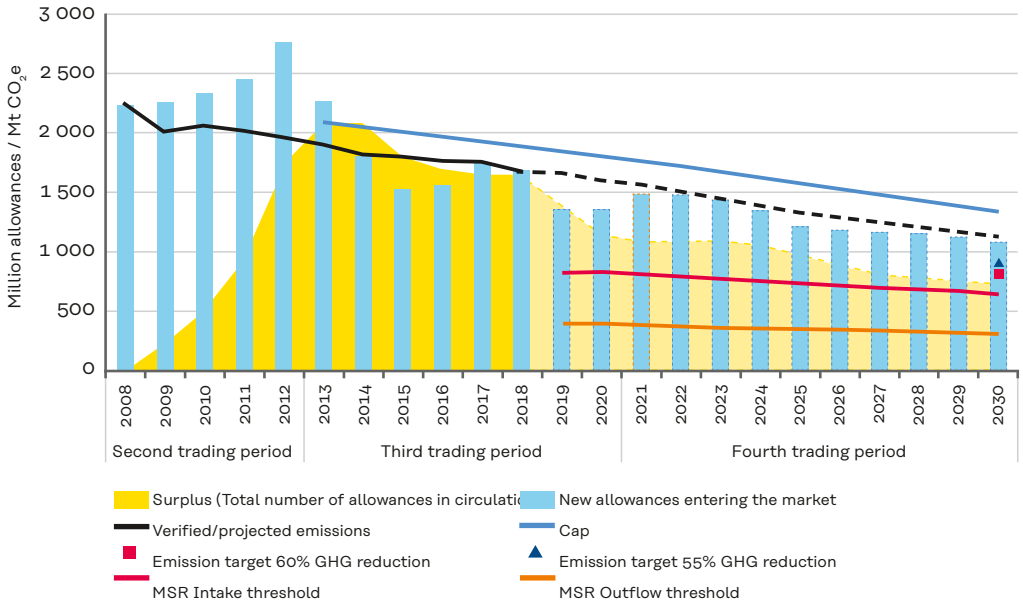


Figure 6. Enhanced MSR (36% intake rate) to increase climate ambition

Source: EEA (2018c); Sandbag (2019); Authors.



In the two MSR scenarios assessed, the changed intake rate is the main driver for avoiding increases in the surplus again and for ensuring that allowances are invalidated. The changed thresholds play a smaller role given the significant surplus of allowances in the market. In the scenario with current settings and the scenario with enhanced MSR (24% intake rate) the surplus (total allowances in circulation) is well above the changed thresholds and, therefore, the adjusted thresholds have no effect. As the MSR is constantly absorbing allowances, the reduced number of allowances to be released to the market also shows no impact. Adapting the thresholds is important, though, to increase the resilience of the MSR to unforeseen developments. This is illustrated in the MSR scenario with 36% intake rate: The number of allowances in circulation would drop below the current upper threshold in 2027. If the thresholds are not adapted, the MSR would no longer absorb allowances, albeit the total number of allowances in circulation remains high.

Table 6.
Overview of invalidation and allowances in the MSR under different MSR settings (in million allowances)

Source: Authors.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Invalidation											
MSR current setting			−1 892	−279	−201	−79	−184	−208	−222	−232	−3 297
Enhanced MSR (24% intake rate continued)			−1 892	−279	−289	−296	−302	−306	−307	−305	−3 975
Enhanced MSR (36% intake rate start 2024)			−1 892	−279	−377	−507	−383	−328	−307	−299	−4 371
Allowances in the MSR											
MSR current setting	2 321	2 592	961	899	832	899	877	848	818	787	
Enhanced MSR (24% intake rate continued)	2 321	2 592	961	943	919	892	864	835	805	775	
Enhanced MSR (36% intake rate start 2024)	2 321	2 592	961	987	1 002	869	823	804	786	765	

Adapting the threshold is even more important when GHG reduction targets are stepped up. With emissions and the cap declining in line with the 2030 targets, leaving the thresholds unchanged will endanger the ability of the MSR to absorb allowances albeit with a surplus in the market. When the thresholds were established, the higher thresholds equalled roughly half of the emissions covered by the scheme and the lower thresholds a quarter. It was argued that the remaining surplus in the market would be bought by market participants, especially power plant operators, to cover their expected emissions in the coming years when selling long-term contracts for electricity. With declining emissions, the absolute amount of allowances bought in advance to ensure against price volatility in the future will decline, too. So, the thresholds will need to be revised downwards to reflect the fact that the total demand of allowances is lower if emissions are lower. In the case of the 60% overall GHG reduction target, the target emissions in the EU ETS (812 Mt CO_2) are lower than the upper threshold of the MSR (833 million allowances). So, the MSR under current rules would stop absorbing allowances even though the number of allowances in circulation would be higher than the annual emissions covered by the scheme.

The analysis suggests that the current setting of the MSR and also the tightening of the setting will lead to an invalidation of a significant number of allowances (700 to 1 100 million allowances additionally to those invalidated in the MSR under current rules), but this will not be sufficient to reach the enhanced ETS target in 2030 alone. The number of new allowances brought to the market in 2030 (both allocated for free and auctioned) amounts to nearly 1 100 million allowances even in the scenarios with enhanced MSR rules. This is well above the targeted ETS budget of 812/913 Mt CO_2e for that year.

3.2.1 Unilateral cancellation under Article 12(4)

a) What is unilateral cancellation of allowances and how is it implemented in the EU ETS?

The unilateral cancellation of allowances allows member states to reduce the amount of auctioned allowances under certain circumstances. It is a policy option that enables participating EU ETS countries within the common cap to accommodate different levels of ambition regarding the mitigation of emissions. If an EU ETS country unilaterally adopts more ambitious mitigation policies than the average level within the EU ETS and the supply of allowances is not reduced to the same extent, this could lead to an increase in emissions in other countries covered by the EU ETS and/or a decline EUA prices as the demand for EUA is lower (Pahle et al. 2018).

The unilateral cancellation of allowances allows member states to reduce the amount of auctioned allowances under certain circumstances.

The unilateral cancellation of allowances by an ETS country prevents these two consequences from occurring. In the past, member states have not been able to reduce the amounts of allowances to be auctioned on their behalf. This has changed, though, with the recently amended Article 12(4) of the EU ETS Directive (2003/87/EC) enabling the unilateral cancellation of allowances that are to be auctioned "in the event of closure of electricity generation capacity in their territory due to additional national measures". In other words, unilateral cancellation helps to adjust the supply of allowances to reflect the reduced demand for allowances associated with the overlapping national policies in electricity generation.

The amount of allowances that can be reduced from the total auctioned amount depends on the average emissions of the closed power plant in the past five years. From the wording of the directive it is not fully clear[8] for how many years this amount can be deducted: only once (so equal to one year of average emissions), for five years or for the average amount until the end of the economic lifetime of the power plant in the absence of additional measures? The details are still to be defined. Based on the discussions when the EU ETS Directive was last revised, it seems likely that the sum of five years of emissions will define the maximum number of allowances that a member state may choose to withdraw from auctioning. For example, a member state could cancel up to 50 million allowances if a power plant with average emissions of 10 Mt CO_2 were closed due to national measures. It is important to highlight that this is a preliminary interpretation of the directive and cannot be confirmed as member states have not yet used the option to cancel allowances.

8 Article 12(4): "In the event of closure of electricity generation capacity in their territory due to additional national measures, Member States may cancel allowances from the total quantity of allowances to be auctioned by them referred to in Article 10(2) up to an amount corresponding to the average verified emissions of the installa-tion concerned over a period of five years preceding the closure. The Member State concerned shall inform the Commission of such intended cancellation in accordance with the delegated acts adopted pursuant to Article 10(4)."

b) How could the unilateral cancellation of allowances increase the climate ambition of the EU ETS?

How much the unilateral cancellation of allowances can contribute to increase climate ambition depends on two factors:

— How high is the maximum amount that can be cancelled?

— How many member states will make use of the option?

Emission abatement would be considerably higher for this policy option if the average verified emissions of an installation were cancelled for multiple years, as shown in the example above. Advocating such an interpretation of the directive will therefore increase ambition. Furthermore, it should specify that the average emissions of the last five years refer to years with full operation only (otherwise average emissions will be underestimated). Especially in the case of very large power plants consisting of multiple units often constructed at different points in time, cancellation should also be made possible if one or several units are retired but other units remain operational. We assume that allowances can be cancelled for the entire emissions of closed plants, also in the case of combined heat and power (CHP) plants.

Furthermore, it would be crucial to get member states to commit to cancelling allowances and securing this in laws or similar legally binding instruments, for example, to ensure that the option will indeed be used. Twelve member states have announced coal phase-out plans by 2030 or earlier: Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Netherlands, Portugal, Slovakia, Sweden and the United Kingdom. In 2012 coal-fired power plants in these countries jointly emitted 251 Mt CO_2. Since then, the emissions have fallen to 98 Mt CO_2 in 2018 (Figure 7). This decline of 61% has

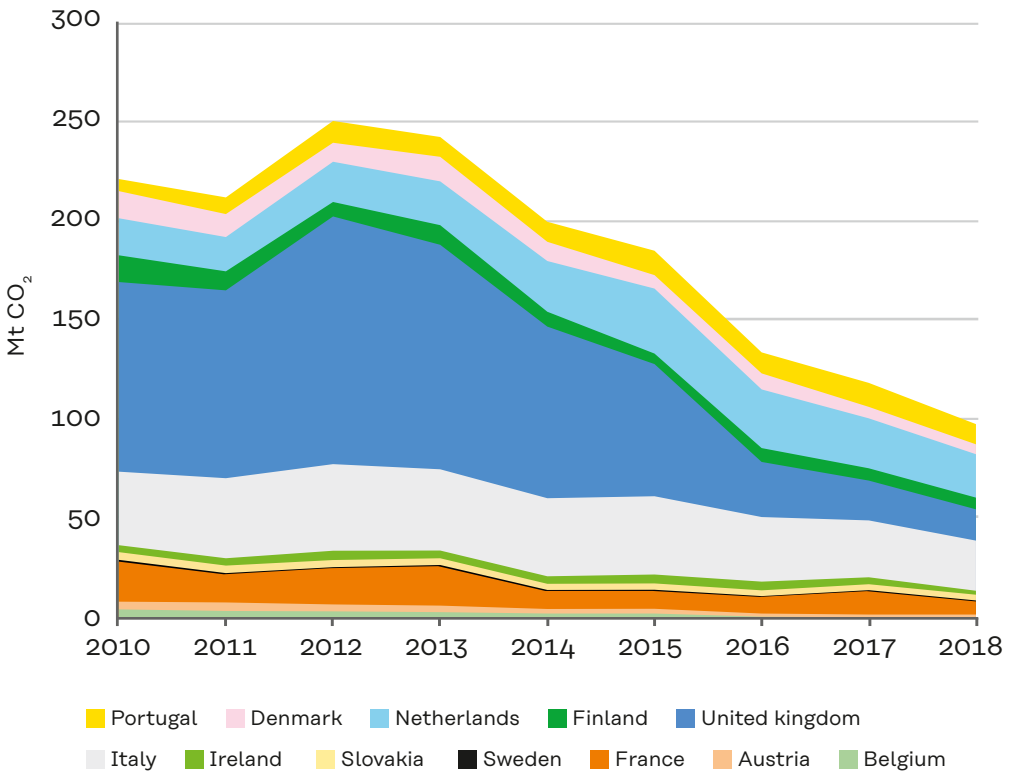


Figure 7. Emissions of coal-fired power plants in EU member states with announced coal phase-out plans by 2030

Note: Numbers include CHP plants that provide electricity to the grid. Source: Europe Beyond Coal (2019a); Authors.

been driven to a large extent by the emission reductions in the UK after the introduction of the carbon price floor.

Additionally, Germany is expected to reduce its coal-fired generation capacity substantially in the coming years. The multi-stakeholder Commission on Growth, Structural Change and Employment, established by the German Government, recommended the following to ensure the German GHG reduction target for the electricity sector in 2030 will be met (BMWi 2019):

— Generation capacity of hard coal and lignite-fired power plants should be reduced to 15 GW installed capacity each by 2022 (in 2017 installed lignite-fired capacity totalled 20 GW and hard coal-fired capacity 23 GW).

— The installed capacity for lignite should be reduced to 9 GW and the hard coal-fired capacity to 8 GW by 2030.

— Coal-fired electricity generation should be phased out by 2038. In 2032 it will be assessed whether the phase-out can be brought forward to 2035.

The commission also recommended making use of the unilateral cancellation according to Article 12(4) that equals the emissions reduced by the implementation of this plan compared to a baseline development. A quantitative assessment of the commission's plan (an energy market model translating the changes in installed capacity to emission reductions, see Figure 8) suggests that the emissions from coal-fired power plants should reduce from 274 Mt CO_2 in 2012 to 88 Mt CO_2 in 2030 (Matthes et al. 2019). The additional emission reduction associated with the plan would amount to 54 Mt CO_2. This estimate already takes into account the fact that other power plants may produce and emit more to replace the closed coal capacities (the rebound effect). This

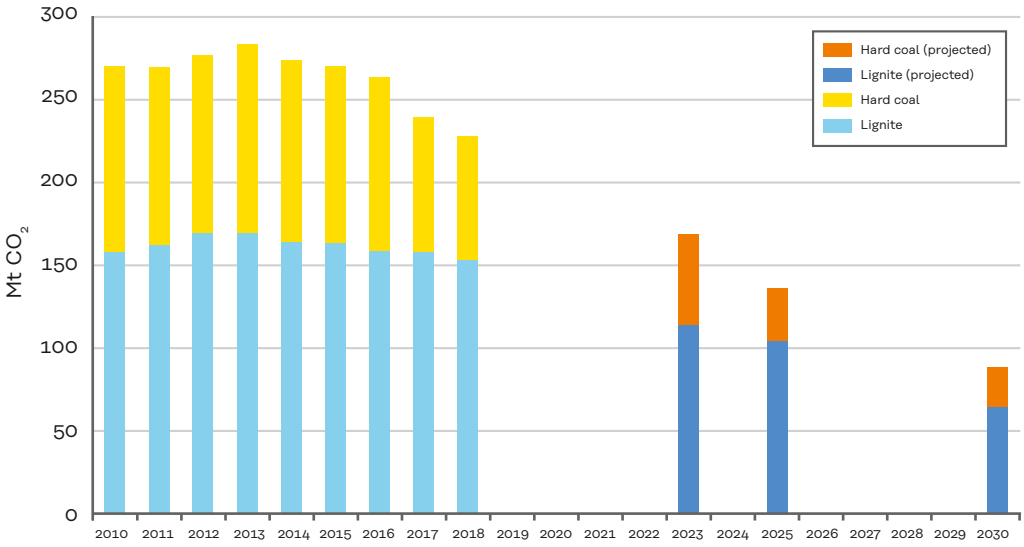


Figure 8. Emissions of German coal-fired power plants with modelled emissions based on the plan by the Commission on Growth, Structural Change and Employment

Source: Matthes et al. (2019); EU (2019); Authors.

amount is expected to be below the average emissions of the power plants closed.

