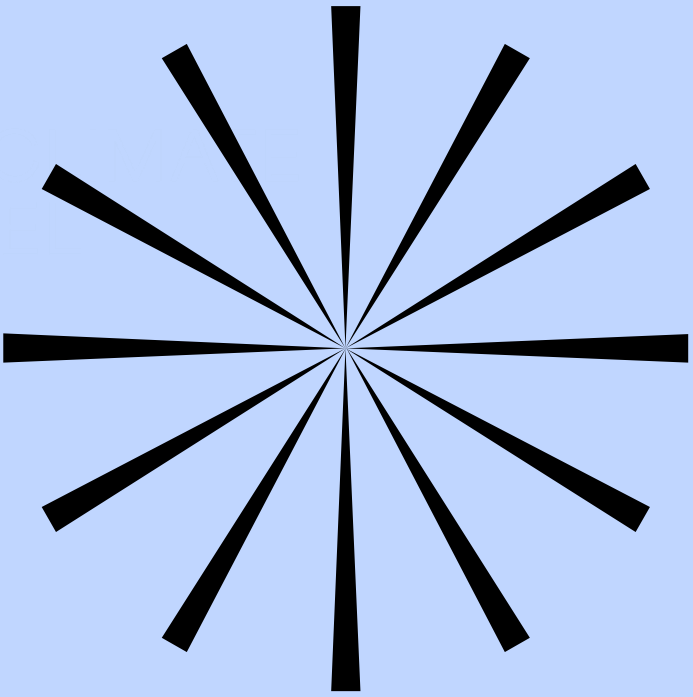

THE FINNISH CLIMATE CHANGE PANEL REPORT 3/2026

# Finland and European Union Climate Policy in the 2030s

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THE FINNISH CLIMATE CHANGE PANEL

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**Finland and European Union Climate Policy in the 2030s**

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The Finnish Climate Change Panel promotes dialogue on climate issues between science and politics. It gives recommendations for the Government's decision-making on climate policy and strengthens a multidisciplinary approach in climate sciences. The Panel's reports and position papers are based on scientific evidence.

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## Emissions pricing promotes cost-effective climate policy

- Cost-efficiency will grow in importance as reducing emissions becomes more challenging with approaching increasingly stringent climate targets. Expanding the pricing of emissions through taxes, emissions trading or emission-based subsidies promotes the cost-efficiency of emissions reductions.
- Finland benefits from a higher emission allowance price in the EU Emission Trading System, as Finland's emissions have decreased relatively quickly in the emissions trading sector, and Finland's auction revenues are determined as a fixed share of total EU auction revenues. Emissions trading could also bring additional income to Finnish companies that are able to produce large volumes of negative emissions if permanent carbon removals are included in emissions trading.
- A high emission allowance price in emissions trading reduces the role of the effort sharing sector in achieving the target set for 2040. On the other hand, carbon pricing in sectors that are currently not covered by emissions trading would also promote cost-effective emissions reductions in these sectors.

## Permanent carbon removals should be integrated into emissions trading with caution

- Linking permanent carbon removals to EU Emission Trading System will create a strong incentive for developing them. However, the price of emission allowances alone will not be a sufficient incentive for investments in the initial phase. Permanent carbon removals could also reduce the scarcity of emission allowances in the early 2040s when new allowances are no longer allocated under the current legislation.
- Permanent carbon removals should be linked to the emissions trading system in a restricted manner, allowing only certified permanent carbon removals (like-for-like principle), while adjusting the number of emission allowances to be auctioned or limiting the use of carbon removal credits. Without adjustments, net emissions could increase due to the operation of the Market Stability Reserve.
- The capture and permanent storage of biogenic carbon dioxide only produce negative emissions when the sustainability of the biomass used is safeguarded and the natural carbon sinks are maintained at a sufficient level from the climate policy perspective. This is why natural carbon sinks must be secured by means of policy instruments targeted at the land use sector.

## Long-term aim should be at combining the EU Emissions Trading Systems

- Integrated emissions trading would likely increase the price of emission allowances in the emissions trading system covering industry and energy production (ETS1), while it would reduce the emission allowance price in the system for buildings, road transport and additional sectors (ETS2). Consequently, it would not only create a stronger incentive for reducing industrial emissions and the introduction of permanent carbon removals but also improve the acceptability of climate policy in areas such as road transport.

- While the emissions trading systems (ETS1 and ETS2) can be integrated in the late 2030s, their integration should be announced as early as possible. This would mean that allowance prices in the separate systems would probably start to converge earlier, and emissions would decrease faster.

## International carbon credits should not be linked to EU Emissions Trading System

- The climate target for 2040 should primarily be achieved by domestic action within the Union. ESABCC[1] analysis shows that setting the target for emissions reduction at a level closer to 95% would enhance the fairness of the EU's contribution to global mitigation.
- If international carbon credits are to be used to achieve the EU's climate targets, the EU should only introduce high-quality credits and create reliable criteria and a system for ensuring their quality.
- International carbon credits should not be linked to EU emissions trading. Linking cheap international credits to emissions trading would reduce the price of emission allowances, displace industrial climate actions, slow down the deployment of permanent carbon removals in the EU and redirect investments outside the EU.

## National climate action continues to play an important role

- While EU climate policy sets a jointly agreed minimum level, Member States can set more ambitious targets on a voluntary basis. The current emissions reduction target set in the Finnish Climate Act for 2040 (reducing emissions by 80% compared to 1990 levels, excluding the LULUCF) appears modest in the light of the EU target. Under the national Climate Act, however, Finland's climate targets must be based on international treaties or European Union legislation.
- Combined effects with EU-level policy instruments should be carefully considered when planning national instruments. In emissions trading for buildings, road transport and additional sectors (ETS2), overlapping national instruments reduce Finland's emissions but will not affect the EU emissions cap unless emission allowances are cancelled. In the current emissions trading system (ETS1), the corresponding waterbed effect will be smaller due to the Market Stability Reserve, as national policy instruments in the ETS1 sector will reduce emissions in Finland as well as at EU level. There are no EU-level price instruments in the non-ETS sectors that would result in the waterbed effect.

[1] European Scientific Advisory Board on Climate Change.

# SUMMARY

This report examines options for the EU climate policy architecture after 2030, with the aim of achieving a 90% net emissions reduction by 2040. The report describes the main features of the current EU climate policy architecture and discusses options for developing it, especially regarding emissions trading. Subsequently, alternative policy scenarios for the EU Emissions Trading System (ETS) are assessed based on economic modelling and legal analysis.

Emissions trading modelling is used to study four different scenarios for the EU climate policy architecture. The aim of the modelling is to understand the impact of the EU's post-2030 climate policy architecture on greenhouse gas emissions in Finland and the EU, as well as its economic impacts. With the help of modelling, the report examines four scenarios for the EU's post-2030 climate policy architecture: emissions trading will continue according to the current rules, permanent carbon removals will be added to the ETS, current emissions trading system (ETS1) and new emissions trading system for buildings, road transport and additional sectors (ETS2) will be integrated, or international carbon credits under Article 6 of the Paris Agreement will be included in emissions trading.

Based on the modelling, all scenarios will lead to a net emissions reduction of 85-88% in the EU, without additional measures. In all scenarios, Finland will achieve the target set in the national Climate Change Act (423/2022) to reduce emissions by 80% by 2040 compared to 1990 levels, excluding emissions from the land-use sector. However, in no scenario will Finland achieve carbon neutrality under the Climate Change Act, i.e. a balance between emissions and removals by 2035, without significant national additional measures. New policy measures in the land-use sector were not addressed in the examined scenarios.

The report finds that emissions pricing promotes cost-effective climate policy in the EU. Finland benefits from a higher emission allowance price, as Finland's emissions have decreased relatively quickly in the emissions trading sector, and Finland's auction revenues are determined as a fixed share of total EU auction revenues. In the long term, the EU should strive to combine the current emissions trading system (ETS1) and the future emissions trading system for buildings, road transport and additional sectors (ETS2), as the integration creates a stronger incentive for industrial emissions reductions and the introduction of permanent carbon removals.

Linking permanent carbon removals to the emissions trading system would create a strong incentive for their development and could also generate additional income for Finnish companies. However, permanent carbon removals should be linked to the emissions trading system in a restricted manner, allowing only certified permanent carbon dioxide removals, while at the same time adjusting the number of emission allowances to be auctioned or limiting the use of carbon removal credits. Without adjustments, net emissions could increase due to the functioning of the Market Stability Reserve. Note, that that the capture and permanent storage of biogenic carbon dioxide produce negative emissions only when the sustainability of the biomass used is safeguarded, and the natural carbon sinks are maintained at a sufficient level from the climate policy perspective.

Based on the analysis, the Finnish Climate Change Panel does not recommend including international carbon credits to the EU Emissions Trading System, as importing cheap international credits to emissions trading would reduce the price of emission allowances, displace industrial climate actions, slow down the deployment of permanent carbon removals in the EU, and redirect investments outside the EU.

# 1. INTRODUCTION

The European Union (EU) and Finland as a Member State are committed to rapidly reducing greenhouse gas emissions to achieve the Paris Agreement goals. The target for 2030 laid down in EU Regulation (2021/1119), which is known as the European Climate Law, is to reduce net emissions in the EU by 55% compared to the 1990 levels and to achieve climate neutrality within the EU by 2050 at the latest. To achieve this target, a legislative package known as 'Fit for 55' comprising 19 new or amended regulations and directives was adopted. Its targets include an emission reduction of 62% in the emissions trading sector and 40% in the effort sharing sector compared to the 2005 levels as well as removals of 310 Mt of carbon dioxide equivalent (later Mt or Mt $CO_2$-eq) in the land use sector, of which at most 225 Mt $CO_2$-eq will be used to achieve the EU's net emissions reduction target of 55% for 2030.

In July 2025, the European Commission proposed amending the European Climate Law by adding to it the target of 90% reduction in net greenhouse gas emissions by 2040 compared to the 1990 levels. The Commission's proposal was based on ESABCC recommendation of reducing net emissions by 90–95% exclusively by domestic action within the Union. However, the Commission's proposal included a limited amount of high-quality international carbon credits referred to in Article 6 of the Paris Agreement, which could be used to account for 3% of the 2040 target. In November 2025, the European Council decided to support the target of reducing net emissions by 90% if international carbon credits can be used to achieve 5% of it. The Parliament concurred with the Council's position in this respect. In trilogue negotiations conducted in December 2025, the Parliament, the Council and the Commission agreed that the EU would aim for a net emissions reduction of 90% compared to 1990 levels by 2040, with international carbon credits accounting up to 5% of this target at maximum. For an illustration of the target for 2040 agreed upon the trilogue negotiation in relation to the current situation and the target for 2030, see Figure 1.

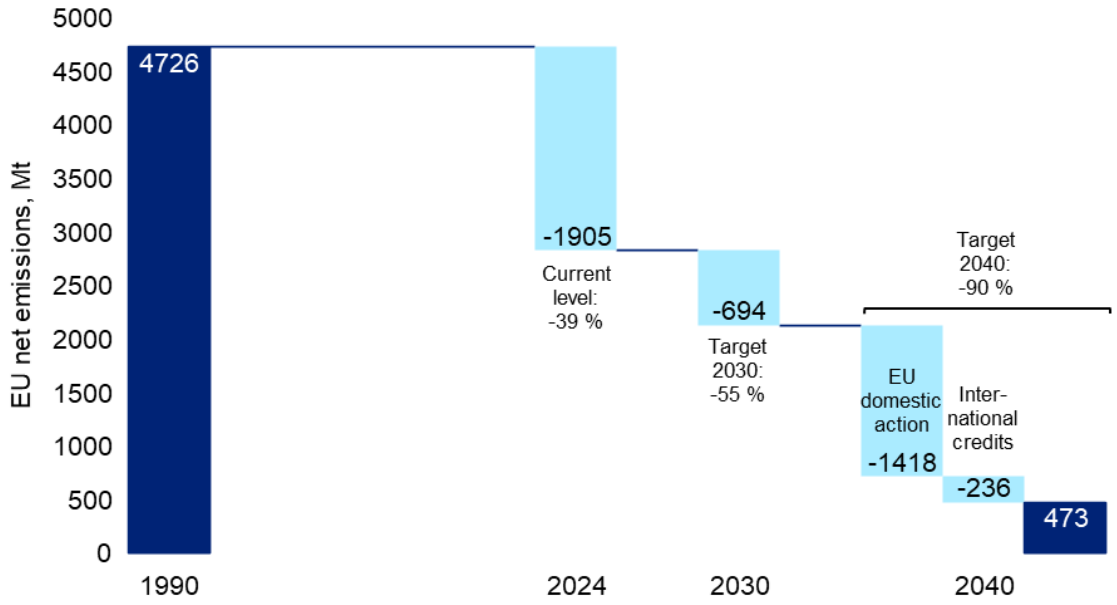


**Figure 1.** Historical EU emission trends and emissions reduction targets. Once EU net emissions have been reduced by 90% in line with the target, they would be 473 Mt $CO_2$-eq in 2040.

The Commission is expected to issue its legislative proposals for achieving the climate target for 2040 in late 2026. In its most recent annual Climate Action Progress Report of November 2025, the Commission estimates that the gap between current policy measures and the EU's climate target for 2030 is 8% (European Commission 2025a). This is mainly due to insufficient national climate action in the effort sharing sector. As more ambitious climate targets are set, the costs of emissions reductions will also go up, emphasising the need to ensure that the system guiding EU towards the 2040 target is cost-effective.

This report analyses the options for climate policy architecture for achieving the EU's 2040 target. In principle, the targets can be achieved in many ways. For example, the Member States could be assigned national emissions reduction targets and given the freedom to create their own policy instruments for achieving them, which basically is the situation in the effort sharing sector under the current regulation. Similarly, the EU has adopted a Regulation on the Land Use, Land-Use Change and Forestry (LULUCF Regulation) and set country-specific climate targets for this sector to increase the carbon sink. On the other hand, EU climate policy has relied heavily on the EU-wide emissions trading system since 2005. In the non-ETS sectors, the trend has also been towards an increasingly stronger EU-level regulatory framework. A key example of the increasing EU regulation on the effort sharing sector is the new emissions trading system for buildings, road transport and additional sectors (ETS2) which, among other things, covers fuels distributed for road transport and separate heating of buildings. At the same time, the EU has expanded regulation on transport – including vehicle emissions and electrification of transport – as well as on energy efficiency, including in buildings. Emissions trading and market-based instruments have also continuously taken on a larger role, as the current EU emissions trading system (ETS1) was expanded to cover maritime transport emissions, and the Carbon Border Adjustment Mechanism was targeted at energy-intensive imported products. The general emissions trading system in the EU covers, among other things, electricity and heat producers, large industrial plants, as well as aviation and maritime transport emissions.

This report discusses the options for developing the current EU legislation to achieve the 2040 target, especially regarding emissions trading. From a broader perspective, the key question is if the key elements of the current EU climate policy architecture will be preserved, such as the Emissions Trading Directive, Carbon Border Adjustment Mechanism, Effort Sharing Regulation, LULUCF Regulation and Methane Regulation that fall within the EU's competence in environmental issues, and the Renewable Energy Directive and Energy Efficiency Directive, which are within the EU's competence in the energy sector. Modifying the basic pillars of the architecture, the coverage or operating principles of the current policy instruments or creating entirely new policy instruments will also be possible after 2030. One of the reforms the Commission is already preparing is related to possible targets to be set for permanent carbon removals and the policy instruments created for them. Under the current ETS Directive, the Commission must issue a communication and possible legislative initiative on the integration of permanent carbon removals into emissions trading in July 2026. Both the Council and the Parliament have stressed the importance of the initiative from the viewpoint of the climate target for 2040 in their positions on amending the European Climate Law. Other reforms are also expected, such as including international carbon market mechanisms referred to in Article 6 of the Paris Agreement in the EU's climate policy architecture. Integrating the Effort Sharing Regulation and LULUCF Regulation and increasing flexibility between the sectors have also been discussed.

The EU climate policy architecture will affect Finland's emissions as well as companies and public finances. EU-wide emissions trading will play a key role, and nationally defined policy measures will also be required to achieve the climate targets laid down for 2030 in the EU Effort Sharing Regulation and the LULUCF Regulation. The Finnish Climate Act (423/2022) also sets the target of achieving carbon neutrality by 2035. In addition, under the Climate Act, Finland must reduce emissions by at least

60% by 2030, by 80% by 2040 and by 90% to 95% by 2050 compared to the 1990 levels. The national Climate Act states that any stricter international or EU climate objectives will override national targets. If EU-level legislation were inadequate to achieve national targets, however, Finland should take additional national measures to achieve its own targets.

Finland's special features include a clean electricity network and high biogenic carbon dioxide emissions from forest industry and bioenergy production, combined with low use of fossil fuels in domestic heating. The EU climate policy architecture is also significant for Finland's public finances and the costs faced by companies and households. The emissions trading system generates auction revenues for Member States based on a pre-agreed allocation rule. In 2025, for example, Finland received EUR 410 million in auction revenues (Energy Authority, 2025). While emissions trading means that companies must pay for their emissions, they may be eligible for compensation for the permanent carbon removals they produce in the future. On the other hand, the emissions trading system also contains measures aiming to prevent carbon leakage which refers to European industry relocating outside the EU due to carbon pricing. Consequently, a significant part of industry has so far received their emission allowances free of charge.

In this report, we look at policy architecture options for achieving the EU's target of 90% emissions reduction by 2040. First, we describe the main features of the current EU climate policy architecture and the options included in the on-going discussion[2] on developing EU climate regulation, especially regarding emissions trading. Second, we focus on emissions trading. The options for developing it were mapped using the methods of economic modelling and legal analysis. Four different scenarios were examined through modelling:

1. Current policy will be continued
2. Permanent carbon removals will be added to emissions trading
3. Emissions trading systems will be integrated
4. International carbon credits will be included in emissions trading.

[2] The original text was finalised in February 2026.

# 2. CURRENT ARCHITECTURE FOR EU CLIMATE POLICY AND ITS OPTIONS BEYOND 2030

Efforts to develop EU climate regulation began in the 1990s. Over three decades, the EU has created a broad regulatory framework that covers most economic sectors and relies on a wide range of climate policy instruments. According to Dupont et al. (2024), characteristics of this long-term development have included

1. setting EU climate targets for ten-year periods
2. setting climate targets at head of state level following a political process
3. continuously expanding legislative packages that contain regulation on climate and energy issues.

New elements regarding the EU climate target for 2040 include the fact that the target was enacted in the European Climate Law in the Union's ordinary legislative procedure, in which both the Council and the European Parliament participate. This reform improves the transparency of the target setting process and, also, enables majority decision-making in the Council. In addition, the EU climate target is for the first time set after the European Scientific Advisory Board on Climate Change's (ESABCC) scientific analysis and recommendations.

According to Dupont et al. (2024), the development of EU climate regulation has also been characterised by reliance on certain key pillars. They include the Emissions Trading Directive, the Effort Sharing Regulation and the LULUCF Regulation that fall within the EU's competence in environmental matters, as well as the Renewable Energy Directive and the Energy Efficiency Directive adopted under the EU's competence in energy issues.

The current EU climate regulation mainly aims for achieving the climate target set for 2030. This is based on the so-called Fit for 55 package that contains nineteen legislative instruments and was in essential parts completed in 2023 (Oberthür and Kulovesi, 2025a). According to the Commission, another extensive legislative reform process is to be launched to ensure that the climate target for 2040 can be attained. The Commission is expected to give its proposals in late 2026.

In Chapter 2 of this report, we examine the options for developing the EU's regulatory architecture beyond 2030, with a particular focus on emissions trading. The discussion is based on a literature review, in which we analysed both the (small body of) academic and (larger amount of) 'grey' literature available by early October 2025.

Key issues relating to the EU's post-2030 regulatory framework include potential changes to the basic architecture. Emissions trading has been proven an efficient and well-functioning policy instrument, which is why its use has been continuously expanded. Should emissions trading be extended further to cover permanent carbon removals or emissions from agriculture or the land use sector, for example? How would the potential changes affect the Effort Sharing and LULUCF Regulations – would they be kept in force or replaced by other policy instruments?

We begin with an introduction to the key elements of the EU's current climate architecture. We then look at the options for implementing the EU's post-2030 climate architecture, with a particular focus on emissions trading.

## 2.1 EUROPEAN CLIMATE LAW

The European Climate Law (EU) 2021/1119 is the cornerstone of the current EU climate policy architecture. Together with the Regulation on the Governance of the Energy Union and Climate Action (EU) 2018/1999, it represents the so-called procedural climate law, which focuses on defining climate policy targets and the institutional and administrative framework for attaining them (Kulovesi, Mähönen and Laininen, 2024). Concrete measures aiming to reduce emissions and achieve climate targets are, however, contained in so-called substantive climate legislation.

Under the European Climate Law, the EU must be climate-neutral by mid-century (Article 2) and achieve a net emissions reduction target of at least 55% by 2030 (Article 4.1). The European Climate Law does not allow the use of international carbon credits as part of achieving the targets set for 2030 and 2050. Regarding the intermediate target for 2040, however, international carbon market mechanisms are to be used as part of the set of measures for achieving the target (European Commission, 2025b). In principle, the use of these mechanisms could also be continued in the 2040s, as long as the 2050 target can be achieved through domestic action within the Union.

The European Climate Law additionally contains provisions on the procedure, schedule and knowledge base for defining the 2040 target (Articles 4.3–4.5). The knowledge base includes ESABCC reports (Article 4(5)(a)). The ESABCC has published two relevant recommendations, the first in June 2023 (ESABCC, 2023) and the second in July 2025 (ESABCC, 2025a). It recommended that the EU set as its climate target for 2040 reducing emissions by 90% to 95%, which is to be achieved through domestic action within the Union (ESABCC, 2023; 2025a). According to the ESABCC, an emissions reduction target level closer to 95% combined with international climate cooperation outside the EU would enhance the fairness of the EU's contribution to global mitigation (ibid.). The ESABCC notes, however, that even an emissions reduction of 90% to 95% does not fully correspond to the EU's fair share of global mitigation under the Paris Agreement (ibid.). This is significant from the perspective of the EU's and its Member States' climate obligations under international law. Both the European Court of Human Rights (ECHR, 2024) and the International Court of Justice (*Obligations of States with respect to Climate Change*, 2025) have found in their recent climate-related rulings that countries' climate targets should correspond to their internationally sufficient share of climate measures required at global level.

In July 2025, the European Commission proposed that the European Climate Law be amended to include the target of reducing net greenhouse gas emissions by at least 90% compared to the 1990 levels by 2040. The Commission's proposal followed but is not fully consistent with the ESABCC recommendation concerning an emissions reduction target of 90% to 95% achieved through domestic action (European Commission, 2025b). The Commission's proposal envisaged the use of no more than 3% of high-quality carbon credits purchased from outside the EU in 2036–2040. The Commission also defined a number of other marginal conditions for achieving the 2040 target, including adding permanent carbon removals in the emissions trading system (European Commission, 2025c). This refers to permanent carbon removals that can be achieved either by combining carbon capture and permanent storage with bioenergy production (BECCS) or by capturing carbon dioxide directly from the atmosphere and storing it permanently (DACCS).

The amendment to the European Climate Law was processed in the ordinary legislative procedure and will be finally adopted by the Council and the Parliament in early 2026. In December 2025, an agreement was reached in trilogue negotiations on a net emissions reduction target of 90% for 2040, according to which at most 5%of the target would be achieved using international market mechanisms and at least 85% would be attained through domestic action. While international carbon credits can only be included in the EU climate target from 2036 onwards, the adopted amendment to the European

Climate Law also refers to a possible pilot period in 2031–2035, the aim of which is to launch a market for high-quality international credits.

However, most details on the use of international market mechanisms are still open, including how and when the use of carbon credits will end. These details will be set out in the legislative initiative that the Commission is expected to issue in late 2026. The European Climate Law provides the Commission with further guidance for drafting legislation on international market mechanisms. Among other things, it allows the Commission to consider if there is a need for more stringent guidance in the EU than that provided in the implementing rules of Article 6.4 of the Paris Agreement to guarantee the high quality of the international market mechanisms, particularly in relation to permanence and human rights. When drafting legislative initiatives related to achieving the 2040 target, the Commission should consider impacts on European competitiveness, including consumer prices, energy and transport poverty, and on regions and sectors, including their investment capacity, SMEs, farmers and households exposed to the impact of the transition to climate neutrality.

## 2.2 EMISSIONS TRADING DIRECTIVE

The EU Emissions trading Directive, known as EU ETS Directive, (2003/87/EC) was adopted in its original form in 2003. In Finland, emissions trading is regulated under the Emissions Trading Act (1270/2023). In addition to the EU Member States, the system includes Norway, Iceland and Liechtenstein as well as Northern Ireland for the part of electricity production. The emissions trading systems of the EU and Switzerland are additionally linked. Emissions trading is a market-based policy instrument that sets an EU maximum level for greenhouse gas emissions in sectors covered by emissions trading. It mainly covers carbon dioxide emissions while also including other greenhouse gas emissions generated by certain sectors. Emissions trading was launched during a pilot period in 2005–2007. The first actual emissions trading period coincided with the first commitment period of the Kyoto Protocol in 2008–2012. The next emissions trading period covered the second Kyoto Protocol commitment period in 2013–2020, and the current period covers years 2021–2030.

The number of new emission allowances allocated annually, which decreases from year to year based on the so-called linear reduction factor, is a key part of the emissions trading system. The allowances to be allocated set a cap on cumulative emissions. Operators within the scope of the emissions trading system are required to have an emissions permit. To obtain a permit, an emissions trading system installation must undertake to monitor and report on its emissions. Operators must annually surrender emission allowances corresponding to the number of their verified emissions for cancellation. If the installation fails to surrender enough allowances, it must pay a penalty.