If the countries committed to a coal phase-out took full advantage of the cancelling provision, this would increase the ambition of the EU ETS. To provide a preliminary estimate of the order of magnitude: coal-fired power plants closed between 2010 and 2019 in countries with coal phase-out plans emitted in total on average 94 Mt CO_2 annually in the five years before their respective closure years (Europe Beyond Coal 2019a).[9] The coal-fired power plants currently still operating in countries with coal phase-out plans by 2030 emit annually around 120 Mt CO_2.[10] In addition, Germany may cancel allowances and plans to do so based on the emission reduction compared to a reference projection; this would add another 54 Mt CO_2 annually (Matthes et al. (2019), see Table 7).

Based on this analysis (which excludes power plants fired by other fuels) and assuming that average emissions will be cancelled for a duration of five years, the auctioning amounts could be reduced by up to 1 337 million allowances. However, whether the full amount will be cancelled depends on the member states' will to do so. Also, if power plants close towards the end of the fourth trading period the cancellation might take effect only in the fifth trading period (i.e. after 2030).

If the countries committed to a coal phase-out took full advantage of the cancelling provision, this would increase the ambition of the EU ETS.

9 The figure includes power plants closed in years before the last change to the EU ETS directive. There is no wording in the directive ruling out this interpretation, but it might be contested if member states aim to do so.

10 If we assume that they keep causing similar emissions in the five years prior to their closure, this forms the basis for the maximum amount allowed for cancellation. Five times the average would equal 600 Mt CO_2.

Table 7. estimate of the maximum potential for unilateral cancellation by the coal phase-out countries

	Target year of the coal phase-out	Average emissions of closed coal-fired power plants ($Mt\ CO_2$)	Average emissions of remaining coal-fired power plants ($Mt\ CO_2$)[1]	Maximum amount for cancellation based on five times the average emissions ($Mt\ CO_2$)
Belgium	Coal-free	4.4	0.0	22.2
Austria	2020	0.2	1.7	9.5
France	2021	5.9	7.7	67.9
Sweden	2022	0.0	0.5	2.5
Slovakia	2023	0.0	0.1	0.6
Ireland	2025	0.0	3.6	18.1
Italy	2025	3.5	32.2	178.5
United Kingdom	2025	44.8	30.7	377.8
Finland	2029	1.8	5.8	37.6
Netherlands	2029	10.8	20.9	158.4
Denmark	2030	3.6	5.5	45.6
Portugal	2030	0.0	11.1	55.3
Germany[3]	2038 planned	18.5	54.0[2]	362.7
Total		93.5	173.8	1 336.6

Notes:
1 The average emissions of closed power plants are based on the five years prior to the individual closure year of the plant. All coal-fired power plant units that were closed/switched fuels since 2010 are included in this figure. The average emissions of the remaining operational coal-fired power plants are based on the last five years (2014-2018). For all countries but Germany the potential for cancellation of currently open power plants is calculated based on the average emissions of all operational coal-fired power plants situated in these countries.
2 In the case of Germany, a different approach is chosen in line with the proposal of the government Commission on Growth, Structural Change and Employment which envisages cancelling the difference between total 2030 emissions of the electricity sector in a reference case compared to the coal phase-out.
3 A government Commission on Growth, Structural Change and Employment proposed a phase-out until 2030. The federal government has announced its intention to follow the plan but has not yet adopted it formally.
Source: Matthes et al. (2019); Europe Beyond Coal (2019a); Authors.

The unilateral cancellation can potentially tighten the cap by up to 1 300 allowances by 2030. When national policies, adopted after the setting of the cap, reduce emissions, unilateral cancellation can be an efficient tool for strengthening the ETS until the next review of the cap itself. Under the current structural surplus of allowances in the market, though, unilateral cancellation alone will not ensure that the enhanced targets for 2030 will be met because the unused allowances from previous years might be used for compliance.

3.3 Carbon price floor

3.3.1 Surrender charge

a) What is a surrender charge and how is it implemented in the EU ETS?

A surrender charge is in place when some or all emitters have to pay a top-up charge representing the difference between the market price of allowances and a set minimum price. The UK is the only EU ETS country that currently implements a surrender charge. The Netherlands are going through the legislative process to introduce a minimum carbon price for electricity production (Government of the Netherlands 2019). The new Finnish Government committed itself in its government plan to exploring options for an EU-wide or Nordic minimum price (Government of Finland 2019).

The UK Government sets Carbon Price Support rates three years ahead of the year in which they will apply, which are paid by electricity generators under the Climate Change Levy. It is a fixed value which needs to be paid in addition to surrendering an allowance. The levy does not apply to industrial installations covered by the EU ETS. The Carbon Price Support (CPS) rates are calculated in £/kWh based upon the following formula (House of Commons Library 2018):

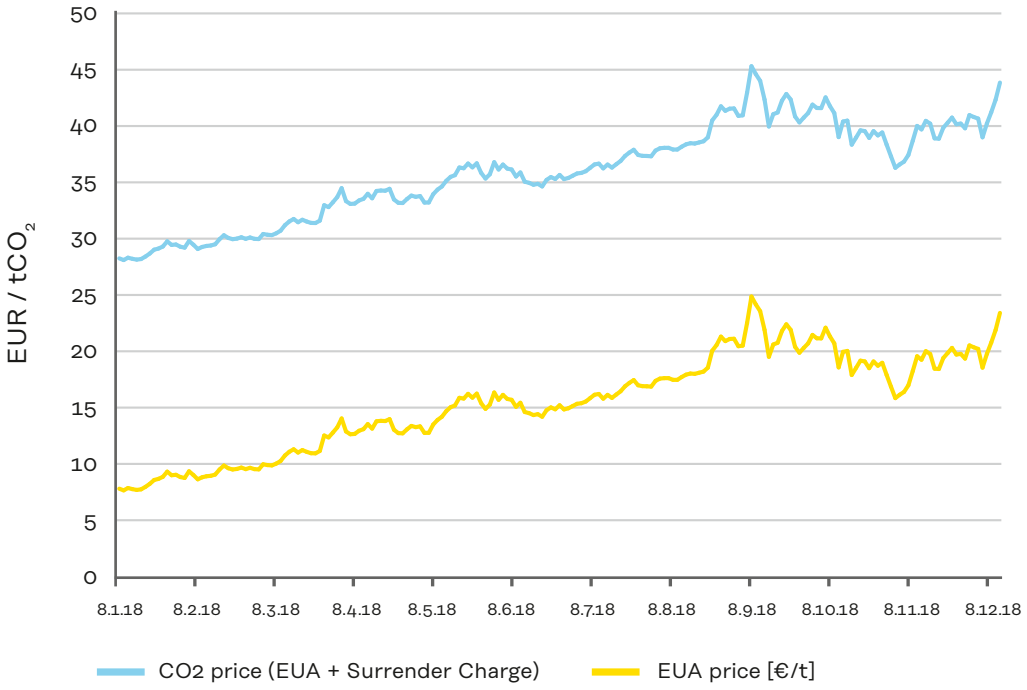
CPS rate = (target carbon price – market carbon price) x (emission factor of the fuel)

The CPS rate has increased from £4.94/t CO_2 for 2013-2014, to £9.55/t CO_2 for 2014-2015 and to £18.08/t CO_2 for 2015-2016. The CPS rate was expected to increase further up until 2020, but, due to the UK government's concern about the competitiveness of energy-intensive industries, the government announced a freeze on the CPS rate at £18/t CO_2 from 2016-2017 to 2019-2020 (House of Commons Library 2018). The impact of the policy option on the carbon price paid by UK electricity generators in 2018 is illustrated in Figure 9 and shows the considerable increase in compliance cost that has resulted in a shift in electricity generation from coal to gas.

In the Netherlands, a draft bill submitted to the parliament on 4 June 2019 foresees that from 2020 onwards a minimum price should apply that is gradually increased over time from 12.30 euros in 2020 to 31.90 euros in 2030. If the EU ETS price is below the minimum price, then a national carbon tax is introduced to cover the difference. It will apply to electricity generators covered by the EU ETS – power plants as well as industrial facilities producing electricity (e.g. chemical plants, food producers and paper factories).

Figure 9. Application of a surrender charge in the UK

Source: EEX (2019); House of Commons Library (2018); Authors.



b) How could the application of a surrender charge increase the climate ambition of the EU ETS?

A surrender charge or carbon tax triggers abatement that otherwise would not have been economical and, thus, increases climate ambition. Furthermore, it reduces uncertainty concerning future price development favouring investments in emission reductions.

Another advantage of this policy option is that it can target specific sectors. In the case of the UK and the Netherlands the surrender charge is targeted at electricity generation, but it could also target certain or all industries. In the case of Nordic countries, the inclusion of industrial and heat-producing installations is of particular interest, as the CO_2 intensity of electricity generation is low compared to average European generation. A surrender charge can be implemented unilaterally or by a group of countries, meaning that individual countries can take the lead, and no EU-wide co-operation is needed.

On the other hand, a surrender charge does not reduce the surplus. If overlapping measures, such as a surrender charge, lead to a reduction of emissions not reflected by the number of allowances brought into the market, it will contribute to the surplus or enable other facilities covered by the EU ETS to emit more. The MSR currently in place does absorb part of the allowances not needed for compliance, but not the entire amount. Therefore, it is recommended that this policy option is combined with measures to reduce the surplus, for example by adjusting the cap, unilateral cancellation and an enhanced MSR.

The impact of a surrender charge on emission reductions depends both on the sectors targeted and the countries applying it. In this study three options are assessed: a surrender charge targeting electricity generation implemented by a coalition of countries, a surrender charge targeting electricity generation in all EU countries and a Nordic surrender charge covering all EU ETS sectors (industry, electricity and heat).

There are several studies assessing the impact of a minimum price all focusing on the electricity sector. The following reasons are given for the focus on electricity

generation: the lower marginal abatement costs in the electricity sector compared to other industrial sectors; the homogeneity of the product; and considerations of political feasibility (there is less concern about carbon leakage in the electricity sector). The studies are based on different CO_2-price assumptions (ranging from 15 to 60 €/EUA) and different coverage of countries (from national to EU ETS-wide). An overview of the studies is given in Table 8.

Table 8. Studies quantifying the emission reduction of a surrender charge

Source: Authors.

Study	Coverage of minimum price	Price level	Abatement potential
Öko-Institut (2018)	Germany	EUA prices of €15, €25 and €35 in 2020 (compared to the price level of 2017 of €6)	Emission reductions of 36-132 Mt CO_2 in Germany, emissions in neighbouring countries increase by 25-64 Mt CO_2 in Germany when taking into account rebound effects in neighbouring countries
Öko-Institut (2018)	Germany, the Netherlands, Belgium, Luxembourg, Austria, France and Denmark	EUA prices of €15, €25 and €35 in 2020 (compared to the price level of 2017 of €6)	28-98 Mt CO_2 in Germany, emissions in neighbouring countries increase by 19-24 Mt CO_2 in Germany when taking into account rebound effects in neighbouring countries
Hecking et al. (2017)	All EU ETS countries and Switzerland (excluding Cyprus, Malta and Iceland not being covered by the model)	€30 in 2020 rising to €50 in 2030	Annual reductions due to the measure range from 68 to 123 Mt CO_2, amounting to 105 Mt CO_2 on average
Roques et al. (2018)	Germany, Austria, France, Spain, Portugal, Belgium, Netherlands, Luxembourg, UK, Denmark, Sweden Norway and Finland	€20/t in 2020 and rising to €60/t CO_2 in 2030	130-140 Mt CO_2 per year
Roques et al. (2018)	Germany, Austria, France, Spain, Portugal, Belgium, Netherlands, Luxembourg, UK, Denmark, Sweden Norway and Finland	€20/t in 2020 and rising to €30/t CO_2 in 2030	20-40 Mt CO_2 per year
Frontier Economics (2018)	Netherlands	€18 in 2020 rising to €43 in 2030 (combined with the coal ban in the Netherlands)	10-25 Mt CO_2 per year in the Netherlands, no significant effect on EU-wide emissions due to increased imports
Frontier Economics (2018)	Netherlands, Germany, Luxembourg, Belgium, France, Austria and Switzerland	€18 in 2020 rising to €43 in 2030 (combined with the coal ban in the Netherlands)	Reduction of 20 Mt CO_2 per year in the Netherlands, net reductions in the EU countries range from 30 to 45 Mt CO_2

The following lessons can be drawn from the studies.

A national minimum price achieves higher emission reductions in the implementing country than a regional one, but at the expense of increasing electricity imports and thus increasing emissions in neighbouring countries (Öko-Institut 2018, Frontier Economics 2018). When taking into account the rebound effects a regional minimum price is associated with more abatement than a national one.

Emission abatements range from 10 to 75 Mt CO_2 per year for studies assuming a regional price of up to €35 per tonne of CO_2 in 2030.[11] Higher prices (rising to €50/60 per tonne of CO_2 in 2030) lead to higher abatement of 105-140 Mt CO_2 annually. The key driver defining the abatement potential is the extent to which prices can trigger a fuel switch from coal to gas. But target prices near to the actual or expected CO_2 prices can also contribute to emission reductions as they reduce the financial risk for low-carbon investments and thus the associated capital costs. According to the analysis by Roques et al. (2018), the lower price floor (rising to €30 in 2030) reduces the Weighted Average Cost of Capital by 1% and the higher carbon price floor (starting at €20 in 2020 and rising to €60 in 2030) by 3-4%. Most studies assume that the carbon price will increase over time by 5-10% annually in order to provide the electricity providers time to adapt and transparency about the future development.

Certain key countries with substantial coal-fired capacity dominate the results: Hecking et al. (2017) provide a quantitative estimate of an EU-wide implementation of the surrender charge and find that the majority of emission reductions occur in Germany, the Czech Republic, Poland, the Netherlands, Greece and Spain.

While the studies on the effect of a **surrender charge for electricity generation** differ according to their scope, they do provide a comparable order of magnitude regarding the emission abatement potential. In the following assessment we will assume a minimum price ensuring €40-45 in 2030 implemented by a **group of countries** resulting in a reduction of about 40 Mt CO_2 to 100 Mt CO_2 annually. An **EU-wide minimum price** is expected to result in a larger reduction of 105-140 Mt CO_2 annually.[12] It is notable that the reduction potential overlaps with the estimated potential of the unilateral cancellation as they both refer to emission reductions in the electricity sector. A surrender charge is one option to push coal power plants out of the market which would then allow member states to use unilateral cancellation. If another policy is used to close coal power plants the impact of a surrender charge would be lower than if implemented on its own.

Due to the lack of data it is difficult to quantify the emission-reduction potential of a **Nordic surrender charge** covering electricity as well as heat and industrial installations. An indicative emission-reduction potential to be triggered by a minimum emission allowance price in the Nordic countries can be derived from Granskog et al. (2018). The approach builds on the fact that an important driver for emission reductions in the industry sector is the electrification of heating processes. The assessment of a cost-efficient reduction pathway for Finland finds that there is potential of 7 Mt CO_2 in industry at a carbon price mark-up of about €45 (on top of the CO_2 price path reaching €31 in 2030). Industry emissions would be halved, but the study also states that there is "a significant

11 The Frontier Economics study assesses higher prices towards the end (€43 in 2030) and finds substantial emission reductions only after 2025. As lower prices are assumed for most of the assessment period, this study is summarised in this category too.

12 Most studies model regional floor prices only. If the results from the regional floor price studies such as Roques et al. (2018) and Öko-Institut (2019) are scaled up to the EU 28 an annual emission reduction of 170 Mt CO_2 in 2030 could be assumed.

timing risk with regard to the single largest lever (blast furnace conversion)" as well to the long payback periods used, whereas industry economic viability assessments rely on shorter periods. An additional reduction potential of about 9 Mt CO_2 is identified in the power and heat sector mostly being already economical under the assumed price path. Out of the 9 Mt CO_2 reduction potential about 5 Mt are related to CHP heat and power; extending the unilateral cancellation to heat is thus an important option for Finland and other Nordic countries because of the importance of district heating.

Assuming that half of the industrial potential and the entire potential in the power and heat sector will be triggered by a price mark-up of €40 the abatement potential for Finland amounts to 10 Mt CO_2. Granskog et al. (2018) assume EUA prices of €21 per tonne of CO_2 in 2020 rising to €31 per tonne CO_2 in 2030 – the resulting minimum price to be reached would thus start from about €60 in 2020 rising to €70 in 2030. For the assessment it is assumed that a Nordic surrender charge can trigger emission reductions similar to those of a regional surrender charge on electricity generation (40-100 Mt CO_2 per year) albeit at a higher price level.

The surrender charge has no direct interactions with the other elements of the EU ETS, but it does reduce emissions and thus reiterates the need to strengthen the scheme. Under current rules the MSR is not able to absorb the surplus fully; any additional emission reductions cause the surplus to grow. If the surrender charge leads to an emission reduction of 100 Mt CO_2 per year starting in 2021, only 40% of the corresponding amount of allowances is cancelled. Under the enhanced MSR rules, the reduction is fully mirrored by cancellation and the surplus does not increase. Nevertheless, it is recommended that the surrender charge is combined with unilateral cancellations whenever applicable to ensure that the emission reductions do not trigger a EUA price reduction and take the emission reductions into account when strengthening the cap.

The surrender charges would be set in a way that, in combination with the EUA price, a certain price level is reached. The preliminary estimates suggest that a surrender charge ensuring a price of €20-30 per tonne of CO_2 in 2020 increasing to €50-60 per tonne of CO_2 in 2030 could help to achieve emission reductions of at least 105-140 Mt CO_2 if implemented in the power sector EU-wide. A surrender charge ensuring a price of €20-25 per tonne of CO_2 in 2020 and increasing to €40-45 in 2030 implemented in the power sector by a group of coalreliant countries could help to achieve 40-100 Mt CO_2 emission reductions annually. A surrender charge ensuring €60-70 per tonne of CO_2 in 2030 for the ETS sectors in the Nordic countries could be associated with annual emissions reductions of 40-100 Mt CO_2.

3.3.2 Auction reserve price

a) What is an auction reserve price and how is it implemented in the EU ETS?

If an auction reserve price is in place, allowances at an auction are only sold if a certain price level is reached. While, in theory, there is an option in the EU ETS to cancel auctions when the price is too low, it has been used only to ensure the orderly functioning of the market and not to support prices. Regulation (EU) No 1031/2010 states in Article 7(6) that where "the auction clearing price is significantly under the price on the secondary market prevailing during and immediately before the bidding window when taking into account the short-term volatility of the price of allowances over a defined period preceding the auction, the auction platform shall cancel the auction" (EC 2010). Indeed, there have been cases where EUA auctions have been cancelled because the auction clearing price was deemed to be significantly under the price on the secondary market. For example, EEX (2018) confirmed that Germany's auction of 4.36 million spot EUA was cancelled on 21 September 2018.

Given that there is not a published target price for the EUA and that the methodology underlying the determination of a clearing price significantly below the price on the secondary market is confidential (EEX 2017), the auction reserve price has not played an important role in strengthening the price signal of the EU ETS.

b) How could the auction reserve price be reformed to increase the climate ambition of the EU ETS?

If an auction reserve price was applied within the EU ETS it should ideally increase over time to best support the climate ambition of the EU ETS (Pahle et al. 2018). A price path set in advance provides certainty to the firms covered by the EU ETS. A minimum price on carbon emissions reduces the uncertainty on the payback times of low-carbon investments and thus reduces the capital cost of these investments (Frontier Economics 2018; Öko-Institut 2018).

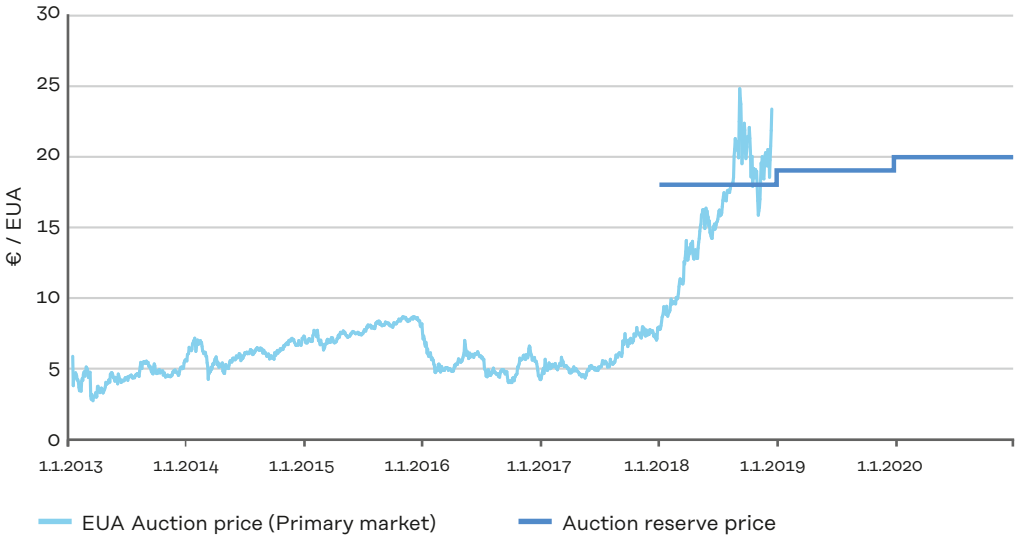
The auction reserve price can be set to reflect the marginal abatement cost curve of different abatement options to ensure that the reserve price is sufficient to trigger investment in more expensive abatement options and make sure that climate action is not delayed (Edenhofer et al. 2017). The auction reserve price can also be used as a backstop to prevent unexpected price drops and thus support market stability.

The allowances that do not clear the minimum price should be cancelled rather than simply postponed to a later date. For example, if a €18/EUA auction reserve price had been implemented in 2018, allowances auctioned from January up until August would have been cancelled as well as some days in November, as the bids were below the minimum auction reserve price (Figure 10). The additional incentive to reduce emissions triggered by an auction reserve price depends both on the difference to the expected price level without an auction reserve price as well as the abatement cost for installations covered by the EU ETS.

A study by Pahle et al. (2018) reviews the introduction of an auction reserve price by ensuring a price level of either €15/EUA or €25/EUA starting in 2020 and rising by 5% annually; the resulting prices would be €24/33 in 2030. The amounts earmarked for auctioning are held back by the participating member states and cancelled until the targeted price levels are reached: 1 600 million allowances in the fourth trading period to reach the trajectory starting with €15/EUA and 2 700 million allowances to reach €25. The allowances are mainly held back in the earlier years of the fourth trading period.

Figure 10. Allowance price trend for 2013-2018 compared to an auction reserve price of €18-20 per allowance

Source: EEX (2019); Authors.



The approach to an auction reserve price by Pahle et al. (2018) stabilises EUA prices in general and thus has an effect on all EU ETS countries. A group of countries decides voluntarily to hold back allowances at auctions until a certain price is met, but the resulting allowance price is not only limited to these countries but to the EU ETS as a whole. The group of countries participating would need to have a substantial share in total auctions to be able to hold back and cancel the needed amounts. If more countries than strictly necessary participate, the impact on the EUA prices would remain unchanged but the share of auctions held back by individual countries (thus foregoing auction revenues) would be lower as more countries distribute it among themselves. The modelling results suggest that the number of allowances that have to be held back from auctions and cancelled amount to 160-270 million allowances per annum in order to ensure an EU-wide EUA price of €15/EUA or €25/EUA starting in 2020 and rising 5% annually.

The auction reserve price proposed by Pahle et al. (2018) interacts with the other ETS elements in the same way as the unilateral cancellation: auctioning amounts are reduced. When auctioning drops, the surplus declines, too, which in turn influences the MSR – the lower the surplus, the lower the number of allowances diverted into the MSR. Depending on other parameters, the unilateral cancellation leads to a reduction of the amounts invalidated in the MSR of 20-40% of the amount held back and cancelled.

An auction reserve price of 15-25 euros in 2020 rising 5% annually could help to reduce auctioning amounts by 160-270 million allowances annually. Given the current surplus in the market this measure alone will not guarantee that the enhanced GHG reduction targets in 2030 are met.

3.4 Extension to the scope of the EU ETS

a) What increasing the scope means and has it been applied in the EU ETS?

When the EU ETS started in 2005, it covered only stationary installations and CO_2. Since then, the scope has increased to cover N_2O emissions from certain chemical processes, PFC from the production of aluminium in the stationary sector, and intra-EU aviation. When additional gases for stationary installations were included, the cap was adjusted accordingly, and rules for free allocation and reporting were amended. The inclusion of aviation differs, as a cap only for aviation was set up and emission allowances for aviation (EUAA) created. The aviation sector may also use allowances from the stationary sector for compliance, but not vice versa. There is an ongoing discussion about whether additional sectors should be included in the EU ETS, for example building-specific heating and cooling, land transport and maritime transport.

Currently heating and cooling is included in the EU ETS when generated in large CHP or heating plants typically connected to district heating networks or situated in industrial parks, but building-specific heating/cooling systems are excluded. Transport is only covered when using electricity (e.g. trains, trams and electric battery vehicles). Other forms of heating/cooling or transport are to date included in the ESR sector and its emission-reduction target. The inclusion of building-specific heating and cooling, as well as land transport, would imply that many smaller sources would be falling under the EU ETS. To avoid many private persons (house or car owners) participating in the scheme, the obligation to surrender emission allowances could be attributed upstream to the fuel providers instead of downstream to the point of emission (house or car). Emissions from building-specific heating and cooling could either be included in the stationary ETS or a linked system, comparable to those for aviation.

International maritime transport is to date neither covered by the EU ETS nor by the ESR reduction targets. As the sector is not covered by the EU's NDC under Paris, coverage under EU ETS has to make sure that the EUs NDC target will still be met – therefore a separate system linked by a one-way trade as is the case with aviation is recommended.

b) How could an increase in the scope further increase the climate ambition of the EU ETS?

Whether an additional sector increases the climate ambition or not depends on two factors:

— For the new sector itself: is the sector expected to reduce emissions when included in the EU ETS or to become a net buyer only?

— For the EU ETS as it currently stands: will the addition to the ETS increase the scarcity or increase surplus?