Allowances are mainly allocated at auctions, and the revenue received is distributed between EU funds and Member States according to pre-determined shares. In 2025, the auction revenues received by Finland were EUR 410 million (Energy Authority, 2025). The Member States are obliged to use the auction revenues to support climate action and energy related purposes to the extent that they are not allocated to the Union budget, with the exception of revenues used to pay so-called indirect carbon costs. Climate and energy related purposes include the development of renewable energy and electricity grids, measures to prevent deforestation, investment in decarbonisation of transport, financial support to low- and middle-income households, and reallocation of labour to promote just transition. Some allowances are allocated free of charge to sectors susceptible to carbon leakage with the aim of preventing companies and production from relocating outside the EU. The free allocation of emission allowances is based on harmonised allocation criteria. However, it has been argued that the scale of the free allocation is excessively large and that the allocations have been poorly targeted (Martin et al. 2014, Ahlvik and Liski 2022). Provisions on the calculation of allowance numbers are contained in

Commission Delegated Regulation (EU) 2019/331 on free allocation of emission allowances and Commission Implementing Regulation (EU) 2019/1842 laying down rules for the application of Directive 2003/87/EC as regards adjustments to free allocation of emission allowances.

### 2.2.1 Current EU Emissions Trading System (ETS1)

The current Emissions Trading System (ETS1) of the EU currently covers electricity and heat production, industry and intra-European aviation. Since 2024, ETS1 has additionally covered a growing share of emissions from commercial maritime transport. The Commission is expected to issue a communication and a possible legislative initiative in summer 2026 on extending ETS1 by adding permanent carbon removals to it.

ETS1 currently covers around 40% of EU emissions. According to research literature, it has significantly reduced emissions compared to a situation without this system and has not had significant adverse effects on companies (Colmer et al., 2025). As part of its steering effect, emissions trading encourages technological development and phasing out of fossil fuels (Calel and Dechezleprêtre, 2016; Ahlvik and van den Bijgaart, 2024). No allowances need to be surrendered for biogenic emissions that meet the sustainability criteria under the Renewable Energy Directive (2023/2413), as they are treated as zero emission sectors and their emissions are considered in the land use sector.

The first emissions trading system periods were characterised by an excessive amount of emission allowances and their accumulation (Ahlvik and Vainio, 2024). Initially, emission allowances were allocated to installations free of charge based on operators' historical emissions (*'grandfathering'*) and allocation plans prepared by the Member States. What emerged as a problem was the excessive total number of allowances and the large number of low-quality credits based on international market mechanisms under the Kyoto Protocol in circulation. The recession following the 2008 financial crisis and aid programmes for renewable energy additionally reduced the demand for emission allowances, and their price was no more than approx. EUR 5/t $CO_2$. Companies started banking cheap emission allowances while waiting for the price to increase which led to oversupply. Despite the low price, emissions trading reduced emissions in the first periods by approx. between 15-20% compared to a situation with no emissions trading system (Bayer and Aklin 2020, Dechezleprêtre et al. 2023; Colmer et al. 2024).

To increase the price of emission allowances and accelerate the energy transition, the Market Stability Reserve was established for either storing or releasing emission allowances, depending on the market situation. If there are too many allowances circulating in the market and a pre-defined threshold is exceeded allowances are transferred to the reserve. Since 2023, allowances have been permanently cancelled in the reserve. Thanks to the Market Stability Reserve, the EU's emissions cap depends not only on predetermined allocation of emission allowances but also on the functioning of the market and accumulation of surplus allowances. The Market Stability Reserve is a key mechanism in the scenario analysis of this work.

### 2.2.2 Inclusion of aviation and maritime transport in the EU Emissions Trading System

EU aviation was included in the EU Emissions Trading System (ETS1) in 2012, but the system currently only applies to flights between airports located in the European Economic Area (EEA). The Commission is to evaluate the effectiveness of the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) system for international aviation in relation to emissions trading in 2026. Should CORSIA not be ambitious enough EU emissions trading in aviation will expand to cover all flights

departing from the EEA. The Commission will also issue a communication and a possible legislative initiative in 2027 to include other than carbon dioxide emissions in aviation sector emissions trading. The monitoring and reporting of these emissions began in 2025.

While the number of allowances allocated to aviation was initially reduced more slowly today the linear reduction factor for air traffic is 4.3% in line with the rest of ETS1 and it will be 4.4% from 2028 onwards. Stationary installations covered by ETS1 were initially not allowed to use ETS1 aviation emission allowances whereas aviation operators were permitted to use ETS1 allowances. Since 2021 the system has been open and allows installations covered by ETS1 to use aviation allowances resulting in a single common emissions market. However, the number of allowances for aviation is still determined separately. Free allocation of emission allowances for aviation is gradually being phased out and the share of auctioned allowances in 2025 grew to 50%. The free allocation of allowances for aviation will end in 2026 after which all allowances will be auctioned. Free allowances are available to a limited extent in compensation for using sustainable aviation fuels.

The latest extension of ETS1 is maritime transport which has been within the scope of emissions trading since 2024. Emissions trading covers 100% of maritime transport emissions generated while ships are in ports and sailing between Member States' ports, and 50% of emissions from voyages between Member States' ports and ports of third countries. The inclusion of these emissions has taken place gradually: operators in the sector must surrender allowances corresponding to 40% of their verified emissions in 2024, 70% in 2025 and 100% from 2026 on. In 2024–2025, only carbon dioxide emissions from maritime transport were covered by emissions trading, whereas in 2026, the regulation will expand to also cover methane and nitrous oxide emissions. Only large cargo and passenger vessels of over 5,000 GT are currently covered by emissions trading but in 2027 the regulation will also extend to large offshore vessels of more than 5,000 GT. The Commission will assess the inclusion of smaller vessels in the Emission Trading System in the context of the ETS Directive review in 2026.

Unlike in aviation, the number of allowances for maritime transport is defined together with those for stationary installations. While the same linear reduction factor is applied to maritime transport as to stationary installations and aviation, as the reference level is used reported emissions in 2018–2019. As there is no free allocation of emission allowances for maritime transport operators purchase needed allowances at the auction.

### 2.2.3 Emissions trading for buildings, transport and additional sectors (ETS2)

Emissions trading for buildings, transport and additional sectors (ETS2) will expand the use of emissions trading as a policy instrument to carbon dioxide emissions generated by such sources as road transport, separate heating of buildings and non-ETS1 industry. The purpose of this system is to direct transport and heating towards lower-emission solutions, for example, by transitioning to electric cars, electrifying heating and saving energy.

Instead of end users ETS2 targets fuel distributors. Fuel distributors must have an emissions permit that includes a description of the fuels supplied by them and the distribution methods used, as well as a plan for monitoring and reporting emissions (Act on Emissions Trading for Fossil Fuel Distribution, 1066/2024). Road transport and separate heating of buildings fall within the scope of the Effort Sharing Regulation, which is why ETS2 makes up a separate entity within this sector as one of the EU policy instruments for achieving the emissions reduction targets of the sector. ETS2 covers road transport, separate heating of households as well as industrial sectors that have previously been excluded from the original Emissions Trading System. Energy use in agriculture can also be included in ETS2 by national decisions, as in Finland (HE 119/2024).

As in the current Emissions Trading System, the emissions cap in ETS2 will also decrease annually based on a linear emissions reduction factor but all emission allowances will be auctioned without free allocation. The Member States should spend any auction revenues on climate actions listed in the ETS Directive. Some of the revenue will also be transferred to the Social Climate Fund described below. A price stability mechanism that complements the Market Stability Reserve will be applied to ETS2. This mechanism will release allowances from the reserve in the early years, should their price increase excessively.

The system was to be launched in 2027. However, the Council and the Parliament agreed in December 2025 to postpone ETS2 introduction by one year as a condition for adopting the EU emissions reduction target of 90% for 2040. Futures trading of emission allowances related to the system began in spring 2025, and futures for December 2027 sold at approx. EUR 85/$tCO_2$ in summer 2025. This price is higher than in ETS1, where the average price of auctioned allowances has been around EUR 72/$tCO_2$ in 2025. The price of futures is also higher than the price of approx. EUR 50/$tCO_2$ suggested in the Commission's impact assessment.

In autumn 2025, ETS2 futures prices dropped suddenly as the Commission announced changes to ETS2 (European Commission, 2025d). The trading volume has so far been low and a great uncertainty about the future price development persists. The price of emission allowances may also settle at a level that is significantly higher than the current futures price, since the modelling (incl. Abrell et al., 2024; Günther et al., 2025; Rickels et al., 2023) predict that it may exceed EUR 300/$tCO_2$. The system has price control mechanisms for releasing more emission allowances in the market if prices rise rapidly or remain at a high level for a long time. The delay in ETS2 introduction may increase price pressure in 2028, and price levels are also affected by expectations of how the system will develop after 2030.

## 2.3 SOCIAL CLIMATE FUND

The creation of ETS2 is strongly linked to the Social Climate Fund, provisions on which are contained in Regulation (EU) 2023/955. The purpose of the Social Climate Fund is to mitigate the impact of the new ETS2 by channelling support particularly to households, micro-enterprises and road transport users affected by the anticipated increase in transport and heating costs. The Fund's goals include supporting these parties by means of measures and investments aimed at, among other things, increasing the energy efficiency of buildings and improving the availability of zero- and low-emission mobility. Direct income support may also be introduced on a temporary basis. The Member States must draw up a Social Climate Plan, based on which the funding will be granted. Under current legislation, the Fund will be operational in 2026–2032.

## 2.4 CARBON BORDER ADJUSTMENT MECHANISM

The risk of production covered by emissions trading relocating outside the EU, known as carbon leakage, has been addressed in the emissions trading system from the outset. This risk has been responded to by the free allocation of allowances and, initially, the possibility of using international carbon credits referred to in the Kyoto Protocol flexibility mechanisms. The Fit for 55 package introduced the Carbon Border Adjustment Mechanism (CBAM) as a new policy instrument. Provisions on this mechanism are laid down in Regulation (EU) 2023/956 establishing a Carbon Border Adjustment Mechanism and, in Finland, in Act 1288/2023 on the Implementation of the Regulation on European Union Carbon Border Adjustment Mechanism.

This mechanism is used to set a carbon emission price for products from outside the EU. The price matches the price of emission allowances allocated to similar products manufactured in the EU within the emissions trading system. The mechanism covers iron, steel, aluminium, cement, fertilisers,

hydrogen and imported electricity. Importers of products to which the Carbon Border Adjustment Mechanism applies are obliged to report their imports and the resulting emissions to the national authority. However, Regulation 2025/2083 exempted companies importing less than 50 tonnes a year of products subject to the Regulation from CBAM obligations, as a result of which around 182,000 importers – mainly SMEs and individuals – were excluded from its scope. Under the current legislation, the free allocation of allowances will additionally be gradually reduced from 2026 onwards and fully phased out by 2034 in sectors covered by the Carbon Border Adjustment Mechanism. The purpose of this was ensuring that the system is compatible with World Trade Organization (WTO) rules.

The importer must buy emission certificates (CBAM certificates) that correspond to the emissions generated in the manufacture of the goods. The price of the CBAM certificates, which will go on sale in February 2027, will be tied to the EU allowance price. The importer must also report annually on their imports subject to the Carbon Border Adjustment Mechanism, emissions associated with the products, any carbon price paid in the country of origin, and the number of CBAM certificates required. If a carbon price has already been paid in the country of origin for the emissions generated by imported goods, this will be accounted for in the number of CBAM certificates required.

## 2.5 EFFORT SHARING REGULATION

Emissions in the EU effort sharing sector are regulated under the Effort Sharing Regulation (EU) 2018/842, as amended by Regulation (EU) 2023/857. It aims for a 40% reduction in emissions covered by the Regulation at EU level by 2030 compared to the 2005 levels. The Effort Sharing Regulation covers emissions from agriculture and waste management, small-scale industry as well as domestic road, rail and waterborne transport and buildings. Even if the ETS2 system is launched, road transport and buildings will remain within the scope of the Effort Sharing Regulation.

For more than 20 years, the breakdown into emissions trading and effort sharing sectors has been one of the pillars of EU climate policy. The Effort Sharing Regulation sets for each Member State a country-specific emissions reduction target, allowing them to choose the policy instruments used to achieve the target. Factors accounted for when setting the Member States' targets include GDP per capita and the country's ability to reduce emissions. Finland’s target for 2030 is a 50% reduction in emissions compared to the 2005 levels.

Compliance with the Effort Sharing Regulation is guided by means of annually decreasing emission allocations. Member States must both achieve the emissions reduction target for 2030 and comply with the annual cap. This makes it possible to regulate the Member States' cumulative emissions, which is a more effective policy instrument in terms of climate change mitigation than, for example, the one included in the Finnish Climate Act that only accounts for the target year's emissions.

The Effort Sharing Regulation also contains flexibilities, however, which allow the Member States to save emissions reductions from previous years, borrow emission allocations from future years, or trade emission allocations with other EU countries. They can also avail of a limited LULUCF flexibility and the possibility of replacing some of the emissions reductions required under the Effort Sharing Regulation by cancelling allowances referred to in the Emissions Trading Directive.

The focus in implementing the Regulation in Finland is on road transport and buildings. Domestic transport in Finland (excluding aviation) accounts for approx. 37% of emissions in the effort sharing sector, which makes reducing transport emissions the key to achieving the 2030 obligation (Seppälä et al., 2024).