An analysis by Öko-Institut (forthcoming) found that the unilateral inclusion of German **land transport** would most likely not lead to emission reductions in the transport sector as abatement costs are higher than in the power sector, for example. This assessment is confirmed by a study using Finnish data (Antturi et al. 2015). The incentives for reducing emissions downstream would be stronger than upstream but, given the high number of entities, only an upstream inclusion seems feasible in practical terms. The compliance obligation would then be covered by allowances bought from the stationary sector. The volume of the net demand depends both on assumed additional allowances created for the inclusion of the

sector as well as the emission projection; in the period up to 2030 a total net demand of 300-450 Mt CO_2 from the German land transport sector was estimated.[13] Given the large surplus in the stationary EU ETS market, the net demand from additional sectors will not lead to emission reductions in the short term: in the beginning, the unneeded allowances are sold first by the stationary sector. Without a further reform to the ETS there will be no or only a very limited effect on emission reduction. Furthermore, transport fuels are already heavily taxed: streamlining (energy) taxation to reflect the associated CO_2 emissions would be an important first step. Therefore, including road transport in the EU ETS is not recommended.

The situation for **building-specific heating and cooling** is similar. Patronen et al. (2019) reiterate that the role of decentralised systems is dominant in the heating sectors (over 90%) and find that building-specific heating has a low price elasticity and would, in consequence, also mainly buy allowances from the stationary sector. Abatement is expected to happen mostly when prices are above €50/t CO_2. There are barriers to emission reductions in the building sector that hinder emission savings even if they are economically feasible. For example, tenants having an interest in reducing heating costs but the owners having to pay for energy modernisation. Another obstacle is the very long renovation cycles. Energy and building standards are therefore deemed more effective in driving down emissions. Furthermore, energy taxation can be revised if the fuels are not taxed according to their CO_2 content. If such perverse incentives exist, an additional top-up caused by the inclusion in the EU ETS might not be enough to trigger emission reductions. Similar to road transport, the EU ETS monitoring and verification rules do not cover up or midstream emissions thus far, and, therefore, the inclusion would require the introduction of national legislation. The decentralised heating sector emits about 650 Mt CO_2 annually compared to 1 700 Mt CO_2 emitted by stationary installations. The inclusion would have to be thoroughly prepared, and Patronen et al. (2019) conclude that inclusion in the EU ETS seems unlikely before 2030.

One transport sector currently not covered by (CO_2) taxes is **maritime transport.** Climate action in the sector has been very slow: at international level little is happening[14] and at the EU level a monitoring reporting and verification regulation has been adopted. The sector is not covered by any binding climate targets. In the revision of the EU ETS Directive, the EU Parliament pushed for a formulation declaring that, if the International Maritime Organization (IMO) did not deliver a global deal by 2023, maritime shipping would be included in the EU ETS. According to the Commission's own 2013 impact assessment, CO_2 emissions from shipping could be reduced cumulatively by 80 million tonnes by 2030 if the sector were included in the ETS. Inclusion in the EU ETS would require new rules both for monitoring and reporting as well as for compliance.

Out of the three sectors the inclusion of maritime transport has the biggest potential to deliver emission reductions. As was the case with aviation, the sector is lagging behind considering climate action and including it in the EU ETS offers the opportunity to send a price signal to a sector vastly exempted from taxes. Road transport and building-specific heating could, in theory, be included in the ETS, but other types of policies seem more appropriate to overcome the barriers to emission reductions in the sector, especially if abatement costs are already negative.

13 Currently transport emissions are covered by the ESR; moving the sector in the ETS requires shifting allowances from one regime to the other as well. This estimates is based on the assumption that the transport sector's share of ESR emissions is transferred to the ETS. This value is lower than the emissions in the sector.

14 Lately IMO has shown more willingness to address climate change with the adoption of the initial strategy on GHG emissions IMO (2018). It remains to be seen whether this will be followed by concrete and effective action.

The analysis suggests that the inclusion of maritime transport in the EU ETS could potentially reduce 80 Mt CO_2 in the sector itself until 2030. The inclusion of road transport and/or building-specific heating is expected to have little impact on emissions in the sectors themselves: these sectors are already subject to energy (and sometimes CO_2) taxation and the additional CO_2 cost incurred by inclusion in the EU ETS is not expected to lead to substantial emission reductions. Furthermore, the inclusion would need a thorough preparation and the adoption of additional rules in the EU ETS; it is therefore not expected that their inclusion could lead to additional emission reductions in the 2021-2030 period.

3.5 Tiered approach to free allocation for industry

a) What is the carbon leakage list and how is it implemented in the EU ETS?

Carbon leakage refers to a situation where businesses may relocate production to other countries with "laxer emission constraints" to offset the costs associated with EU ETS compliance (DG CLIMA 2019). The sectors and sub-sectors "deemed to be exposed to a significant risk of carbon leakage" were allocated a higher share of free allowances than other industrial installations during the third trading period (DG CLIMA 2019) in order to prevent carbon leakage.

The first two carbon leakage lists, applied for the periods 2013-2014 and 2015-2020, outlined the eligible sectors and sub-sectors for support. The eligibility was based on sectors' trade intensity, and the direct and indirect costs of their compliance with the EU ETS. This approach was criticised, however, for making too many firms eligible for free allocations based upon their trade intensity regardless of the carbon intensity of their production. Article 10b of the revised EU ETS Directive (EU 2018) later reformed the methodology for assessing carbon leakage risk: a carbon leakage indicator based on the multiplication of a sector or sub-sector's trade intensity value and emission intensity value.[15] The reformed approach was applied when the third carbon leakage list for 2021-2030 was compiled. The number of sectors and sub-sectors eligible for support declined from 175 in the second carbon leakage list to 63 in third.

Free allocation to industry installations for the fourth trading period is calculated as follows:

Free allocation = Benchmark x historic activity level x carbon leakage factor x cross-sectoral correction factor
For (sub-) sectors deemed at risk the carbon leakage factor is 100%; for all other (sub-) sectors 30%.[16]

15 Trade intensity is defined as the share of imports and exports in the domestic market (production plus imports). Emission intensity is calculated based on the sum of direct emissions covered by the EU ETS and indirect emissions caused by the consumption of electricity as share of gross value added.
16 The cross-sectoral correction factor CSCF is used to ensure that the sum of free allocation to all industry installations does not exceed the available quantity of allowances. If this is the case the CSCF scales free allocation for all installations by a common value. If this is not the case, the CSCF is 1.

b) How could a reform of the carbon leakage list further increase the climate ambition of the EU ETS?

While the number of sectors and sub-sectors deemed to be at risk of carbon leakage have declined over time, reflecting a more focused approach, the coverage of industrial emissions on the carbon leakage lists has only declined from 98% for the second carbon leakage list to 96% for the third (DG CLIMA 2019). A tiered approach, whereby the share of free allowances given to a sector or sub-sector on the carbon leakage list would depend upon their carbon leakage indicator value, could substantially reduce the number of allowances allocated for free.

The carbon leakage list for the fourth trading period classifies all sectors with a carbon leakage indicator of at least 0.2 to be at risk of carbon leakage. These sectors are eligible to receive free allocation based on a carbon leakage factor of 100%.[17] All sectors not deemed at risk receive allocation based on a factor of 30% for the period 2021-2025 with the factor declining in the second half of the fourth trading period.

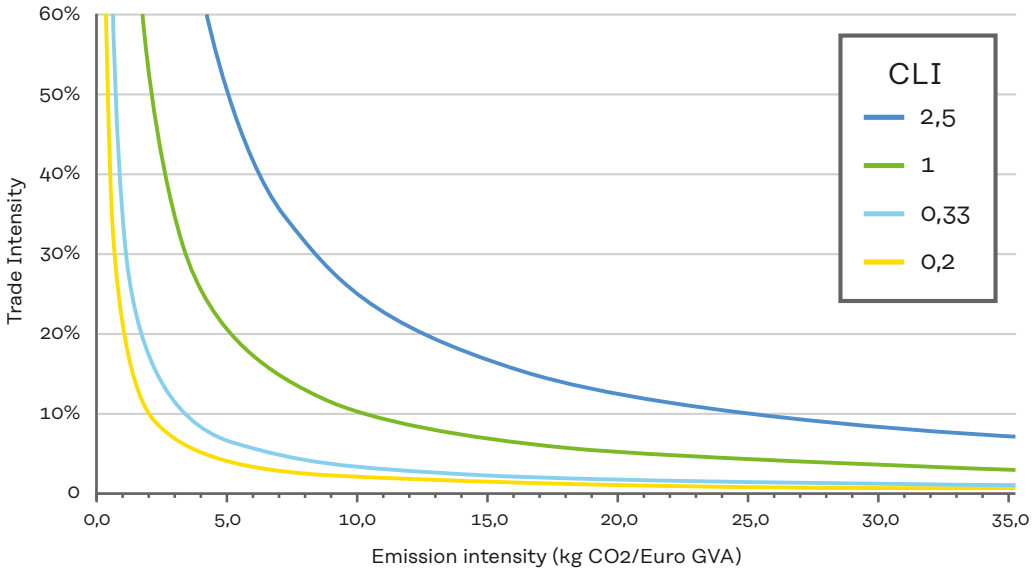
The impact assessment for the adoption of the carbon leakage list (EC 2015) also included tiered approaches to free allocation. Option four of the impact assessment suggested the following tiered approach for the carbon leakage factor (see formula above) based on the carbon leakage indicator adopted for the fourth trading period (see Figure 11):

— When the carbon leakage indicator exceeds 2.5, the sector is considered at very high risk of carbon leakage and receives a carbon leakage factor of 100%.
— Sectors with a carbon leakage indicator between 1 and 2.5 receive a carbon leakage factor of 80%.
— Sectors between 0.33 and 1 receive a carbon leakage factor of 60%.
— Sectors with a carbon leakage indicator below this value receive 30% free allocation.

Reforming free allocation to industry would support emission reductions in the industry sector by strengthening the CO_2 price signal: high levels of free allocation reduce the incentive for emission abatement.[18]

Figure 11. Reform of free allocation from carbon leakage list (tiered approach)

Source: European Commission (2019); Authors.



17 Allocation to incumbent installations is based on benchmark values, historical activity levels, the carbon leakage factor and – if applicable – the cross-sectoral correction factor. Receiving 100% carbon leakage allocation does not necessarily mean that the amount allocated corresponds to the emissions of the installation.
18 In theory, the effectiveness of an emissions trading scheme does not depend on the mechanism by which allowances are allocated – whether it is free allocation or an auction. In practice, however, the levels of free allocation in the EU ETS have proven to be too high to create an incentive for industrial facilities to reduce their emissions.

Furthermore, the amounts not needed for free allocation due to a tiered approach could be used to increase the ambition of the EU ETS. This could be done by auctioning these allowances, instead of allocating them for free, and steering the proceeds of the auctions to fund emission reduction in industrial sectors covered by the EU ETS. This would, however, not increase the climate ambition of the EU ETS in the short term but would rather reduce the cost of compliance and might improve the political support from industry sectors for higher climate targets.

The potential to reduce free allocation by a tiered approach depends on several variables. Some of these are not yet defined for the fourth trading period: the benchmarks defining the free allocation a certain product receives, the activity level (production volume of a product) in the base period, and whether additional amounts are needed to satisfy free allocation or whether a cross-sectoral correction factor will be applied. An approximation of the extent to which free allocation could be reduced can be made based on the current free allocation of those sectors which would receive a reduced carbon leakage allocation. Based on the quantitative carbon leakage assessment valid for the 2021-2030 period we assessed which sectors were considered at risk of carbon leakage. Receiving 100% carbon leakage allocation under the current system would be classified in a tiered approach in three categories: only those (sub-) sectors with a very high carbon leakage risk would still receive 100% carbon leakage allocation. Installations with high carbon leakage risk would receive 80% of free allocation and those with medium risk would receive 60%. Those with low risk would continue to receive 30% as under the current rules.

Out of the group considered at risk of carbon leakage under the valid carbon leakage rules for the fourth trading period, 17% would continue to be considered as very high risk and receive 100% carbon leakage allocation, 71% would be considered high risk, 9% medium risk and 4% low risk (all figures based on their share of free allocation in 2020). If we assume that their allocation would only change by the carbon leakage factor and all other parameters remain unchanged, we can use the difference between the carbon leakage factors to calculate the number of allowances no longer allocated for free. Following this approach, the reduction in free allocation would amount to 18% of the overall amount available for free allocation. These allowances could then be auctioned. Considering the uncertainties associated with this approach, we estimate that 15 to 20% of allowances envisaged for free allocation in the 2026-2030 period would be auctioned instead of allocated for free. This is equal to 500-660 million allowances in the 2021-2030 period. If these allowances are auctioned, the overall number of allowances available to the market changes very little (invalidation increases, but only very slightly by 10-20 Mt CO_2).

Another option would be to cancel these allowances. The impact would be substantial and comparable to at least half of the impact of rebasing the cap in 2026. However, acknowledging that carbon leakage has proven to be a significant concern in the political discussions accompanying the EU ETS reform, this option is not assessed further in this study.

A tiered approach to free allocation may reduce the amount of allowances given out for free, so that only sectors considered most at risk of carbon leakage receive 100% benchmarked allocation. If this approach is implemented and the allowances are transferred to the auctioning budget from 2026 onwards, the auctioning amounts increase by 500-660 million allowances. The proceeds from those auctions should be used to fund emission abatements in industries covered by the EU ETS. The impact on ambition in the fourth trading phase is considered low, but the policy option is an important step to prepare industries for a pathway of decarbonisation in view of the long-term targets.

4. Evaluation of the policy options for abatement potential and political feasibility

4.1 Abatement potential

The previous section presented policy options and the associated emission abatement potentials by 2030. None of them alone achieved the reductions necessary to meet the enhanced GHG reduction targets.[19] Thus, several of the measures will have to be combined. A package of various options increases the resilience of the scheme to unforeseen developments and avoids extreme parameters for a single option. The joint application of several options is also recommended because of the differences in time horizon: some options show a quicker impact while others take more time (either for legislation to be passed or because their full potential builds up over time) but are important to make the EU ETS fit in the longer term.