The fate of the Effort Sharing Regulation regarding climate policy architecture beyond 2030 is open. Whereas it has been one of the cornerstones of EU climate policy architecture for a long time, the sector is subject to increasing EU-level regulation, especially (but not exclusively) along with ETS2. It is

possible that, rather than the Effort Sharing Regulation, the post-2030 climate policy architecture could include legislation regulating both the effort sharing sector and the LULUCF sector. This would enable greater flexibility between the sectors and allow the Member States more room for manoeuvre in the targeting of climate measures at different sectors. On the other hand, the architecture must also be able to secure the achievement of both the climate target for 2040 and all sectors' contribution to attaining it.

As explained more thoroughly below, ideas of combining ETS2 and ETS1 have been brought up in the discussion on the EU's future climate policy architecture, as well as the idea of an emissions trading scheme that covers agriculture, or the AFOLU sector (Agriculture, Forestry and Other Land Uses). The options for reforming emissions trading could work in parallel with integrating the Effort Sharing Regulation and LULUCF Regulation. The possibility of linking international market mechanisms to the EU's post-2030 climate policy architecture is also an open question. For example, Member States could fulfil part of their obligation relating to the current effort sharing sector by purchasing international carbon credits directly. The credits could be purchased centrally at the EU level (Bart and Barata, 2025a).

Discussions in late 2025 indicate that even if the Effort Sharing Regulation has been a key part of EU climate policy architecture for a long time, its status may not remain unchanged in the post-2030 architecture.

## 2.6 LULUCF REGULATION

The third pillar of EU climate legislation is the LULUCF Regulation (EU) 2018/841 on land use, land use change and forest use, as amended by Regulation (EU) 2023/839. The EU target for 2030 is a net sink of 310 Mt $CO_2$-eq, of which 225 Mt $CO_2$-eq will be used to achieve the emissions reduction target of at least 55% set in the European Climate Law.

The LULUCF Regulation imposes binding obligations on the Member States for the LULUCF sector in commitment periods 2021–2025 and 2026–2030. During the first commitment period, the '*no debit*' rule will be followed, according to which greenhouse gas emissions from the land use sector may not exceed their removals. This means that the Member States must ensure that the land use sector as a whole is not an emission source, in other words that it does not generate calculated atmospheric emissions. The Regulation also contains accounting rules applicable to the first commitment period. For Finland, accounting provisions on managed forest land and their reference level are in key role. If the carbon sink in 2021–2025 is less than the reference level, the result is a calculated emission, and if the carbon sink exceeds the reference level, a calculated sink is produced.

For the second commitment period, the EU target of -310 Mt $CO_2$-eq for 2030 has been divided between the Member States based on each country's average greenhouse gas inventory data for 2016–2018. According to the current calculation rules and the greenhouse gas inventory report submitted to the UN in 2025 (Statistics Finland, 2025c), Finland’s obligation under the LULUCF Regulation for 2030 would correspond to a net sink of -3.8 Mt $CO_2$-eq, and stricter annual limits will be introduced linearly until this level is reached (Seppälä et al., 2025). In the light of current information, Finland faces significant challenges in fulfilling its obligations under the LULUCF Regulation. According to Finnish Climate Change Panel estimates from spring 2025, there will be a deficit of approx. 110 Mt $CO_2$-eq in the first obligation period which means that, under the LULUCF Regulation, the deficit should be offset with flexibilities or by purchasing credits (Seppälä et al., 2025). Finland has at its disposal flexibilities of no more than 27 Mt $CO_2$-eq for 2021–2025 and 22 Mt $CO_2$-eq for 2026–2030, but the EU-level target must be achieved to use them. There are also uncertainties in the availability and price of credits.

As discussed above in the context of the Effort Sharing Regulation, it is uncertain if the LULUCF Regulation will be kept in force as a separate legal instrument in the EU's post-2030 climate policy architecture. The need to provide the Member States with more flexibility and room for manoeuvre regarding the extent to which different sectors contribute to achieving climate targets has been brought up forcefully in the discussion. However, there are also concerns over this development: if the net sink of the land use sector decreases (EEA, 2025a), reversing the direction can be difficult without specific binding targets.

## 2.7 CARBON REMOVAL CERTIFICATION FRAMEWORK (CRCF REGULATION)

Regulation (EU) 2024/3012 on permanent carbon removals and carbon farming and storage in products entered into force at the end of 2024. It sets up a voluntary carbon dioxide removal certification scheme, creates an intra-EU framework for the production, methods and trade of removal credits, and ensures the sustainability and quality of solutions. The removal credits produced in this voluntary system can be purchased and sold within the EU. The credits cannot be used to achieve the EU climate target for 2030. The role of this Regulation in the EU's post-2030 climate policy architecture is currently an open question. For example, it could lay the foundation for integrating permanent carbon removals into ETS1. However, the Regulation currently has no links to other EU climate legislation.

Certification must ensure that removals are additional and durable and that double counting is avoided. The removals subject to the Regulation include both permanent storage of carbon dioxide for several centuries and temporary storage in long-lasting products or through carbon farming, Table 1. The Commission will create certification methodologies for different techniques in delegated acts. Definitions provided in the Regulation:

- Permanent carbon removal means any practice or process that, under normal circumstances and using appropriate management practices, captures and stores atmospheric or biogenic carbon for several centuries, and which is not combined with enhanced hydrocarbon recovery. This includes carbon chemically bound in products permanently. Permanent carbon removals can consequently create carbon sinks that are longer lasting than natural sinks.
- Carbon farming means any practice or process carried out over an activity period of at least five years, related to the management of a terrestrial or coastal environment and resulting in the capture and temporary storage of atmospheric or biogenic carbon in biogenic carbon pools, or in the reduction of soil emissions.
- Carbon storage in products means any practice or process that captures and stores atmospheric or biogenic carbon for at least 35 years in long-lasting products, allows on-site monitoring of the carbon stored and is certified throughout the monitoring period.

The Commission's proposal for a delegated act published in February 2026 in the context of the CRCF sets out the methods for certifying permanent carbon dioxide removals. The proposal contains definitions and certification methods for carbon dioxide removal activities based on direct air carbon capture and permanent storage (DACCS) or biogenic carbon capture and storage (BioCCS, BECCS) as well as biochar carbon removal (BCR) (European Commission, 2026). The Annex to the draft proposal presents detailed methods based on life cycle assessment. The publication date of this document did not allow for an analysis of the criteria for the purposes of this report.

The certification methods enable operators to demonstrate that their carbon dioxide removal activities meet the necessary quality requirements, ensuring that the generated removals are eligible for certification in the EU. There are currently no economic incentives for permanent carbon removals, apart from the voluntary carbon market. Standardised certification methods make it possible to, for

example, compare sites eligible for support if State aid is allocated to permanent removals. These certification methods could also be used at a later stage if a decision were made to incorporate permanent carbon removals in the EU ETS.

**Table 1**. Actions covered by the Carbon Removal Certification Framework.

| Action | Certified unit |
|---|---|
| **Permanent carbon removal**<br>BECCS, BioCCS, DACCS, biochar where applicable, permanent chemical binding of carbon dioxide | Permanent carbon removal credit (t $CO_2$-eq) |
| **Carbon farming**<br>Improving carbon sequestration in soil or reducing soil emissions, for example by re-wetting of peatlands | Carbon farming credit (t $CO_2$-eq)<br>Soil emission reduction credit (t $CO_2$-eq) |
| **Carbon storage in products**<br>Incl. timber products for construction, mineralisation in non-permanent products, other CCU products | Credit for carbon storage in products (t $CO_2$-eq) |

## 2.8 OTHER EU CLIMATE AND ENERGY REGULATION

In the sections above, we have discussed essential EU climate legislation from the perspective of this report. The EU has several other legislative instruments for achieving climate targets and the goal of climate neutrality. They include:

- Renewable Energy Directive (RED III), as amended by Directive (EU) 2023/2413
- Energy Efficiency Directive, as amended by Directive (EU) 2023/1791
- Energy Performance of Buildings Directive, as amended by Directive (EU) 2024/1275
- Methane Regulation (EU) 2024/1787
- Regulation on the deployment of alternative fuels infrastructure (EU) 2023/1804
- ReFuelEU Aviation Regulation (EU) 2023/2405
- FuelEU Maritime Regulation (EU) 2023/1805
- Regulation setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, as amended by Regulation (EU) 2023/851
- Regulation setting CO2 emission standards for new heavy-duty vehicles, as amended by Regulation (EU) 2024/1610
- Net Zero Industry Act (EU) 2024/1735
- Regulation establishing a framework for ensuring a secure and sustainable supply of critical raw materials (EU) 2024/1252

## 2.9 OPTIONS FOR REFORMING EMISSIONS TRADING

Emissions trading has been the most effective policy instrument for reducing greenhouse gas emissions. This is why the discussion on reforming the EU's climate policy architecture revolves around several proposals for expanding and strengthening emissions trading. The following central options have been brought up:

- adding permanent carbon removals to ETS1;

- integration of ETS1 and ETS2;
- extending emissions trading, either to new sectors or geographically; and
- including international carbon credits in emissions trading.

Rather than being mutually exclusive, these options can be combined. Proposals for more technical modifications to emissions trading have also come up in the discussion, such as revising the linear reduction factor, extending the free allocation of emission allowances, and modifying the threshold values of the Market Stability Reserve. Adding permanent carbon removals to ETS1, extending the free allocation of emission allowances and modifying the linear reduction factor were also included in both the Council's and the Parliament's positions in the trilogue negotiations on amending the European Climate Law. Under the ETS Directive, the Commission must also issue a communication and possible legislative proposal on permanent carbon removals in July 2026, which means that the process aiming for the possible revision of the ETS Directive is already under way as described below.

Little or no peer-reviewed research is available on the options. This report seeks to describe the discussion on the options and key proposals based on available material. The material consists of proposals publicly available before the beginning of October 2025, including grey literature. The use of such material is justified when the aim is to map various stakeholders' proposals for the possible emissions trading reform. In the following sections, key options are examined on the basis of the literature review described above.

### 2.9.1 Adding permanent carbon removals to Emissions Trading System

The purpose of permanent carbon removals is to offset residual emissions in sectors where reducing emissions is particularly challenging, such as steel and cement production. Permanent carbon removal methods such as BECCS and DACCS are intended to ensure that removals included in the emissions trading system deliver genuine, measurable and durable climate benefits. The goal is to maintain the credibility of the emissions trading system and to reduce the risk of removals being reversed, which is associated with the durability of carbon sinks in the land use sector, for example.

Adding permanent carbon removals to emissions trading differs from other proposals for developing the emissions trading system in that the policy process relating to it is already under way and currently progressing separately from the rest of the post-2030 legislative process. The revision of the ETS Directive (EU) 2023/959 of 2023 obliges the Commission to prepare a communication and a possible legislative proposal on the inclusion of negative emissions in the emissions trading system by 31 July 2026. Preparations to this effect have already been initiated, and the Commission held a consultation on this topic in summer 2025 (European Commission, 2025h). Carrying out this reform is also included in the Parliament's and the Council's positions on amending the European Climate Law and achieving the EU's climate target for 2040. Adding permanent carbon removals to emissions trading has consequently received fairly extensive support and appears likely to go ahead.

**The ESABCC** proposes ensuring the viability of the ETS Directive after 2040 and preparing for net-zero and net-negative emissions by integrating permanent carbon removals into the emissions trading system (ESABCC, 2025b). According to the ESABCC, permanent carbon removals should be integrated into the emissions trading system in stages, and the precondition for this should be creating a reliable certification system which ensures that the carbon removals will be durable and additional. The ESABCC notes that in this integration, mitigation deterrence should be prevented, environmental risks should be addressed, fairness should be supported and dynamic cost-efficiency improved. The ESABCC also recommends creating an institutional framework to manage the integration process and support early deployment. (ESABCC, 2025b)

**Other stakeholders** have proposed that while permanent carbon removals could also be stepwise included in ETS2, in the early stages the integration should only concern ETS1 (ERCST, 2025a). They see no economic justification for limiting the removals to certain economic sectors. Several stakeholders have proposed limitations on using allowances obtained through permanent carbon removals, for example by setting a clear cap for them (Meyer-Ohlendorf, 2023a). It has also been proposed that the demand could be limited by defining a maximum share of emissions that a company can offset by using permanent carbon removals (UK Government, 2024). Some researchers additionally argue that demand-side limitations could be tailored for specific sectors or activities with high residual emissions (Rickels et al., 2021).

In addition to quantitative limitations, restrictions on areas where permanent carbon removals can be applied have been proposed. For example, the Ecologic Institute (Meyer-Ohlendorf et al., 2023a) proposes that the use of BECCS technology should be limited exclusively to exploitation of waste biomass due to its multiple adverse impacts on ecosystems. The European Academies Science Advisory Council (EASAC, 2022) has recommended limiting biomass use in the context of BECCS technology to rapidly growing crops cultivated on unused or degraded lands, as well as to limited volumes of forest residues that would otherwise rapidly degrade on site and whose exploitation is compatible with biodiversity conservation. It has also been suggested that a broader reform of the bioenergy and biomass policy in the EU is an essential precondition for the expansion of bioenergy applications, including BECCS (CONCITO, 2023). ERCST (2025b) proposes that carbon removal projects be assessed on a case-by-case basis, rather than imposing quantitative or qualitative restrictions. According to ERCST, the assessment should be based on strict accounting rules, biomass sustainability criteria and quality standards defined by the Carbon Removal Certification Framework.

Adapting the supply of emission allowances is seen as a precondition for integrating permanent carbon removals into the system in order to keep up the environmental performance of the system and the credibility of emissions reduction targets (Sandbag, 2025). If permanent carbon removals were included in the emissions trading system as additional emission allowances, it would result in raising the emissions cap. Several stakeholders have also stressed the need for clear liability provisions for situations where carbon removal methods do not work as expected (e.g. La Hoz Theuer and Olarte, 2023; Schuett, 2024). On the other hand, it has also been proposed that the CCS Directive (2009/31/EC) on the geological storage of carbon dioxide should also cover any leakage caused by BECCS and DACCS technologies, since it is interpreted as including the requirement of offsetting leakages by surrendering an equivalent number of emission allowances (Rickels et al., 2021).

The inclusion of permanent carbon removals in the emissions trading system has been opposed, particularly on the grounds that their use could lead to the replacement or postponement of actual emissions reductions. The uncertainty associated with the availability and costs of these technologies additionally raises concerns over their integration into emissions trading being premature and risky. Some authors have claimed that permanent carbon removals should be sufficiently advanced and that genuine, large-scale net removal benefits must be possible before their inclusion in the System can be considered (Sandbag, 2025). Burke and Gambhir (2022) have questioned the sufficiency emissions trading system carbon price alone as an incentive for the necessary innovation and cost reductions in carbon removal technologies. They argue that separate mechanisms should be in place to stimulate innovation and reduce costs before such technologies are integrated into the emissions trading system. Carbon Market Watch (De Simone, 2025) suggests that channelling part of emissions trading system revenues to financing permanent carbon removals without including permanent carbon removals in the actual System could be an optional solution. The establishment of a separate emissions trading system for permanent carbon removals has additionally been proposed (see e.g. Burke and Gambhir, 2022).

The ESABCC (ESABCC, 2025b) proposes that, if necessary, such a separate carbon removal market could be indirectly integrated into the emissions trading system through an intermediary organisation.

### 2.9.2 Integration of ETS1 and ETS2

One of the reform options brought up in the discussion on the EU's post-2030 climate policy architecture concerns the integration of ETS1 and ETS2.

**The ESABCC** (ESABCC, 2024) has suggested that maintaining two separate emissions trading systems may create distortions and harmful incentives. For example, including fossil fuels in ETS2 represent efforts to promote the electrification of the transport and building sectors. However, electrification may be slowed down by the fact that electricity is covered by ETS1, where the price of emission allowances is currently higher than the reference price for ETS2 allowances, which the Commission has set at a low level.

**Other stakeholders** see the integration of ETS1 and ETS2 as a way to increase the availability of emission allowances and the potential to reduce emissions, which could improve market liquidity and reduce price fluctuations over the short term (see e.g. Elkerbout et al., 2024). The integration is additionally seen as a desirable development when it comes to adding permanent carbon removals to the ETS, as it would make setting a single, comprehensive carbon price for both emissions reductions and carbon removals possible (Edenhofer et al., 2023).

This proposal has its challenges, however. So far, there is no experience of ETS2 implementation, as in the light of current information, the system is only to be launched in 2028. Integration of the emissions trading systems before sufficient experience has been gained of ETS2 could undermine the effectiveness of ETS1.

Significant differences between the systems also make their integration challenging in practice: whereas ETS1 covers approx. 10,000 high-emission installations, in ETS2 the efforts to reduce emissions involve hundreds of millions of individuals, each of whom is responsible for a small emission source (Meyer-Ohlendorf et al., 2023b). In addition, the costs of reducing emissions in the sectors covered by the systems are different, as are the numbers of options and volume of information available.

ETS2 also differs from ETS1 in that the price of emission allowances has a clearer impact on citizens' everyday lives through costs of mobility and heating. This will increase the political pressure to keep the allowance price at a moderate level in ETS2. If the emission allowance price in ETS2 ended up being lower than in ETS1, integrating the systems might be politically difficult. However, price development in ETS2 remains uncertain: the European Commission's original proposal (2021) put the price of the emission allowance at EUR 48–EUR 80, whereas other studies indicate that it could even exceed EUR 300 (e.g. Abrell et al., 2024; Günther et al., 2025; Rickels et al., 2023).

In addition, even if the inclusion of ETS2 emissions in the integrated system would increase the supply of allowances and reduce price fluctuations in the early stages, the relatively limited emissions reductions achievable in the sectors covered by it could ultimately exacerbate the liquidity problem (see Elkerbout et al., 2024; Carbon Market Watch, 2025). This is because the increased demand for emission allowances would undermine the ability of ETS1 sectors to purchase allowances on the market, increasing the price.

In the longer term, however, maintaining separate emissions trading systems will reduce the cost-efficiency of the policy, as it does not incentivise emissions reductions where they can be achieved

most cost-effectively (ESABCC, 2024). A single emissions trading system and a single carbon price would also make the system less complex and more comprehensible, which would improve trust in and commitment to it (Meyer-Ohlendorf et al., 2023b). The options include creating a single coherent emissions trading system (with a common cap, carbon price and administrative arrangements), or more gradual solutions, such as allowing the trading of emission allowances between the two systems, which could gradually result in their prices converging (ESABCC, 2024).

### 2.9.3 Expanding emissions trading

Various options for expanding emissions trading have also been brought up in the discussion on the post-2030 climate policy architecture of the EU. They include:

- creating a third emissions trading scheme (ETS3) for emissions from either agriculture or, more broadly, the entire AFOLU sector;
- including agriculture or other new sectors in the existing emissions trading systems; and
- geographical expansion of emissions trading.

#### 2.9.3.1 EMISSIONS TRADING IN THE AGRICULTURAL SECTOR (ETS3)

The establishment of a third emissions trading system (ETS3) has been proposed in order to promote climate action in the agricultural sector.

According to **the ESABCC** (ESABCC, 2024), the EU should start preparing to extend the emissions trading system to the agricultural, food and LULUCF sectors. It also proposes that emissions trading be complemented with other policy instruments, including a reform of the Common Agricultural Policy and measures that support more sustainable diets.

**Other stakeholders** have suggested three different emissions trading models for reducing agricultural emissions (see e.g. European Commission, 2023; ERCST, 2025c):

- an emissions trading system for farms that covers farm greenhouse gas emissions and all agricultural operators (*on-farm ETS*);
- an emissions trading system for the upstream value chain of agriculture that covers input production, including the fertiliser and feed industries, and guides them to develop lower-emission products and indirectly reduce farm emissions (*upstream emissions trading system*); and
- an emissions trading system for the downstream value chain that covers greenhouse gas emissions from processed agricultural products to share the costs and responsibility more evenly across the whole value chain (*downstream emissions trading system*).

It has also been proposed that operators subject to the emissions trading system for agriculture could meet part of their emission obligations by obtaining carbon farming credits referred to in the CRCF Regulation (European Commission, 2023; McDonald et al., 2025). For example, ERCST (2024) has proposed a model that would impose emissions trading obligations on upstream industrial installations and downstream producers, whereas farmers could participate in a voluntary market by producing carbon farming credits that could be bought by operators covered by the emissions trading system. In this model, farmers would be able to sell the credits they produce, which would reward them for emissions reductions as well as for transition towards net zero and more sustainable farming practices. ERCST finds that this model could make the system more acceptable by providing farmers with new sources of income. It has also been proposed that other operators covered by the emissions trading system outside the agricultural sector could also buy carbon farming credits (Verschuuren et al., 2024).

However, the Ecologic Institute and Öko-Institut (McDonald et al., 2025) note that the inclusion of carbon farming credits in emissions trading would be risky as they pose significant problems associated with durability and additionality. The possibility of operators resorting to such credits to offset their emissions rather than reducing them directly is also a concern.

Rather than establishing a completely new system, the inclusion of agricultural emissions in existing emissions trading systems, in other words ETS1 or ETS2, has also been proposed (see e.g. Scheffler and Wiegmann, 2024; ERCST, 2024). At national level, the Member States may extend the scope of ETS2 to cover emissions from energy use in agriculture, as done in Finland (HE 119/2024). However, the expansion of emissions trading to other emissions contains risks, as agricultural emissions differ from those of other sectors, both regarding their sources and their emissions reduction potential. Without sector-specific adjustments, the system could cause harmful income distribution effects that agricultural operators would consider unfair. Verifying agricultural emissions reductions is also very different in nature from verifying fossil fuel emissions or industrial process emissions. It has also been suggested that other sectors, such as municipal waste incineration (and landfills), should be included in ETS1 (ERCST 2024). Under the ETS Directive, the European Commission has a duty to consider extending the system to waste incineration by 2026, with the aim of adding the sector to emissions trading system as of 2028.

#### 2.9.3.2 GEOGRAPHIC EXPANSION

While no concrete proposals concerning the geographical expansion of emissions trading have been put forward, Article 6.2 of the Paris Agreement would provide a legal framework for this. The emissions trading systems of the EU and Switzerland have already been linked. Also, as part of their new strategic partnership, the EU and the United Kingdom agreed in May 2025 on linking their emissions trading systems (European Commission, 2025f). Linked Emissions Trading Systems may bring benefits, including more cost-effective possibilities of reducing emissions, reduced risk of carbon leakage between systems, and increased market liquidity (Holtsmark and Midtømme, 2021; ICAP, 2023). However, the preconditions for linking systems include their harmonisation and trust between different actors.

### 2.9.4 Including international carbon credits in the emissions trading system

The discussion on the EU's post-2030 climate architecture is also closely linked to the question of how the international market mechanisms and Article 6 of the Paris Agreement can be integrated into it. The present report does not deal with the details of this issue, which will be addressed in the next report of the project to be completed in 2027.

Article 6 of the Paris Agreement creates a legal framework for voluntary cooperation between the Parties aiming to achieve the mitigation outcomes set in the Agreement. Article 6.2 of the Paris Agreement contains the possibility of agreeing on transfers of mitigation outcomes (emissions reductions and removals) between countries to achieve nationally determined contributions. This Article concerns *Internationally Transferred Mitigation Outcomes (ITMOs*), whereas Article 6.4 focuses on emission-reducing climate projects and lays the foundation for a mechanism for certifying international mitigation outcomes, the *Paris Agreement Crediting Mechanism* (PACM). This mechanism makes possible to trade carbon credits produced in projects that comply with internationally agreed rules.

Under the European Climate Law (2021/1119), the EU climate targets for 2030 and 2050 will be attained through domestic action within the Union. The objective defined in its Article 2(1) is that:

> "Union-wide greenhouse gas emissions and removals regulated in Union law shall be balanced within the Union at the latest by 2050, thus reducing emissions to net zero by that date, and the Union shall aim to achieve negative emissions thereafter."

Further, under Article 4(1):

> "In order to reach the climate-neutrality objective set out in Article 2(1), the binding Union 2030 climate target shall be a domestic reduction of net greenhouse gas emissions (emissions after deduction of removals) by at least 55% compared to 1990 levels by 2030."

Regarding the target for 2040, however, a provisional agreement on using the flexibilities referred to in Article 6 of the Paris Agreement was reached in December 2025. The trilogue negotiations on amending the European Climate Law concluded with an agreement that limited use of international market mechanisms can be included in achieving the 90% emissions reduction target: 85% of the emissions reductions must be achieved through domestic action, whereas up to 5% can be covered by carbon credits purchased on the international market. However, this is a significant increase compared to 3% originally proposed by the Commission (European Commission, 2025c). 5% share means that EU emissions could be 50% higher in 2040 than if carbon credits were not used (Graichen et al., 2025a). This raises the question of how Article 6 of the Paris Agreement can be linked to the EU's climate policy architecture and what possible additional criteria the EU will set for carbon credits purchased on the international market.

The EU has prior experience of linking international market mechanisms to ETS1 through the so-called Linking Directive of 2004 (2004/101/EC), which integrated the 'project-based mechanisms' of the 1997 Kyoto Protocol into the EU ETS. The mechanisms included the industrial countries' *Joint Implementation (JI*) and *Clean Development Mechanism (CDM*). The goal was to reduce the costs of emissions trading for European companies. The experiences of this arrangement were mostly negative, however. The international carbon credits combined with the financial crisis and an oversupply of emission allowances led to a collapse in the price of emission allowances and the EU emissions market being flooded with poor-quality carbon credits.

Against this backdrop, the Commission stated in its legislative initiative for amending the European Climate Law that "these international credits should not play a role for compliance in the EU carbon market" (European Commission, 2025c). This policy statement has been interpreted to mean that rather than integrating the international carbon credits referred to in Article 6 of the Paris Agreement directly into the EU ETS, they should be linked to the EU's climate policy architecture in some other way.