The Table 9 below summarises the abatement potentials identified in the previous chapter taking the interactions with the current MSR into account. It is important to note that the potential to increase ambition is not simply added: some of the policy options interact with each other and others target the same potential. The one option interacting with the abatement potential of all options is the MSR. The MSR is designed to absorb allowances as long as there is surplus in the market. Therefore, the higher the surplus is, the larger is the intake and invalidation in the MSR. Reforming the MSR alone will not lead to the needed increase in ambition; it will have to be combined with other options which reduce the surplus. As a result, the need for the intake and invalidation of allowances in the MSR is lower, as is the effect of an MSR reform (for further details see the next section). The table below takes the interactions with the currently valid MSR into account; abatement figures are thus lower than those given in the previous chapter.

The policy options are classified as high potential to increase ambition (the higher end of the range reaching 1 000 Mt CO_2 or more), medium (250-1 000 Mt CO_2) and low (below 250 Mt CO_2). Furthermore, they are attributed to a short time horizon (starting to have impact before 2025), the medium term (starting 2026) and long term (end of the fourth trading period and beyond).

All policy options directly targeting the cap have a high potential for increasing abatement and are expected to have an effect in the medium to long term. The effect of an adjusted cap will also prepare for greater ambition in the fifth trading period and is thus considered one of the key measures for effectively enhancing ambition.

Also, the reform of the MSR has a medium to high potential for increasing ambition depending on the parameters. The

19 The enhanced caps (increasing the LRF eventually in combination with rebasing the cap) can ensure that the cap in 2030 equals the 2030 GHG target for the ETS, but not that EU ETS emissions do not exceed the target because unused allowances from previous years can be used for compliance.

Table 9. Estimate of the potential to increase climate ambition for the options assessed (interactions with current MSR rules taken into account)

		Abatement potential (2021-2030)		Timing of the impact
Strengthening the cap	Higher LRF	High	1 400-2 000 Mt CO_2	Medium- and long-term
	Rebasing	High	1 000-1 200 Mt CO_2	Medium-term
	Rebasing and higher LRF	High	1 900-2 500 Mt CO_2	Medium- and long-term
Enhancing resilience	Enhanced MSR (24% intake rate)	Medium	Up to 700 Mt CO_2	Short-term
	Enhanced MSR (36% intake rate)	High	Up to 1 100 Mt CO_2	Short-term
	Unilateral cancellation	High	300-1 000 Mt CO_2	Short- and medium-term
Carbon price floor	Surrender charge on electricity by group of countries/Nordic surrender charge on all ETS sectors	Medium	280-700 Mt CO_2	Medium-term
	Surrender charge on electricity EU-wide	Medium	500-700 Mt CO_2	Long-term
	Auction reserve price	High	800-2 000 Mt CO_2	Long-term
Other	Extension of the scope to cover maritime transport	Low	Up to 80 Mt CO_2	Long-term
	Extension of the scope to cover road transport/decentralised heating	Low	None in the fourth trading period	Long-term
	Tiered approach to free allocation	Low	No reduction of available allowances, amounts are auctioned instead	Long-term

*Note: *In the case of the surrender charges/auction reserve price a start in 2024 is assumed.*
Source: Authors.

MSR is an option that can have an impact in the short term. This is important to increase resilience in the mid-2020s. Compared to the other measures there is some uncertainty about the amount of invalidation as this depends on the level of surplus which in turn is influenced both by macroeconomic developments and whether other reform options are implemented. On the other hand, the MSR reform is a no-regret option: if the market is tight due to other developments, the MSR will simply not be triggered to absorb allowances.

The unilateral cancellation of allowances also has the potential to act in the short and medium term with a medium to high abatement potential depending on the extent to which member states make use of the rule and its exact interpretation.

The price floor options have the potential to contribute to medium to high emission abatement. While in theory a surrender charge could be applied immediately and thus have an effect in the short term, it is anticipated that political processes will take some time. Options that rely on a group of pioneer countries are expected to take a shorter time to implement than those involving all EU countries such as the auction reserve price requiring a change in the EU legislation.

The extension of the scope and the tiered approach to free allocation are options expected to deliver a low contribution to an increased ambition of the EU ETS in the fourth phase. The extension of the scope of the EU ETS is expected to take a long time to implement. In addition, the current EUA prices are not expected to deliver substantial reduction in the road transport and heating sectors. The tiered approach to free allocation increases the exposure of industry sectors to the carbon price and increases auctioning amounts. This measure is important to prepare industries for emission reductions in line with the long-term targets but will show emission reductions only in the longer term (after the fourth trading period).

4.2 Interactions of policy measures

Several of the policy options presented above interact with each other. For example, measures targeting the cap (LRF, rebasing the cap) interact with the MSR. Both the LRF and rebasing the cap aim to augment the emission reductions delivered by the ETS system. When the cap is strengthened, the MSR still contributes to emission reductions, but to a lesser extent. The larger the surplus, the higher the number of allowances diverted to the MSR and as a consequence more allowances are invalidated in the MSR. The lower the surplus, the lower the number of allowances invalidated in the MSR. Nevertheless, strengthening the cap cannot be replaced by an enhanced MSR, because there is a difference in the certainty of emission reduction. The cap is set ex ante and defines reliably the maximum amount of emissions allowed. In contrast, the MSR depends on a number of uncertain developments, most notably the future emission levels. This is in line with the objective of the MSR to provide a backstop against unforeseen developments and not as a means to enhance ambition. Nevertheless, the MSR reform is important for enhancing the resilience of the EU ETS in the face of unforeseen shocks and should be pursued in any case.

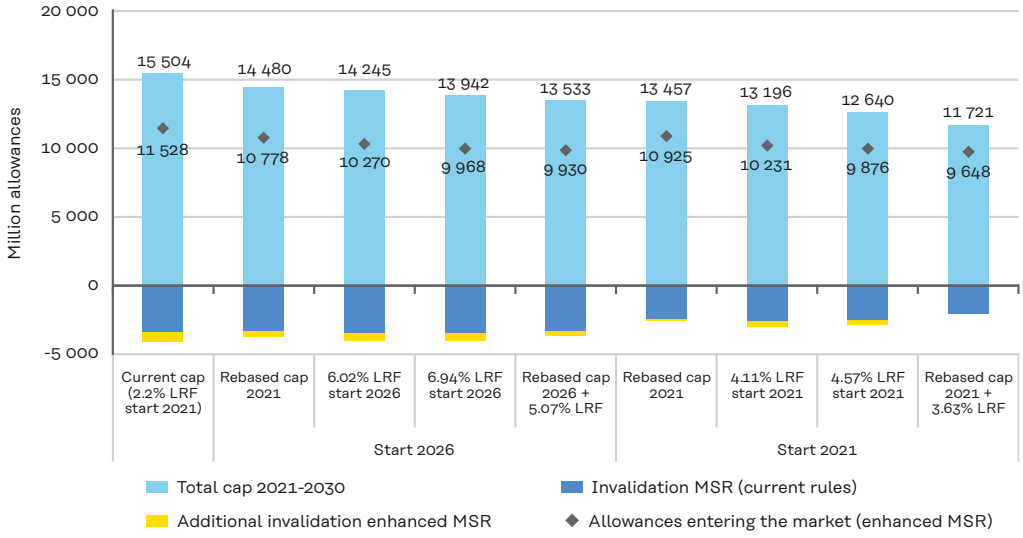
Figure 12 presents emissions scenarios for a combination of different linear reduction factors and rebasing the cap (see section 3.1.1 for details on how these are derived). The figure also presents the impact of the MSR on overall ambition. When comparing the scenarios for an enhanced EU ETS (see Figure 12) for the 2021-2030 period we can observe the following.

— In all scenarios the MSR contributes to emission reductions. The lower the cap, the lower the cancellations by the MSR.
— The enhanced MSR rules assuming an intake rate of 24% increase the invalidation of allowances in all scenarios. The additional invalidation is limited compared to the invalidation already expected to be reached by the current MSR rules. This is because the invalidation is dominated by the invalidation of the historic surplus accumulated in the second and third trading period in 2023 (nearly 1 900 million allowances out of 3 300 million allowances in total are invalidated in the reference case).
— Starting early to adapt the cap pays off: The earlier the LRF is adapted, the lower is the annual decrease needed. To reach the goal of overall GHG reduction of 60% in 2030 (without rebasing) either an increased LRF of 4.57% starting from 2021 or an LRF of 6.94% starting in 2026 will lead to a cap of 812 Mt CO_2 in 2030. When looking at the overall emission budget for the fourth trading period, the option starting in 2021 scores higher in terms of climate ambition. The same holds true for the scenarios reaching the overall 55% GHG reduction target (4.11 % LRF starting in 2021 and 6.02 % LRF starting in 2026).
— When the cap is rebased but the LRF remains unchanged, the scenarios do not meet the 2030 EU ETS budget in line with the over 55% or 60% GHG reduction target. But rebasing the cap reduces the LRF needed to reach this target and avoids a structural surplus being built up. Furthermore, it helps decrease the surplus in the early years and thus avoids investments in GHG reduction being postponed to later years.

When member states implement additional policies and measures that lead to the decommissioning of power plant capacities, they have the right to cancel part of their auctioning amount. Again, the unilateral cancellation interacts with the

Figure 12. Interaction of strengthening the cap with MSR (total 2021-2030)

Source: Authors.



MSR, because it reduces the auctioned amounts:

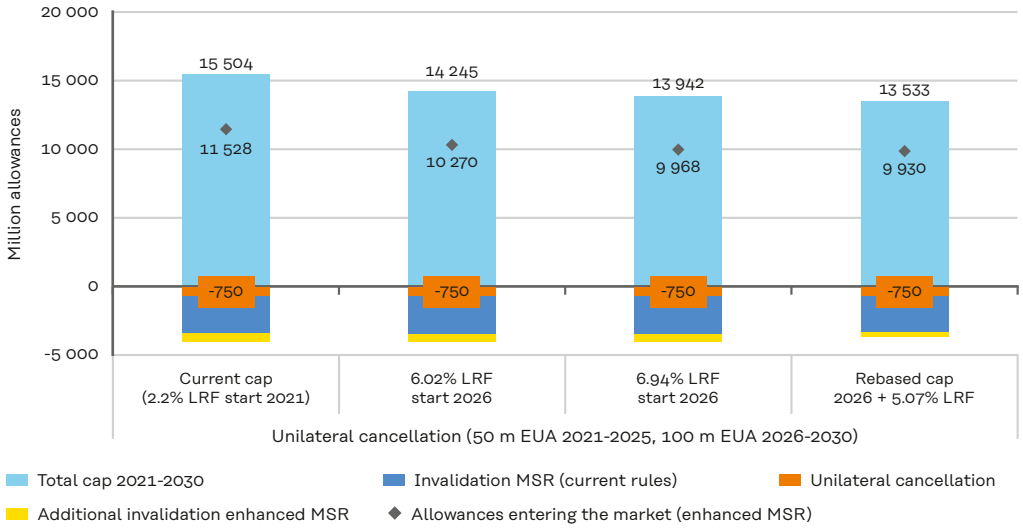
— When auctioning amounts drop, the amount of allowances in circulation decline and thus the intake of the MSR is reduced.
— At the same time the probability of invalidation of allowances placed in the MSR increases, because all allowances above the (lower) auctioning amount of the previous year are deleted.

All measures targeting the supply of allowances (cap adjustment, MSR and unilateral cancellation) reinforce each other. The effect of the MSR is slightly dampened if unilateral cancellation is applied. The additional contribution of unilateral cancellation is the highest, when the others contribute less. Nevertheless, the total ambition is strongest when all reform elements are combined. So, if the MSR is not to be reformed, cancellation should best take place in the years with low intake.

In a scenario where those member states phasing out coal cancel around half of the emissions of power plants retired in the 2010-2019 period (five times 50 million allowances) and nearly 60% of the closures to follow until 2030 (five times 100 million allowances), a total amount of 750 million allowances would be cancelled. In all scenarios this leads to an increase in ambition, albeit the cancellation in the MSR is slightly reduced.

Figure 13. Interaction of unilateral cancellation with cap and MSR (total 2021-2030)

Source: Authors.



4.3 Political feasibility

The political feasibility of implementing a policy option to increase the climate ambition of the EU ETS depends ultimately upon the political will of decision-makers. This political will is subject to considerable uncertainty over time as a result of European and national elections and unforeseen events that may influence public opinion on environmental issues. It is important to acknowledge that all policy options considered are, in theory, possible to implement, but only if there is sufficient political will. However, the political will of decision-makers is more subjective in nature and therefore difficult to quantify.

In our assessment we have therefore focused on developing a set of objective criteria that may help to indicate the relative ease of implementation of one policy option over another. The underlying assumption is therefore that if a policy option is easier to implement then this will make it more likely to be adopted. The ease of implementation depends more on the nature of the policy option than on its ambition level (i.e. adopting higher LRFs at different rates), therefore only the policy options (i.e. without any further variants in its ambition) are considered in this assessment. In order to rank the policy options according to their ease of implementation, each policy option considered (refer to Chapter 3) is awarded a score (refer to Section 7.2) based upon our expert judgements on the following set of objective questions.

1. Has the legislation previously been adopted?

We assume that it is easier to increase the ambition of an existing mechanism than to introduce a new element to the EU ETS. If a policy option has been previously adopted, it will rank higher in terms of political feasibility.

2. Are there plans currently in place to amend the existing legislation?

We assume it is more likely that a policy option will be implemented if it is already in progress, planned or a review is scheduled to assess whether further reform is necessary. If there is only an opportunity to potentially review the implementation of a policy option then its political feasibility will rank lower as a consequence of this uncertainty.