The Council and the Parliament also proposed making it clear that international carbon credits cannot be used to fulfil emissions trading obligations (Council of the European Union, 2025; European Parliament, 2025). This would limit the use of carbon credits to non-ETS sectors, which are currently regulated under the Effort Sharing Regulation and the LULUCF Regulation (Kulovesi and Oberthür, 2025b). However, the details will only be ironed out in the implementing acts on attaining the target for 2040, the proposals for which the Commission is expected to issue by the end of 2026. According to some interpretations, directly integrating carbon credits into emissions trading would not be completely excluded as a possibility (see e.g. Leisinger, 2025). This issue is also not mentioned in the text provisionally agreed upon in the trilogue negotiations on amending the European Climate Law.

In May 2025, the **ESABCC** published a report explicitly stating that it does not recommend using international credits to replace domestic emissions reductions to meet the target for 2040 (ESABCC, 2025b). According to this report, using carbon credits to meet the target could at least partly direct

resources away from necessary investments in EU infrastructure, expertise and innovation. The ESABCC also warns that international carbon credits involve significant risks to the carbon market and environmental integrity. These risks include uncertainties about additionality and challenges in ensuring reliable monitoring, reporting and verification (MRV).

**Other stakeholders** have expressed their concern over the combination of emissions trading and Article 6 of the Paris Agreement:

> "The inclusion of carbon credits in the ETS poses a serious risk. We find that including Article 6 or low-quality carbon removals like biochar could undermine the environmental integrity and effectiveness of the ETS. These instruments should not be considered as an option to ease tension in the EUA market." Graichen et al. (2025b)
>
> "There is a risk that the uncertain prospect of 'cheap' foreign mitigation deters investment in EU domestic mitigation." Zachmann (2024)
>
> "Including international carbon credits into the ETS will destroy the hard won integrity of the ETS to deliver a carbon price incentive adequate to trigger decarbonisation, and will funnel investment outside of the EU." Carbon Market Watch (2025)

The prevailing view consequently is that carbon credits should not be used to meet emissions trading obligations, which is also aligned with the official position of the Finnish government:

> "The Government approves the Commission’s proposal concerning the use of high-quality carbon credits under Article 6 of the Paris Agreement. However, the Government considers that the credits should not be used to fulfil the obligations under the EU’s emissions trading scheme in order that the EU ETS will guide to emission reductions and use of new technologies such as technical sinks to achieve these within the EU.” Government (2025)

Nevertheless, the integration of emissions trading and Article 6 has also received support, particularly because any permanent carbon removals added to emissions trading are regarded as being linked to international carbon credits over the medium and long term (see e.g. Delbeke, 2024; ERCST, 2025a). They are deemed to create markets for carbon removal technologies, provided that the use of the credits is guided by strict MRV and durability standards and clear eligibility requirements.

Bart and Martins Barata (2025b) argue that adding international carbon credits to ETS1 could provide a way of managing residual emissions and mitigating market liquidity problems. In ETS2, it could work as a way of curbing the anticipated costs of the system, protecting it from possible revocation, delays or watering down. They propose the introduction of a centralised reserve mechanism that would only release credits in the market when necessary. The Confederation of Finnish Industries (2025) also supports the limited use of carbon credits to meet the obligations of both Emissions Trading Systems.

# 3. APPLICATION OF THE EMISSIONS TRADING SYSTEM MODEL TO EU CLIMATE POLICY SCENARIOS

As the above analysis of the EU's post-2030 climate policy architecture showed, key issues relate to the integration of permanent carbon removals into emissions trading, combination of ETS1 and ETS2, and the role of international carbon credits in the architecture. In this chapter, we examine four scenarios for the EU's climate policy architecture based on emissions trading system modelling. See Table 2 for these scenarios, and the subsections for a more detailed discussion of them and the results of modelling. The aim of the modelling is to understand the economic impacts of the EU's post-2030 climate policy architecture on Finland and the EU, as well as the impacts of the architecture options on emission trends.

**Scenario 1: Current policy will be continued.** The current architecture of the EU's climate policy will stand, with no changes to the division into emissions trading, effort sharing and land use sectors. ETS1 and ETS2 will continue as separate systems, the current rules will be extended to cover 2031–2040, and the allocated allowances will decrease year by year according to the current linear reduction factors. Permanent carbon removals or international carbon credits will not be integrated into the emissions trading system.

**Scenario 2: Permanent carbon removals will be added to emissions trading.** Permanent carbon removals will be added to ETS1, where generation of negative emissions creates more emission allowances for the market. Sinks in the land use sector will remain excluded from the emissions trading system. We also examine the inclusion of removals to ETS2 as well as different rules for and limitations on trading in them. International carbon credits will remain excluded from the emissions trading system.

**Scenario 3: Emissions trading systems will be integrated.** ETS1 and ETS2 will be integrated to form a single system in 2035. The integration will be announced in 2030, and trading in allowances between sectors will be permitted. This means that mainly agricultural emissions will remain in the effort sharing sector, and the remaining effort sharing sector will be combined with the land use sector to make up a new sector, AFOLU. Permanent carbon removals or international carbon credits will not be integrated into the emissions trading system.

**Scenario 4: International carbon credits will be included in emissions trading.** The use of international carbon credits in ETS1 will be permitted, with a limit of 3% of the target for 2040 (approx. 140 Mt). ETS1 companies can use these credits to meet their emissions trading obligations, and this will not reduce the emission allowances to be released. Permanent carbon removals will remain excluded from the emissions trading system.

The modelling of emission trends related to the emissions trading systems is based on current legislation. The emission trends in other sectors are based on the With Additional Measures (WAM) scenarios of the European Environmental Agency (EEA) and the New actions and scenarios of national energy and climate policy project (KEITO). In none of the scenarios changes in emissions trading alone are sufficient to achieve the 90% emissions reduction target for 2040, which means that the necessary additional measures must be allocated to other sectors (non-ETS2 effort sharing sector, land use sector, permanent carbon removals or international carbon credits). It should be noted that while emissions trading system modelling includes only structural changes additional measures could also be taken for example by increasing the linear reduction factor. However, the basic premise is that the target for 2040 is achieved in all four scenarios, which means that they are comparable in this respect. Nonetheless, cumulative emissions and the impacts on Finland's emissions and economy vary between the different scenarios.

**Table 2**. EU climate policy architecture in scenarios 1–4.

| | Emissions trading sector | Effort sharing sector | Land use sector |
|---|---|---|---|
| Scenario 1: Current policy will be continued | ETS1 | ETS2 | LULUCF |
| Scenario 2: Permanent removals included in emissions trading system | ETS1<br>Permanent carbon removals | ETS2<br>Remainder of the effort sharing sector | LULUCF |
| Scenario 3: Emissions trading systems will be integrated | ETS1 + ETS2 | AFOLU sector:<br>Remainder of the effort sharing sector<br>LULUCF | AFOLU sector:<br>Remainder of the effort sharing sector<br>LULUCF |
| Scenario 4: International carbon credits included in emissions trading | ETS1<br>International carbon credits | ETS2<br>Remainder of the effort sharing sector | LULUCF |

## 3.1 DATA AND METHODOLOGY

### 3.1.1 Emissions trading model

This report relies on a model describing an EU-wide emissions market whose basic structure corresponds to that proposed by Gerlaghi et al. (2021) based on sector-specific price elasticities. This model has previously been used by such authors as Seppänen et al. (2022). For the purposes of this report, the model has been expanded and calibrated to correspond to any changes to the climate policy architecture after 2030. The model can be used to assess the climate and economic impacts of possible changes in emissions trading on Finland and the rest of the EU.

In the model, the price of emission allowances is based on their supply and demand. As companies can bank allowances for later use, the expected allowance price will increase annually by a discount rate following the so-called Hotelling Rule (1931). The initial price of the emission allowance in the model is produced by assuming that the actual demand along the price trajectory in question corresponds to the supply, and that banked emission allowances will be used up by 2050 at the latest. The annual supply of allowances is determined based on the number of allowances to be released under the current rules (Directive 2003/87/EC, Decision (EU) 2015/1814) and a well-functioning Market Stability Reserve.

When the supply of allowances exceeds their demand, allowances will be banked, and in the opposite situation, the banked allowances will be used to cover the demand. If the number of banked allowances becomes high, some are transferred from the market to the Market Stability Reserve. If the ETS1 Market Stability Reserve grows large, some of the allowances held there will be cancelled. The ETS1 cap, which determines the cumulative emissions in the emissions trading sector, will consequently be determined by the behaviour of market actors. No allowances will be cancelled in the ETS2 Market Stability Reserve, which means that the ETS2 cap will be determined by the allowances released by the Commission. See Figure 2 for an illustration of the Market Stability Reserve's importance in creating a balanced market.

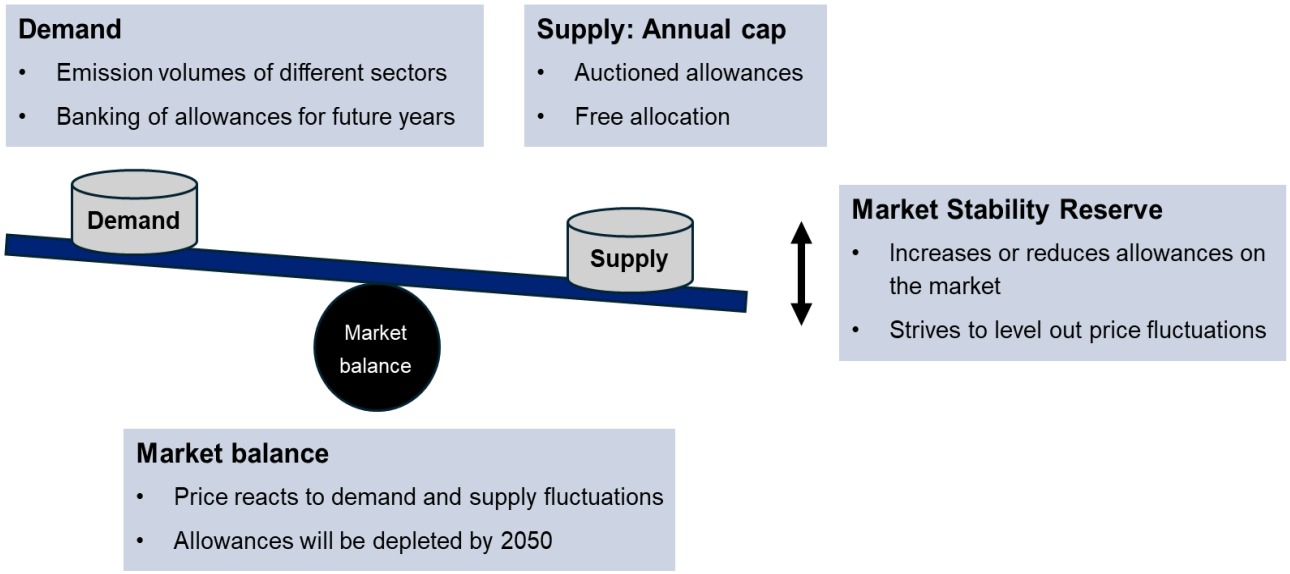


**Figure 2**. The role of the Market Stability Reserve in creating a balanced market.

In terms of economic analysis, it is essential to understand how rational and forward-looking operators will behave in the emissions market. The demand for emission allowances is based on the costs incurred by companies from reducing their emissions: if reducing emissions is more expensive for the company than using emission allowances, the company will use the allowances. Companies can also bank allowances for later use and change their behaviour in response to changes in the emissions market. This will influence the dynamics of the emission allowance market: for example, if the Commission announces that it will release a greater amount of emission allowances than expected, rational and forward-looking operators will realise that once this promise has been fulfilled, the scarcity of emission allowances will ease off slightly. The allowance price will then drop immediately. This makes banking allowances less profitable, and companies will use their allowances rather than bank them. As fewer allowances are banked, the number of allowances transferred to the Market Stability Reserve will decrease correspondingly. This will, in turn, reduce the number of allowances cancelled and consequently increase cumulative emissions more than what could be intuitively inferred from the increase in the number of allowances released.

The aim of the economic analysis is to understand the economic impacts of the EU's post-2030 climate policy architecture on Finland and the EU. The integration of new sectors, or permanent carbon removals and international carbon credits, into the emissions trading system is associated with key economic issues. Regarding the new sectors, the intensity of their reaction to the allowance price is essential. We use sector-specific price elasticities to assess the impact of the emission allowance price. Price elasticity describes the extent to which a relative increase in the price of an emission-generating commodity reduces its demand in proportion. As changes in demand are not always immediate, we factor in price elasticity both over the short term (reduced consumption) and the long term (technological advancement). Regarding permanent carbon removals, the report focuses on removal credits produced using BECCS technology, where understanding the production costs of BECCS and the evolution of storage capacity is essential.