3. What is the decision procedure for amending the legislation?

We assume that a policy option that can be adopted by a decision procedure will rank higher in terms of political feasibility if it can be completed within a short time period and involves a lower number of decision-making institutions. Therefore, delegated acts rank highest as the European Commission can issue them and the European Council and the European Parliament are only allowed to raise objections. In contrast, the ordinary legislative procedure at EU level gives the European Council and Parliament more weight. National rules rank in between as they do not require the agreement of the majority of EU member states as is the case if the European Council has to agree to something.

4. Is the policy option targeted at certain sectors?

We assume that it is easier to implement a policy option if it does not target the industry sector. Policy options that target only sectors that are deemed not at risk of carbon leakage or can be tailored to do so will therefore rank higher in terms of political feasibility. All policy options primarily affecting the amount of auctioning are ranked higher as this will affect the electricity sector more than industrial sectors, which are the primary target of free allocation.

The political feasibility of each of the policy options are outlined in Table 10. The policy options are categorised into high (>10), medium (from 5 to 10) and low levels (<5) of political feasibility based upon their total score, which is the sum of all the points awarded in the assessment matrix.

High political feasibility

Three of the policy options assessed were categorised as having a **high political feasibility:**

- a surrender charge applied by a small coalition of member states;
- unilateral cancellation of allowances;
- reform of the MSR.

Table 10. Overview of the political feasibility of each policy option for increasing the climate ambi-tion of the EU ETS

Note: A maximum of four points is rewarded for each criterion in the assessment matrix. For further information please refer to the Annex (Section 7.2).
Source: Authors

		Legislation previously adopted?	Plans to amend legislation?	Decision procedure?	Ability to target the impact of the policy option?	Political feasibility
Unilateral cancellation of allowances	Score	4	4	3	3	14
	Reason for score	Yes	Already in place at EU level	National legislation	More impact on sectors with low carbon leakage risk (electricity and heat)	High
Surrender charge (coalition of member states)	Score	2	4	3	4	13
	Reason for score	Partially	Yes in progress	National legislation	Can be targeted to certain sectors	High
Reform of the MSR	Score	4	3	1	3	11
	Reason for score	Yes	Planned	Ordinary legislative procedure	More impact on sectors with low carbon leakage risk (electricity and heat)	High
Applying a more ambitious LRF	Score	4	1	1	2	8
	Reason for score	Yes	Opportunity to review	Ordinary legislative procedure	Equal impact on all sectors	Medium
Rebasing the cap	Score	2	0	1	2	5
	Reason for score	Partially	No	Ordinary legislative procedure	Equal impact on all sectors	Medium
Surrender charge (EU-wide)	Score	0	0	1	4	5
	Reason for score	No	No	Ordinary legislative procedure	Can be targeted to certain sectors	Medium
Scope extension to maritime transport	Score	0	1	1	3	5
	Reason for score	No	Opportunity to review	Ordinary legislative procedure	More impact on sectors with low carbon leakage risk (electricity and heat)	Medium
Auction reserve price	Score	0	0	1	3	4
	Reason for score	No	No	Ordinary legislative procedure	More impact on sectors with low carbon leakage risk (electricity and heat)	Low
Scope extension to transport and heating	Score	0	0	1	3	4
	Reason for score	No	No	Ordinary legislative procedure	More impact on sectors with low carbon leakage risk (electricity and heat)	Low
Tiered approach to free allocation	Score	0	0	1	1	2
	Reason for score	No	No	Ordinary legislative procedure	Can be targeted to certain industry sectors	Low

Legislation previously adopted

All three policy options propose to enhance legislation that has been previously adopted. For example, a revision of the EU ETS Directive (2018/410) amended Article 12(4) to include a provision for the **unilateral cancellation of allowances** to account for the closure of electricity generating capacity due to additional national measures. **The MSR** has been previously reformed following the same revision to the EU ETS Directive (2018/410) amending Article 1 of Decision (EU) 2015/1814 to increase the rate at which allowances are placed in the reserve. These policy options therefore receive the maximum score of four points for the criterion "Legislation previously adopted?" in Table 10. **A surrender charge** has been adopted in the UK via the introduction of the carbon price floor, a legislative process has started in the Netherlands and several member states have CO_2 taxation in place that might be amended to act as a surrender charge. The option therefore receives two points.

Plans to amend legislation

A draft law for the Dutch carbon price floor was published in 2018, which intends to raise the carbon price levied on electricity production from €12.30 to €31.90 by 2030 (Government of the Netherlands 2019). Given that the Dutch parliament are expected to vote on a carbon price floor in 2019, the policy option of implementing a **surrender charge for a small coalition of member states** is awarded four points under the criterion "Plans to amend legislation?" in Table 10. The **reform of the MSR** receives three points as plans are in place to review the existing legislation (although it is not yet certain that the legislation will be amended). Article 3 of Decision (EU) 2015/1814 states that "within three years of the start of the operation of the reserve and at five-year intervals thereafter, the Commission shall … review the reserve and submit a proposal, where appropriate, to the European Parliament and to the Council." This review process could result in an increase in the ambition of the MSR by altering existing parameters. The recently amended Article 12(4) of the Emission Trading Directive (EU) 2003/87/EC enables the **unilateral cancellation of allowances** to be auctioned "in the event of closure of electricity generation capacity in their territory due to additional national measures." This provision can already be applied and does not require further legislative acts at EU level.

Decision procedure

Given that the decision procedure for the **unilateral cancellation of allowances** and the implementation of a **surrender charge** (for a small coalition of member states) occurs at the national level, it is assumed that this is easier to implement than the reform of the MSR as it would only require the consent of at least one member state. If several member states intend to implement such a measure it would likely be beneficial if they agreed on common rules/application (e.g. a common surrender charge) but this is not a prerequisite: different rules in different countries are feasible in many cases but would increase the complexity of the ETS. Political acceptability would most likely be higher under a co-ordinated approach. In contrast, the ordinary legislative procedure would be necessary to adopt **any reform of the MSR.** This would be more time-consuming as both the Council of Ministers and the European Parliament have a deciding vote in the legislative process, and both institutions may amend any proposal.

Ability to target the impact of the policy option

The **surrender charge** applied for a small coalition of member states receives the maximum score of four points for the fourth criterion entitled "Ability to target the impact of the policy option" in Table 10. The carbon price floor currently implemented in the UK was specifically

targeted at generators of electricity. This policy option therefore enables the safeguarding of sectors deemed at risk of carbon leakage from efforts to increase the ambition of the EU ETS that enhances its political feasibility (i.e. less opposition from industrial lobby groups). Given that the policy options to **unilaterally cancel allowances** and to **reform the MSR** both affect the volume of allowances to be auctioned, these policy options receive three points each, as it is expected that the implementation of these policy options would affect the electricity sector more than industrial sectors, many of which receive allowances for free under the carbon leakage rules.

Medium political feasibility

Four policy options assessed were categorised as having a **medium political feasibility:**

- applying a more ambitious LRF;
- rebasing the cap;
- the implementation of a surrender charge at the EU-wide level;
- the extension of the scope to include maritime transport.

Legislation previously adopted

Legislation was previously adopted for the application of a **more ambitious LRF** (increasing from 1.74% to 2.2%) following a revision to Article 9 of the EU ETS Directive (2018/410). This option was awarded the maximum score of four points for the first criterion entitled "Legislation previously adopted?" in Table 10. Since the introduction of an EU-wide cap it has not been rebased, but between the first trading period (2005-2007) and the second (2008-2012) several national caps were rebased; the policy option **rebasing the cap** is thus awarded two points. In contrast, no legislation has previously been adopted for the application of a **surrender charge across the EU nor the inclusion of maritime transport in the EU ETS** and therefore these policy options received zero points.

Plans to amend legislation

There are currently no plans for a more ambitious LRF beyond 2.2% or for the rebasing of the cap. However, the revised EU ETS Directive (2018/410) amended Article 30 of Directive 2003/87/EC to provide for a review in light of the implementation of the Paris Agreement. Article 30 of the revised EU ETS Directive (2018/410) specifically mentions the possibility of increasing the LRF and this policy option was therefore awarded one point for the second criterion entitled "Plans to amend legislation?" in Table 10. The EU ETS Directive includes a stipulation that if the International Maritime Organization (IMO) does not deliver a global deal by 2023, **maritime shipping** will be included in the EU ETS; the option is thus receiving one point. As the **rebasing of the cap** is not explicitly mentioned, it received zero points, as did the policy option for an **EU-wide surrender charge,** as there are currently no plans to introduce such legislation.

Decision procedure

All policy options that are classified under the category "medium political feasibility" would require the use of the ordinary legislative procedure in order for further legislation to be adopted. This reduces the ease with which these policy options could be implemented both with regards to time and the number of decision-making institutions that would need to reach agreement on any proposal. These four policy options therefore receive only one point for the third objective criterion entitled "Decision procedure?" in Table 10.

Ability to target the impact of the policy option

The **surrender charge applied at the EU level** could target specific sectors and therefore receives the maximum score for the fourth criterion in Table 10. It is the ability of this policy option to target the impact to certain sectors that ensures that it

is classified under the "medium political feasibility" category. The application of a **more ambitious LRF,** the **rebasing of the cap** and the inclusion of **maritime transport** in the EU ETS receive only two points each as the impact of the policy option would apply equally to all sectors and therefore may have an impact on sectors deemed at risk of carbon leakage.

Low political feasibility

Three of the policy options assessed were classified as having a **low political feasibility:**

- auction reserve price;
- extending the scope of the EU ETS to transport and heating;
- tiered approach to free allocation.

Legislation previously adopted, plans for its amendment and decision procedure

Given that these policy options have no previous legislation adopted, with no plans currently in place to do so, and that any future legislation would require the ordinary legislative procedure involving the Commission, the Council and the EU parliament, the political feasibility of these policy options is considered to be low.

Ability to target the impact of the policy option

The main point of differentiation for these policy options is in their ability to target certain sectors. For example, if the **extension to the scope of the EU ETS to heating and transport** was applied in a similar manner as to the aviation sector (i.e. covered entities would be allowed to purchase allowances from the stationary sectors in order to comply with their separately calculated cap, with the trade of allowances only possible in one direction) then it is likely that the increased demand for allowances on the primary market would impact the electricity sector more than industrial sectors, many of which receive allowances for free under the carbon leakage rules. The **auction reserve price** is also more likely to impact upon the electricity sector than industrial sectors for the same reason (because it directly impacts the auctioning of allowances). These two policy options therefore receive three points for the fourth metric in Table 10.

The **tiered approach to free allocation** is awarded one point as it targets industrial sectors making its implementation less politically feasible, as the removal of free allocation from sectors deemed vulnerable to carbon leakage would be strongly opposed.

4.4 Summary evaluation of the policy options

The options to increase the ambition of the EU ETS differ according to their abatement potential, the point in time when this potential is expected to be realised and the political feasibility of the option.

All **options strengthening the cap** have a high abatement potential and their political feasibility is considered medium. The medium-term impact of strengthening the cap can be seen by the fourth trading period and it provides an important contribution to the long-term decarbonisation path even beyond the fourth trading period. Therefore, any policy package should include measures to adjust the cap and all efforts should be targeted to ensure the necessary support during the decision-making processes.

The abatement potential of the **enhanced MSR** is medium to high depending on the intake rate (24% or 36%). The political feasibility of this option is considered high mainly because the MSR Directive has stipulated that it should be reviewed in 2021. This option is also one of the few delivering emission reductions in the short term. It is also a no-regret option: it will only be triggered if there is surplus in the market. Therefore, it is recommended that the enhanced MSR is included in the reform package.

The abatement potential of the **unilateral cancellation** is high and so is its political feasibility: no amendment to EU legislation is needed. What is needed, however, is the political will of individual member states to take advantage of the opportunity provided. Therefore, building a coalition of member states willing to increase climate ambition is of great importance for ensuring that the full abatement potential of this option materialises.

Similarly, a **surrender charge on electricity by a group of countries** as well as a **Nordic surrender charge** for the ETS sectors are options that do not depend on EU legislation. Therefore, they score high in political feasibility even though they still require the political will of the member states to implement the options. The abatement potential is considered medium, but a more detailed assessment of the abatement potential is needed once the group of member states implementing the surrender charge is agreed. Finally, this option is considered important for supporting the EU ETS in the medium term and for building long-term confidence by reducing the risk of price drops.

A **surrender charge on electricity for all EU ETS countries** and an **auction reserve price** score lower on political feasibility as they would require the introduction of new legislation not yet adopted at EU level. Therefore, the impact of these measures would materialise only in the long term. The associated abatement potential is higher compared to only a group of countries implementing a surrender charge.

The **extension of the scope of the EU ETS to cover maritime transport** scores medium in terms of political feasibility as the European parliament has backed the inclusion of a paragraph in the EU ETS Directive to consider the inclusion, if the IMO does not move forward on the issue. The abatement potential is considered low, because the option is assessed by its contribution to reaching the EU ETS target. For the maritime transport sector, the inclusion in the EU ETS is considered important, however, as no CO_2 or energy taxes apply to international navigation and emissions are under no binding regime. Given the preparation needed to include a new sector in the EU ETS, the impact is expected to show in the long term only.

Table 11. Evaluation of abatement potential, political feasibility and timing of the policy options

		Abatement potential	Political feasibility	Timing of the impact
Strengthening the cap	Higher LRF	High	Medium	Medium- and long-term
	Rebasing	High	Medium	Medium-term
	Rebasing and higher LRF	High	Medium	Medium- and long-term
Enhancing resilience	Enhanced MSR (24% intake rate)	Medium	High	Short-term
	Enhanced MSR (36% intake rate)	High	High	Short-term
	Unilateral cancellation	High	High	Short- and medium-term
Carbon price floor	Surrender charge on electricity by group of countries/Nordic surrender charge on all ETS sectors	Medium	High	Medium-term
	Surrender charge on electricity EU-wide	Medium	Medium	Long-term
	Auction reserve price	High	Low	Long-term
Other	Extension of the scope to cover maritime transport	Low	Medium	Long-term
	Extension of the scope to cover road transport/decentralised heating	Low	Low	Long-term
	Tiered approach to free allocation	Low	Low	Long-term

The **extension of the scope to cover road transport or building-specific heating** ranks lower in terms of political feasibility. It would entail opening the split between ETS and ESR sectors and imply new legislation to include upstream sectors in the ETS system. The abatement potential is considered low because those sectors are already now subject to various energy and CO_2 taxes which are often substantially higher than the current EUA price. Therefore, it is considered likely that including them in the EU ETS will not overcome the barriers they face concerning the reduction of emissions.