The model was calibrated as follows:

- Theoretical maximum demands for emission allowances per sector (in other words, emissions when the price of the allowance is zero) were determined using actual emissions (EEA, 2025b) for the ETS1 sector and WAM scenarios (EEA, 2025c; KEITO, 2025) for the ETS2 sector. Price sensitivities in individual sectors are based either directly on flexibilities proposed in literature or on estimates derived from them.
- Relative changes in demand for emission allowances over time were calibrated using EUR 72/tCO2 as their price in ETS1 based on realised ETS1 auctions in 2025 (EEX, 2025), and EUR 89.25/tCO2 as the initial price in ETS2 (buildings, road transport and additional sectors) in 2028 based particularly on the price of futures (ICE, 2025).
- The supply of permanent carbon removals in Finland was adapted to VTT's estimate of the marginal costs of BECCS based on literature (Kujanpää et al., 2023; Kujanpää et al., 2024). The supply in the rest of Europe was scaled from the supply in Finland, assuming that the supply of permanent carbon removals will correspond to estimates of the BECCS production capacity in the EU at large (ESABCC, 2025b).

For a description of the emissions trading model and more detailed information on the calibration, see the Appendix to the report.

### 3.1.2 Scenario background assumptions

For the purposes of this report, we did not separately model emission trends in the effort sharing and land use sectors (Table 3). To be able to calculate net emissions from emissions trading system modelling, however, emission trends in the effort sharing and land use sectors were assumed to be in line with the WAM scenarios (EEA, 2025a; EEA, 2025c; KEITO, 2025). The sectors to be added to ETS2 in 2028 were itemised in the effort sharing sector emissions and modelled separately. This means that emissions reductions in the remaining effort sharing sector are assumed to continue elsewhere in the EU at the same rate as in 2020–2027, or on average by 2.2% a year. In Finland, emissions reductions are expected to continue in line with KEITO project's WAM scenario. The reference level for net emissions reductions is the EU net emission level of 4,726 Mt in 1990 (EEA, 2025d).

**Table 3**. Background assumptions of emission trends in sectors not modelled in scenarios 1–4.

| Sector | EU | Finland | Notes |
|---|---|---|---|
| Effort sharing sector (excl. ETS2) | Emissions are expected to decrease by 2.2% per year after 2027 in line with the WAM scenario (EEA, 2025c). | In line with KEITO project's WAM scenario (2025), gaps filled in linearly. | The ETS2 sector assumed for the EU includes road transport, buildings and 58% of industry not covered by ETS1 (Rickels et al., 2023). The ETS2 sector assumed for Finland includes road traffic, buildings, mobile machinery and other processes and products. |
| Land use sector | In line with the WAM scenario (EEA, 2025a) | In line with KEITO project's WAM scenario (2025). | Scenario 2 assumes that permanent carbon removals will not affect the sink in the land use sector. BECCS will only produce carbon removals if the used biomass does not undermine the land use sector sink. |

Assumptions for calculating auction revenues and companies' emission allowance purchases were based on the current legislation. The impact of the Carbon Border Adjustment Mechanism on free allocation of emission allowances in ETS1 was factored in by reducing free allocation in the sectors subject to Regulation (EU) 2023/956 from 2026 and stopping it completely in 2034. We assume that in sectors not covered by the Carbon Border Adjustment Mechanism, free allocation of emission allowances in ETS1 will continue in compliance with current legislation. As there will be no free allocation in ETS2, all allowances will be auctioned. The calculation factors in allowances released from the Market Stability Reserve and transfers of auction revenues to funds. We also assume that Finland's shares in ETS1 and ETS2 auction revenues will remain the same as under the current legislation. The calculation includes uncertainties related to such factors as the price development of emission allowances, future of free allocation in ETS1, and sharing of auction revenues between the Member States and EU funds.

## 3.2 SCENARIO 1: CURRENT POLICY WILL BE CONTINUED

Scenario 1 describes the situation under current legislation (Directive 2003/87/EC, Decision (EU) 2015/1814) with two separate emissions trading systems. ETS1 covers heavy industry, energy production, maritime transport and aviation, whereas ETS2 will cover road transport, separate heating of buildings and small industries outside the scope of ETS1 from 2028. In reality, Member States may also include other Effort Sharing Regulation sectors to ETS2 ('opt-in'), but detailed country-specific information is not yet available. The opt-in possibility is consequently not examined in this report, and we presume that all Member States will include the same sectors in ETS2.

The final ETS1 emission allowances for energy and industry will be allocated in 2039 and for aviation and maritime transport in 2045, after which companies will still be able to use the allowances they banked and those released from the Market Stability Reserve. Due to these banked allowances, generation of emissions will continue especially in maritime transport and aviation, even if new allowances are not allocated in the market. The cancellation of allowances in the ETS1 Market Stability Reserve will continue until 2035, and a total of 400 Mt of allowances will be released from the reserve in 2040–2043. The last ETS2 allowances will be released in 2043, after which the generation of emissions will continue owing to banked allowances until 2047. A total of 220 Mt of allowances will be released from ETS2 Market Stability Reserve in 2028–2030 and a further total of 380 Mt in 2041–2044.

### 3.2.1 ATTAINMENT OF CLIMATE TARGETS

See Figure 3 for the emission trend in scenario 1 for the EU (panel a) and Finland (panel b). EU emissions will continue to fall, particularly due to the fact that the linear reduction factors for ETS1 and ETS2 will reduce the amount of allowances to be released. ETS1 emissions in the EU will be 153 Mt in 2040. Prior to this, the ETS1 sector will achieve its 2030 target of a 62% reduction compared to the 2005 levels, with a 71% reduction in emissions. As ETS2 is launched in 2028, emissions in this sector will start to decrease faster, and in 2040 emissions in the ETS2 sector will be 304 Mt. The effort sharing sector, which will still include ETS2 in 2030, will achieve its 2030 target of 40% reduction in emissions compared to 2005 levels, as emissions are reduced by 41%. However, the achievement of this target will largely depend on how, after its launch, ETS2 will start reducing emissions from transport, heating of buildings and small industry.

Altogether, emissions trading and measures included in the WAM scenario in the remainder of the effort sharing sector and in the land use sector will be sufficient to reduce the EU's net emissions by 85.7% compared to 1990. In this case, the additional measures needed to achieve the 2040 target will amount to 203 Mt, or 4.3% of the 1990 levels. If the EU makes use of international carbon credits to account for 5% of this amount, the 90% target will be met.

Emissions trading and reductions in line with KEITO project's WAM scenario in the remainder of the effort sharing sector will be sufficient to meet the target set in the Finnish Climate Act (80% reduction in emissions compared to the 1990 levels, excl. LULUCF). In 2040 the emissions will be 12.1 Mt excluding the land use sector, corresponding to a 83.0% reduction from the 1990 levels. However, the fact that the carbon sink of forests will turn into an emission source will prevent the achievement of the carbon neutrality target laid down in the Climate Act for 2035, in which year the net emissions will be 33.1 Mt. Rather than meeting the obligation set by the EU to reduce emissions in the effort sharing sector by 50% by 2030 compared to the 2005 levels, Finland's emissions will decrease by 46%.

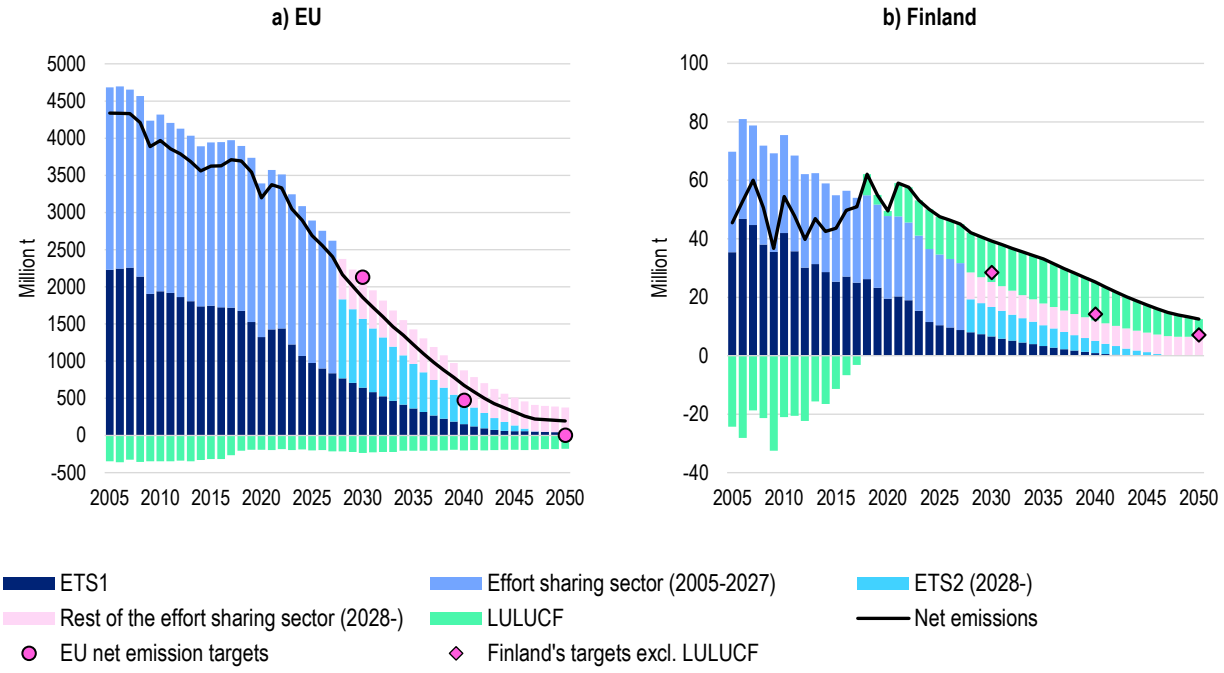


**Figure 3.** Emission trends in a) EU and b) Finland in 2020–2050, scenario 1.

### 3.2.2 ECONOMIC IMPACTS ON FINLAND

See Figure 4 for the economic impacts of scenario 1 on Finland in terms of auction revenues for the government (panel a) and emission allowance purchases for companies (panel b). The auction revenues will be allocated to Finland as part of the total EU auction revenues based on a standard share that is expected to remain unchanged throughout the review period. The auction revenues have increased in recent years as the emission allowance price has risen, and the volume of free allocations decreased.

Finland's auction revenues in the ETS1 sector are expected to remain stable at around EUR 400 million a year until the end of the 2030s. Even if fewer allowances are released, the share of auctioned allowances will gradually increase as the Carbon Border Adjustment Mechanism enters into force, and the price of allowances is raised. After this, a reduction in the number of released allowances will result in a temporary dip in revenues. However, the release of allowances from the ETS1 Market Stability Reserve will bring the auction revenues back to around EUR 300 million in 2040–2043, after which ETS1 auction revenues will rapidly drop to zero from 2046 on. Emissions trading revenues are predicted to increase significantly in 2028 as auctions of ETS2 allowances begin. The modelling shows

that in its first years, ETS2 will generate approx. one billion euros in auction revenue for Finland each year, which means that Finland's total revenues from emissions trading will reach at maximum EUR 1.6 billion in total in 2028. Subsequently, the reduction in allowances to be released will also reduce the ETS2 auction revenues which, however, will remain a significant source of income until the 2040s. While these forecasts for ETS2 are based on 2025 futures market prices, significant uncertainty is associated with the prices and auction revenues.

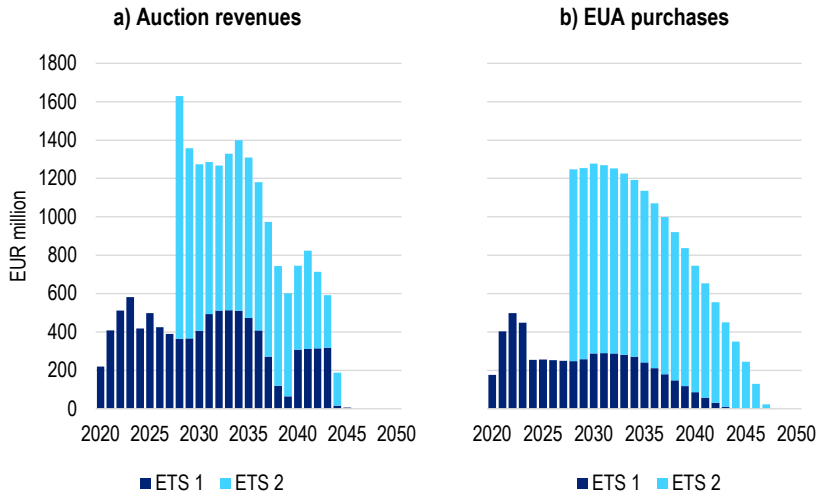


**Figure 4.** a) Auction revenues for the Finnish government and b) purchases of emission allowances by Finnish companies in scenario 1.

The costs incurred by Finnish companies from purchasing emission allowances will be lower than the auction revenues, especially in the ETS1 sector, where Finland will benefit from a relatively large free allocation. Finnish companies are predicted to purchase ETS1 emission allowances worth approx. EUR 200 million annually in the late 2030s and early 2040s, which figure will rapidly drop to zero by 2044. In the early years of ETS2, Finnish companies are expected to buy emission allowances worth approx. EUR 1 billion, explained by the fact that as there will be no free allocation in ETS2, all allowances will be auctioned. Finland's emissions in the ETS2 sector will decrease slightly more slowly than in the rest of the EU. This is due to the level of price control, which is already high, and a higher level of distribution obligation than in the rest of the EU, especially in transport. In terms of cash flows, Finland will benefit from emissions trading by collecting revenue from foreign polluters. However, this calculation of cash flows does not cover all impacts on the national economy, which should also include the costs of reducing emissions.