The **tiered approach to free allocation** scores low in terms of political feasibility because legislation has been adopted only very recently: In addition, the risk of carbon leakage for industries was a major concern when the EU ETS Directive was adopted for the fourth trading period. Therefore, if implemented, we suggest reallocating the allowances freed up by a tiered approach to auctioning and use the associated proceeds to fund emission abatement in the industries covered by the EU ETS. This would, however, not increase the climate ambition of the EU ETS in the short term but could reduce the cost of compliance. This, in turn, might improve the political support from industry sectors for higher climate targets in the long term (after the fourth trading period).

4.5 Policy package

The analysis undertaken here demonstrates that there are several options for increasing the ambition of the stationary EU ETS and improving the resilience of the scheme. Most options can be combined and will work to reinforce each other. Some options are effective already in the short term and others in the long term, and some may be quicker to implement than others. Therefore, it is recommended that a phased approach is adopted by implementing several options with medium to high abatement potential and political feasibility jointly. Strengthening the cap ensures that the long-term targets are met whereas strengthening the MSR helps reduce the historic surplus accumulated in the system. Furthermore, a group of member states willing to take the lead should make use of the option to cancel allowances when power plants are closed and implement a carbon price floor by introducing national surrender charges. All these options can realistically be implemented quick enough to deliver emission reductions before 2030. In the meantime, further options should be prepared to be implemented in the fifth trading period: an auction reserve price to be established at EU level and a tiered approach should target free allocation for sectors most at risk of carbon leakage.

The analysis undertaken here demonstrates that there are several options for increasing the ambition of the EU ETS and improving the resilience of the scheme.

The **cap** is the key element ensuring that the ETS emission-reduction target is met. When the target is stepped up, the cap must follow too. Furthermore, the cap has proven to be structurally above emissions both in the second and the third trading periods: in the third trading period the cap exceeded emissions by 205 million allowances on average. So, the adjustment needs to ensure that the EU ETS cap is in line with the targets as well as a rebasing to correct for historically being set too high. We therefore propose rebasing the cap by the average historic difference between verified emissions and cap in the third trading period (205 million allowances) as soon as possible. With the rebasing the linear reduction factor (LRF) is adopted in order to reach the ETS target of 812 Mt CO_2 in 2030. In the context of the Paris stocktake (2023) the new cap could be set – if the cap is rebased in 2026, the resulting LRF is 5.07%. If the cap is improved in the context of the MSR review 2021, a lower LRF of 3.63% would suffice to reach the enhanced 2030 ETS target.

While adjusting the cap is particularly important from a long-term perspective, the **MSR** is the most important element for stabilising the system in the short term. This is vital in any scenario and a no-regret option as the MSR will only be triggered when there is a surplus. The MSR is currently absorbing allowances from the market and the reduced auctioning amounts are driving down the surplus. The invalidation of allowances in the MSR in 2023 eliminates the surplus inherited from the second trading period. But if the MSR continues within the current parameters, the surplus will start to build up again towards the mid-2020s and prevail until the end of the trading period. This is caused by the intake rate dropping in 2024 to 12% (from the current 24%). It is of utmost importance that the intake rate remains at at

least 24%. If the cap is not adjusted in the fourth trading period, the intake rate should be increased to 36% to deal with the new surplus building up.

A review of the MSR is scheduled for 2021 and should not only be used to increase the intake rate but also to prepare the MSR for the fifth trading period. As the emissions and the cap decline, the thresholds defining whether the MSR absorbs or releases allowances will follow the same dynamic. When the current thresholds were set, the upper limit defining whether allowances are absorbed equalled about half the annual emissions. With declining emissions this threshold should decline too. If the threshold is not altered, in 2030 the upper threshold defining whether allowances are absorbed would be higher than the proposed cap of 812 Mt CO_2 in line with an overall GHG reduction of 60%. We suggest applying the LRF to the upper and lower limit defining outflow as well as the maximum amount that enters the market from the MSR in one year starting in 2021 and being effective after the adoption of the MSR.

A review of the MSR is scheduled for 2021 and should not only be used to increase the intake rate but also to prepare the MSR for the fifth trading period.

An addition to those measures taken at the European level, countries willing to support additional climate ambition should implement a surrender charge. A surrender charge can be implemented at national level and ensures a minimum price for chosen sectors. The **surrender charge** would be set in a way that if the prices in the market are below the minimum price, the surrender charge fills the gap. Overall abatement reached is highest when connected markets, such as those in the Nordic countries, apply it jointly, but adoption by individual member states can also lead to emission reductions even when taking into account rebound effects.

In addition, the minimum price of the EUA should be set in a way that a fuel switch from coal to gas becomes economically viable for power plant operators from the start of the surrender charge and further mitigation measures are triggered when the minimum price increases over time. The long-term perspective of the increasing price projection is considered particularly important to influence investment decisions. Studies suggest that a minimum price of **€20-25/t CO_2 in 2020** reaching €40-45/t CO_2 in 2030 would help protect against price drops during the transition in the electricity sector and a minimum price of **€30-35/t CO_2 in 2020** reaching €50-60/t CO_2 in 2030 would make most fired power plants not economically viable. If the minimum price aims to trigger abatement in industry, too, further research on the needed price levels is recommended, taking into account further national energy and CO_2 taxes. As abatement costs in industry tend to be higher than in the electricity sector, a higher minimum price of about €60-70/t CO_2 is likely to be needed.

Additionally, countries are encouraged to make use of the **unilateral cancellation clause** (Article 12(4)) when power plants are closed. This means reducing auctioning amounts corresponding to five years of verified emissions preceding the closure. Especially those countries with a coal phase-out policy and/or those applying a surrender charge can thus ensure that the GHG savings achieved by additional policies are fully realised. Without unilateral cancellation, part of the saved emissions could be transferred to other countries (the waterbed effect) and/or EUA prices might drop due to lower demand. The commitment to cancel allowances should also be secured for the

future, by including it in a national law, for example. With a view to the trading period starting in 2031, the widening of the unilateral cancellation clause to also include industrial abatements should be advocated.

In preparation for the fifth trading period starting in 2031 it is recommended that an **auction reserve price** be introduced with the cancellation of allowances not sold at the clearing price. The auction reserve price acts as a soft price floor and thus gives certainty to investors in abatement technologies as it avoids price drops. The cancellation of unsold allowances ensures that emissions are not simply postponed to future years. The implementation of an auction reserve price is deemed easier than the application of a surrender charge but would require European legislation to be adopted.

Free allocation to industry due to competitiveness concerns has dampened the incentive for industries to reduce emissions. A better targeted carbon leakage list with different tiers is recommended, to ensure that the price signal is maintained for industries and the declining amount available for **free allocation is targeted** to the most vulnerable sectors only. The allowances not allocated for free due to the tiered approach are auctioned instead. It is recommended that the proceeds to fund emission reductions in industries covered by the EU ETS are used.

The **inclusion of additional sectors in the ETS** should focus on sectors where the inclusion in the ETS leads to emission reductions in the sector itself or sectors with little or no CO_2 taxation, such as maritime transport. Therefore, the inclusion of road transport and decentralised heating is not seen as a priority. Other instruments seem more suited to overcoming the obstacles to emission reduction in those sectors.

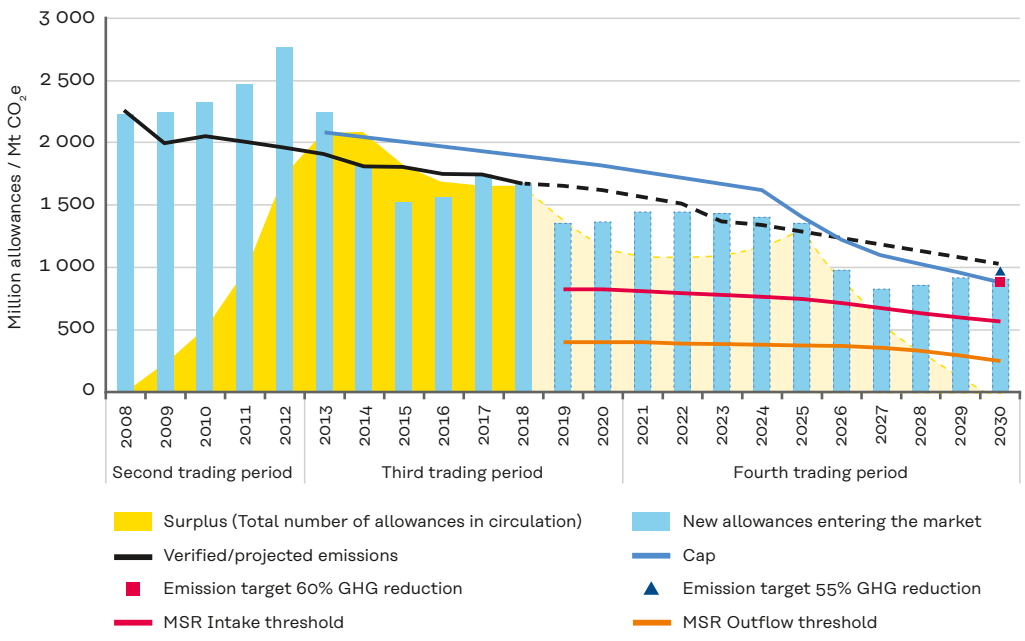
Based on these considerations the following **reform package** is recommended to ensure that the EU ETS is resilient to unexpected developments and is fit to deliver emission reductions to meet the enhanced GHG reduction targets.

1) A strengthened cap in line with enhanced climate targets:

— rebasing of the cap in 2026 by 205 million allowances (based on the historical difference between

Figure 14. Reformed ETS to reach 2030 climate targets

Note: In our modelling we have assumed that the cap is rebased and LRF strengthened in 2026 only; unilateral cancellation of allowances due to power plant closures amount to 750 million allowances in total (50 million allowances annually in the period 2021-2025, 100 million allowances annually in the period 2026-2030) and that the introduction of a surrender charge leads to 75 Mt CO_2 additional reduction of the projected emissions in the period 2023-2030.
Source: Authors.



emissions and the cap in the third trading period);
— an LRF in line with the overall 60% GHG reduction target for 2030 (increasing from 2.2% to 3.63% from 2021 onwards or to 5.07% from 2026 onwards).

2) An enhanced MSR able to absorb past and future surpluses of emission allowances:
— at least 24% intake rate continued after 2023;
— the same LRF as for the cap is applied to the thresholds and the outflow from 2021 onwards – this would ensure that the triggers under which the MSR becomes active are consistent with the declining cap of the ETS; under current rules these triggers are constant whereas the cap deceases annually. In the Figure 14 above the application of an LRF of 2.2% until 2025 and 5,07% between 2026 and 2030 gives the following thresholds: intake threshold 530 million (from 833 million), outflow threshold 255 million (from 400 million) and outflow 64 million (from 100 million).

3) A group of countries taking the lead to strengthen the system:
— a surrender charge implemented by a group of countries by 2023 to ensure a minimum price (minimum price starting with at least €25-30/t CO_2 and reaching €40-45/t CO_2 in 2030);
— unilateral cancellation – withdrawing the maximum number of allowances allowed from auctioning when power plants are closed due to national measures.

The cap ensures that the climate target is reached and the rebasing avoids a new surplus being built up as a result of historically overestimated emissions in the ETS sector. It is also the most reliable option for strengthening EU-wide ambition.

Unilateral action by member states contributes to reaching the target and strengthening the system. It may also ease the further increase of ambition in the period post-2030 and help build support for a minimum price at EU level, such as an auction reserve price.

This reform package drives the cap down to reach the overall GHG reduction target of 60% in 2030 and reduces the surplus in the market effectively (see Figure 14). Despite the enhanced MSR and unilateral cancellation of auctioning amounts, the surplus rises slightly in the mid-2020s before the cap is reduced. A strong MSR with a high intake rate is a prerequisite in any scenario to avoid delaying abatements towards the end of the period and reducing the risk of low EUA prices in the mid-2020s.

This reform package drives the cap down to reach the overall GHG reduction target of 60% in 2030 and reduces the surplus in the market effectively.

5. Recommendation and conclusions

The current ambition shown by parties to the Paris Agreement in their NDCs already falls short of limiting global warming to well below 2 °C; limiting the temperature increase to no more than 1.5 °C would require even more mitigation action (UNEP 2018). All actors, including the EU, will need to review their climate targets to meet the Paris commitments. In light of this, a large majority of EU member states are calling for achieving climate neutrality by 2050 (European Council 2019). Various parties, including the Finnish Government and the EU Parliament, have therefore demanded higher ambition in the period until 2030 to ensure a smoother transition to a decarbonised economy and to steer the EU along a path towards climate neutrality.

This report has reviewed the contribution of the EU Emission Trading Scheme towards an EU-wide 2030 target of reducing emissions by 55-60% below 1990 levels. In addition, it has presented options for increasing the ambition of the stationary EU ETS and assessed them according to their abatement potential and political feasibility.

The report finds that the EU ETS would need to reduce emissions by 61% below the 2005 levels by 2030 to reach the overall EU target of 55% reduction below 1990 levels. For the overall 60% target the EU ETS would need to achieve a reduction of 65% below 2005 levels. The current target is 43% below 2005 levels. The enhanced targets imply that the stationary ETS sector would emit no more than 812/913 Mt CO_2e in 2030. The baseline projection adopted in this report suggests emission levels of 1 060 to 1 540 Mt CO_2e in 2030. Using a projection based on the adopted energy targets (renewable energy, energy efficiency and coal phase-out) an emission gap of 212 Mt of CO_2e remains for the 55% target and 313 Mt for the 60% target.

To date, the EU ETS has been characterised by a surplus of allowances. A step to improve the system has been taken with the market stability reserve (MSR); this has helped support allowance prices that have been volatile and dropped to very low levels in the past few years. Despite this, the ETS is not yet showing its full potential and the surplus of emission allowances accumulated in the past endangers the achievement of the EU ETS emission targets – both the current and the enhanced ones.

There are several options for improving the resilience of the scheme and preparing it for the new emission targets updated to meet the Paris commitments. Most can be combined and will work to reinforce each other. Some options are strong in the short term (MSR) and others in the long term (cap adjustment). Some may be slower to implement than others – those requiring new legislation will take longer than those only requiring the adjustment of an existing mechanism. We suggest taking a phased approach, implementing several options jointly. Strengthening the cap ensures that the long-term targets are met. Strengthening the MSR helps reduce the historic surplus in the system. A group of member states willing to take the lead should make use of the option to cancel allowances when power plants are closed and, in addition, implement a carbon price floor by way of national surrender charges. All these options can be realistically implemented soon enough to show effects before 2030. In the meantime, further options should be prepared for implementation in the fifth trading period. These include an auction reserve price established at EU level and a tiered approach focusing on free allocation in sectors at risk of carbon leakage.

The **cap** is a key element for ensuring the ETS emissions reduction target is met. When

the target is stepped up the cap, too, must follow. We therefore propose rebasing the cap by the average historic difference between verified emissions and the cap in the third trading period (205 million allowances) as soon as possible. After the cap is rebased, the linear reduction factor (LRF) is then adjusted to reach the ETS target of 812 Mt CO_2e in 2030. In the context of the Paris stocktake (2023) the new cap could be set: if the cap is rebased in 2026, the resulting LRF is 5.07%; if the cap is improved in the context of the MSR review in 2021, a lower LRF of 3.63% would suffice to reach the 2030 ETS target.

While the cap adjustments are especially important in the long term, the **MSR** is the most important element for stabilising the system in the short term. This is vital in any scenario and a no-regret option as the MSR will only be triggered in a situation of surplus. It is of utmost importance that the intake rate remains **at least at 24%.** If the cap is not adjusted in the fourth trading period, the intake rate should be **increased to 36%** to deal with the new surplus building up.

In addition to those measures taken at the European level, countries willing to support additional climate ambition should implement a **surrender charge in combination with unilateral cancellation** when power plants are closed. A surrender charge can be implemented at national level ensuring a minimum price for the chosen sectors. The charge could be set in a way that when the market price for allowances is below a minimum level, the surrender charge fills the gap. Overall abatement is highest when connected markets apply a charge jointly, but also a single member state adopting the charge leads to emission reductions. Studies suggest that a minimum price of **€20-25/t CO_2 in 2020** reaching €40-45/t CO_2 in 2030 would help protect against price drops during the transition in the electricity sector and a minimum price of **€30-35/t CO_2 in 2020** reaching €50-60/t CO2 in 2030 would make most fired power plants not economically viable. A **Nordic surrender charge ensuring prices of €60/t CO_2 in 2020 and rising to €70/t CO_2** would trigger abatement in industry sectors as well as electricity and heat. In preparation for the fifth trading period starting in 2031, it is recommended that an **auction reserve price** is introduced with cancellation of allowances not sold at the clearing price.

The **inclusion of additional sectors in the ETS** should focus on sectors where the inclusion leads to emission reductions in the sector itself or in sectors with little or no CO_2 taxation, such as maritime transport. For as long as the ETS is struggling to cope with surplus, the inclusion of additional sectors may generate demand for allowances that otherwise would be invalidated or cancelled.

Based on these considerations the following **reform package** is recommended to ensure that the EU ETS is resilient to unexpected developments and is fit to contribute to enhanced GHG reduction targets.

- A strengthened cap in line with enhanced climate targets:
  - rebasing of the cap by 205 million allowances (based on the historical difference between emissions and the cap in the third trading period) as early as possible and at the latest by 2026;
  - an LRF in line with the overall 60% GHG reduction target for 2030 (increasing from 2.2% to 3.63% from 2021 onwards or to 5.07% from 2026 onwards).

- An enhanced MSR able to absorb past and future surpluses of emission allowances:
  - an intake rate of at least 24% continued after 2023;
  - application of the LRF is applied to the thresholds and the outflow from 2021 onwards: this would ensure that the triggers under which the MSR becomes active are consistent with the declining cap of the ETS; under current rules these triggers are

constant whereas the cap deceases annually.
— A group of countries taking the lead to strengthen the system:
  — a surrender charge implemented by a group of countries by 2023 to ensure a minimum price (minimum price starting with at least €25-30/t CO_2 and reaching €40-45/t CO_2 in 2030);
  — unilateral cancellation: withdrawing the maximum number of allowances allowed from auctioning when power plants are closed due to national measures.

This study provides concrete and politically feasible proposals to strengthen the EU ETS and to achieve an enhanced target in line with the Paris Agreement. Doing so will only be possible if there is political will in the European Parliament, member states and the European Commission. A group of frontrunners could quickly agree to set a minimum price and apply unilateral cancellation to the maximum level allowed by the ETS Directive. The review of the MSR is due by 2021 and the elements proposed here could also be agreed in time for their implementation. The discussion and adoption of the politically most challenging part – strengthening the cap through rebasing and higher annual reduction rates – should also start as quickly as possible. This would ensure that the necessary certainty could be provided to market participants who need to prepare for such an enhanced level of ambition in time.

The analysis presented here has shown ways to enhance the functioning of the EU ETS and ways to increase ambition in the trading scheme in line with higher GHG targets for the EU. Some areas for further research include the following.

— **Carbon price floor.** There is only very limited data available on abatement costs across all ETS sectors and member states. Major uncertainties remain when estimating the impact of a certain carbon price floor of emissions in the ETS.

— **Political feasibility.** The assessment presented here has looked at the potential avenues to adopt a certain measure assuming that there is sufficient political will. In other words, how complicated it would be to introduce a measure. It has not assessed the willingness of the relevant actors to actually adopt a measure. The European Parliament has a long history of calling for more action and trying to raise the ambition of climate policy where possible. The Commission has been pushing for higher ambition as well; for example, it tried to convince member states to increase the total GHG target to 45% below 1990. It has also driven the reforms of the ETS and, when needed, proposed measures during a trading period (such as backloading and the MSR). The main uncertainty is the level of ambition that could be achieved in the European Council. To achieve an agreement there it might be necessary to accompany the proposals with other measures that take into account concerns of some member states. This has been done in the past, for example with some special rules that only apply to Eastern European member states or member states below a certain value of GDP per capita.

— **Impact on competitiveness.** This study has not assessed the impact of the options on the competitiveness of European industry.

The new European Commission will be appointed for the period of 2019-2024 and, without doubt, fighting climate change will be high on the agenda. Initiating the political process to adopt higher GHG targets for the EU under the UNFCCC and to adopt new rules for the ETS would demonstrate and reclaim the EU's leadership on fighting climate change.

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7. Annex

7.1 Scope of the EU emissions used in this paper

For the purposes of this study a value of 5 720 Mt CO_2e will be used for the 1990 base-year emissions against which the 2030 targets are calculated (EEA 2018a). Thus, a reduction of 55% corresponds to no more than 2 575 Mt CO_2e of GHG emissions in 2030, and a 60% target to 2 290 Mt CO_2e. These values are based on the following assumptions.

— **Land Use, Land-Use change and Forestry (LULUCF).** LULUCF is excluded from the scope of the EU target. There are uncertainties around the accounting of LULUCF in 2030. Member states are only now in the process of setting their forest reference levels which will determine the accountable emissions or removals related to their LULUCF sector. The accounting of LULUCF in the EU's NDC is not yet fully determined. Based on the current accounting rules, the inclusion of LULUCF in the headline target of 55/60% reduction below 1990 levels would allow the other sectors to emit somewhat more. Preliminary estimates for the forest reference levels suggest the impact would be around 1% of the target emission level in 2030 (Böttcher & Graichen 2015).

— **International aviation.** All emissions from domestic and international aviation, as defined under the United Nations Framework Convention on Climate Change (UNFCCC), are included in the scope of the target. In effect this means that all fuel sales to the aviation sector within the EU are included; this is very similar to emissions from all flights departing from an EU airport. Under the UNFCCC the EU has included international aviation in the scope of the EU ETS in its obligations. Currently this only includes all flights within the EU but not flights from the EU to third countries; this scope is due for review and could change in the coming years. This depends on the EU's assessment of the level of ambition of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) which is developed under the International Civil Aviation Organisation (ICAO). From a data perspective a complete time series for emissions from aviation only exists for fuel sales for domestic aviation (flights within a country) and for international definition (flights between two countries including between EU member states) as defined by the UNFCCC/IPCC Guidelines. For 1990 there is no emission data for the current scope of the EU ETS. Due do these uncertainties and data availabilities the EU includes all emissions from aviation in its reports to the UNFCCC under the convention. This approach is used also in this study.

— **International shipping.** Emissions from international shipping are excluded from the scope; this also excludes shipping between EU member states. Only domestic shipping is part of the analysis. Currently, international shipping is not included in any of the EU's GHG targets

for 2030. Compared to aviation it is much harder to determine the EU's share of the global emissions from shipping. There is only a very weak link between fuel sales to the sector in the EU and actual emissions because ships do not need to be refuelled at every port. The European Parliament has called for the inclusion of this sector in the EU ETS in the absence of action by IMO (EP 2017). Since then the IMO has adopted a preliminary GHG strategy (IMO 2018); measures to achieve the targets included in the strategy are currently under discussion. This is discussed qualitatively but will not be part of the quantitative assessment of this study.

— **United Kingdom/Brexit.** The analysis is based on the EU-28 including the United Kingdom. The relationship between the UK and the EU-27 after Brexit is still very open. One potential future scenario is a very close alignment in the area of climate policy similar to the way the EU and Norway co-operate: Norway is part of the EU ETS and intends to join the Effort Sharing Regulation (Government of Norway 2015). Another possible scenario is a Brexit without any alignment in the area of climate policy. In the former case (or if Brexit were to be cancelled) the situation for the ETS would be as it is under the EU 28 scope. In the latter case the EU would need to decide how the decision affects the NDC, ETS and ESR targets.
  — **Keep the current targets** – For the ETS it would be necessary to deduct the UK's share of emissions from the cap; one option to do so would be to recalculate the cap applying the LRF (see below) from the revised reference years without the UK. No other adjustments to the trading system would be necessary. To achieve the overall target of 30% below 2005 in the ESR sectors, it would be necessary to revise the national targets of the remaining 27 member states; without the UK the current national obligations will fall short of the overall target because the UK's contribution is above the average 30% reduction. Finally, it would be necessary to assess whether the sum of the ETS and ESR targets would still be sufficient to meet the EU NDC.
  — **Adjust the current targets** – The alternative would be to adjust the EU's targets to reflect the departure of the UK. This would lead to an overall lowering of the NDC target as the UK has reduced emissions in the ETS above the EU average and the UK's ESR target is above the EU average as well. Doing so might have international repercussions as it could be seen as the EU backtracking from its obligations under the Paris Agreement, a violation of the rules set out in Article 4.

Therefore, it seems likely that the EU would keep its headline targets even in a Brexit without further co-operation on climate change. Because of these considerations, the lack of emission projections for the EU 27 and the uncertainties with regard to the UK's contribution to the climate targets, the quantitative analysis is based on the EU 28 including the UK.

7.2 Model calculating the increase of ambition for quantity-based reform options

The Öko-Institut's MSR tool represents the supply and demand for allowances from stationary installations and aviation in the EU ETS for the period 2008-2030 and thus calculates the annual and cumulated surplus of allowances, as well as the point in time when the market becomes scarce again.

The model includes free allocation and auction quantities, takes into account the net demand from aviation, historic and projected emissions from stationary EU ETS installations, and the use of international credits and allowances remaining unallocated.

Historical data is based on the most recent numbers from the Union Registry. Future allocation and auction quantities are based on current legislation but can be adjusted variably. The emission baselines can also be replaced variably. The emission projections by member states under the Monitoring Mechanism Regulation (MMR), the projections of the European Commission and EU-wide projections by research institutions are implemented as standard evaluations.

The model also depicts the MSR with all its parameters, which can be freely varied. This concerns the threshold values and withdrawal and release rates, as well as rules on cancellation of allowances from the MSR. The LRF can also be adjusted.

The Öko-Institut's MSR tool is particularly suitable for evaluating the compensatory effect of the MSR in case of a reduction in emissions from stationary sources due to overlapping policies. In this context, the impact of unilateral cancellation on the MSR can also be analysed. This can be done for various MSR scenarios, where underlying emissions projections and/or MSR parameters are varied.

7.2 Criteria applied in the assessment of political feasibility of the policy option

Below are the criteria applied in the assessment of the political feasibility of the policy options.

Table 12. Criteria for political feasibility assessment

Source: Authors

Legislation previously adopted?	**Score**
Yes	4
Partially	2
No	0
Plans to amend legislation?	
Yes, or legislation already in place at EU level	4
Planned	3
Opportunity to review option and possibly amend the legislation	1
No	0
Decision procedure?	
Procedures establishing secondary legislation (implementing or delegated acts)	4
Role of national parliaments	3
Special legislative procedures	2
Ordinary legislative procedure	1
Ability to target the impact of the policy option?	
Can be targeted to certain sectors (e.g. electricity sector only)	4
More impact on sectors with low carbon leakage risk (electricity and heat)	3
Equal impact on electricity sector and industries	2
Can be targeted to certain industry sectors (e.g. depending on carbon leakage risk)	1
Impacts industries more than electricity sector	0

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