## 3.3 SCENARIO 2: PERMANENT CARBON REMOVALS WILL BE ADDED TO EMISSIONS TRADING

In scenario 2, permanent carbon removals are integrated into ETS1, carbon removal credits produced with BECCS increase the allowances, and companies are permitted to use these credits to cover their demand for emission allowances in full. Incorporating the carbon removal credits in ETS1 is a natural choice, as it already includes the industrial sectors that play a key role in fossil carbon capture and storage (CCS) and BECCS. Alternatively, the removal credits can replace allowances, or permanent

carbon removals can be included in ETS2. After examining the results of this scenario, we also discuss these other ways of linking them.

In practice, a producer of permanent carbon removals, such as a company producing BECCS, can create removal credits that correspond to emission allowances and sell them, either directly or through an intermediary, to companies covered by the emissions trading system. The price of the emission allowance will provide a strong incentive for carbon capture and storage, and the volume of permanent carbon removals produced will consequently increase rapidly as the emission allowance price exceeds the cost of permanent removals. In this modelling, the production of permanent carbon removals will only start when the emission allowance price rises sufficiently, in other words no earlier than the late 2030s. The expected price of emission allowances is likely to guide research and development even before this.

Because the total amount of removal credits used as emission allowances will be tied to the demand for the allowances, the volume of permanent carbon removals will start to decrease in the late 2040s. This is because reduced emissions in the ETS1 sector will no longer generate sufficient demand for the removal credits. In other words, the capacity and ability to produce permanent removals would exceed their requirement in ETS1. The question of who would pay for permanent carbon removals produced outside the emissions trading sector is left open in the scenario, and the economic analysis only focuses on what happens within the emissions trading system.

### 3.3.1 ATTAINMENT OF CLIMATE TARGETS

See Figure 5 for the emission trend in scenario 2 for the EU (panel a) and Finland (panel b). At the price of the ETS1 emission allowance, permanent carbon removals will not yet be profitable in the early 2030s. When integrated into the emissions trading system, their production will only begin once the emission allowance price exceeds the production costs. In 2040, the volume of permanent carbon removals across the EU will be 13 Mt, which means that they will play a relatively small role in achieving the 2040 target. Permanent carbon removals will rapidly increase in significance in the 2040s, however, and their volume will already be 61 Mt by the middle of the decade. From 2046 on, the demand for allowances will no longer be high enough to maintain the permanent removals, as emissions in the ETS1 sector will drop below the BECCS potential. If the permanent carbon removals are to be maintained or increased after this point, their funding must come from other sources, such as the Member States or joint EU funds. Modifying the emissions trading system in a way that creates demand for permanent carbon removal after 2040 could be another option.

ETS1 emissions will increase compared to scenario 1 (Figure 4), as removal credits will reduce the scarcity of emission allowances in the 2040s. This will make the price trajectory of emission allowances less steep and undermine the importance of emissions trading as a policy instrument from the late 2020s on. Despite this, the ETS1 sector will achieve its target for 2030 (62% emissions reduction compared to 2005), with a 67% reduction. ETS1 emissions will be 192 Mt in 2040, and 179 Mt including the negative emissions generated by permanent carbon removals. In the effort sharing sector, emissions will decrease as in scenario 1: the target for 2030 will be achieved (41% reduction compared to 2005), and emissions in the ETS2 sector will be 304 Mt in 2040.

Altogether, emissions trading, permanent carbon removals and measures included in the WAM scenario in the remainder of the effort sharing sector and in the land use sector will be sufficient to reduce the EU's net emissions by 85.2% compared to 1990. In this case, the further measures needed to achieve the 2040 target will be 229 Mt, or 4.8% of the 1990 levels. This is 26 Mt more than what will be achieved with current policy. If the EU makes use of international carbon credits to account for 5% of

this amount, the 90% target will be met. The cumulative net emissions of the EU in 2025–2050 will increase by 2.8% compared to current policies.

As far as Finland is concerned, the integration of permanent carbon removals into emissions trading will bring major changes. The volume of permanent carbon removals in Finland will be 2.9 Mt in 2040. The amount of removal credits produced for emissions trading in Finland will be at maximum 13.2 Mt in 2046, after which the permanent removals will also decline in Finland as the ETS1 sector is cleaned up, reducing the demand for removal credits. At the end of the review period in 2050, Finland's permanent carbon removals will be 10.2 Mt. In KEITO project's WAM scenario, BECCS investments in Finland will amount to 3 Mt by 2040 and 14 Mt by 2050. Consequently, the results of the modelling are in the same order of magnitude as those in KEITO scenarios.

Similarly to the situation of the EU as a whole, Finland's emissions will also increase slightly in this scenario in the 2030s compared to the current policy as the emission allowance price drops. Emissions trading, permanent carbon removals and reductions in keeping with KEITO project's WAM scenario in the remainder of the effort sharing sector will be adequate to meet the targets set in the Finnish Climate Act for 2040. In that year, the emissions will be 12.6 Mt excluding the land use sector, which corresponds to a reduction of 82.4% from the 1990 levels. Finland's net emissions will be 34.0 Mt in 2035, and the carbon neutrality target set in the Climate Act for 2035 will not be achieved. While permanent carbon removals, which will grow rapidly in the early 2040s, will bring Finland closer to carbon neutrality, the country's net emissions will still be 2.3 Mt at the end of the review period in 2050. As in scenario 1, Finland will not meet the obligation set by the EU to reduce emissions in the effort sharing sector by 50% by 2030 compared to the 2005 levels, since emissions will decrease by 46%.

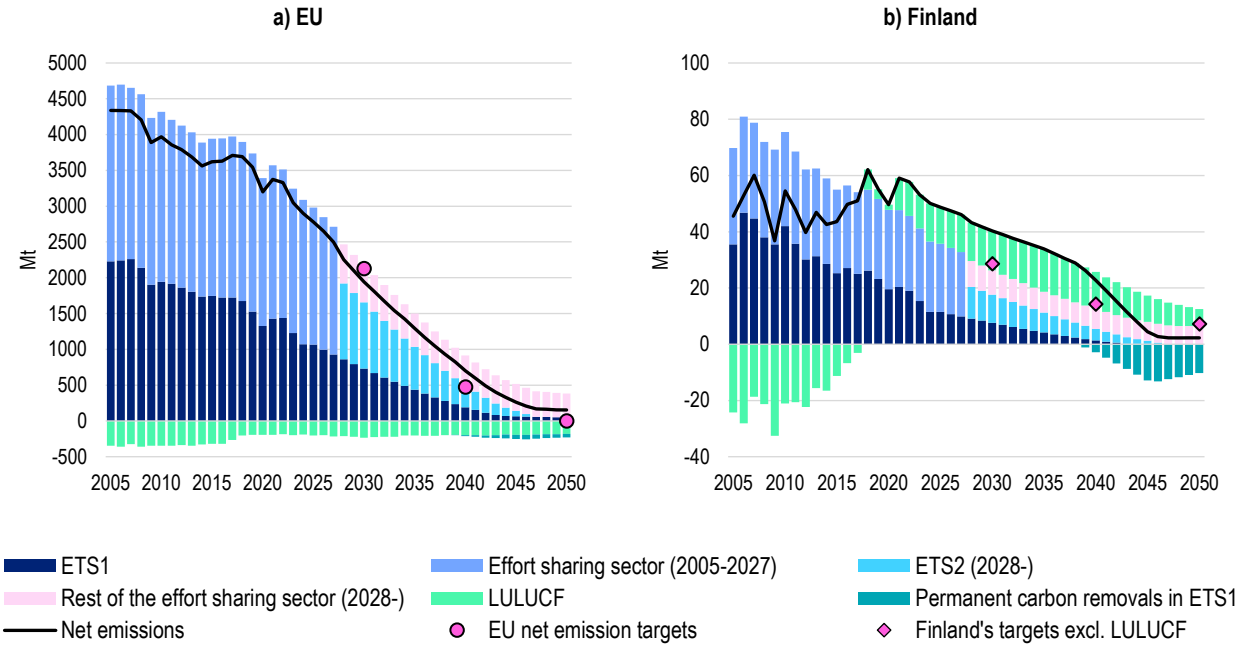


**Figure 5**. Emission trends in a) EU and b) Finland in 2020–2050, scenario 2.

Note that the capture and permanent storage of biogenic carbon will only reduce net emissions when the sustainability of the biomass used is safeguarded, and the natural carbon sinks are maintained at a

sufficient level from the climate policy perspective. Consequently, policy instruments that guarantee sustainable use of forests will be needed for the land use sector when permanent carbon removals are introduced (ESABCC, 2025b). In this report we assume that the carbon sink in the land use sector will develop in keeping with the EEA's and KEITO's WAM scenarios without being adversely affected by BECCS. However, KEITO project's WAM scenario for Finland assumes a particularly high accumulation of roundwood removals (approx. 80 million $m^3$/year), as a result of which the LULUCF sector will remain an emission source at least until 2050. Lack of balancing policy instruments, such as a Forest Act reform or a carbon rent system, poses a risk of reducing the carbon sink of the land use sector due to high harvest volumes combined with permanent carbon removals. The Commission's proposal for BECCS certification criteria was published as a Regulation under the CRCF in February 2026 (European Commission, 2026). The sustainability criteria under the Renewable Energy Directive and, indirectly, future regulation on and policy instruments for the LULUCF sector, will affect BECCS. It is possible that these criteria will later become a threat to the sustainability of BECCS in Finland if the situation of the land use sector sink is not significantly improved.

### 3.3.2 ECONOMIC IMPACTS ON FINLAND

Figure 6 shows the auction revenues received by the Finnish government (panel a), emission allowances bought by Finnish companies (panel b), and the profits from sale of removal credits to Finland (panel c). Compared to current policy (Figure 5), auction revenues will drop slightly as removal credits reduce the price of ETS1 allowances. The costs incurred by Finnish companies from buying emission allowances will also decrease slightly compared to current policy. In relative terms, however, this change will be smaller than in auction revenues, as the demand for allowances will increase.

In addition, Finland may receive profits of up to EUR 700 million a year from selling removal credits in ETS1 by the end of the 2040s. However, it should be noted that these potential profits and the emission allowance price are associated with a significant risk that is likely to affect companies' willingness to invest and may delay investments in biogenic carbon capture and storage.

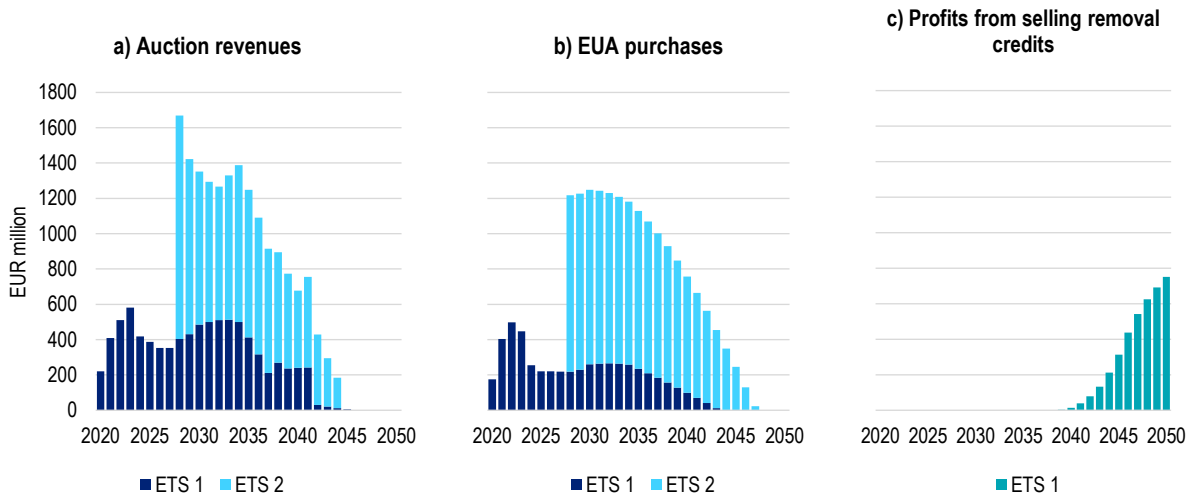


**Figure 6**. a) Auction revenues for the Finnish government, b) purchases of emission allowances by Finnish companies, and c) profits from selling removal credits for Finland in scenario 2. Of the profits from credit sales, only credits sold as ETS1 emission allowances are factored in, not non-ETS credits.

### 3.3.3 COMPARISON OF DIFFERENT METHODS OF INTEGRATING PERMANENT CARBON REMOVALS

In scenario 2, rather than reducing the number of emission allowances to be released, the full amount of permanent carbon removal credits will increase the number of allowances on the market. Companies will be permitted to buy them to cover their emissions in full. When integrated in this way, permanent carbon removals will reduce the emission allowance price but also increase net emissions. However, the removals can also be added to emissions trading using a system where the removal credits included in the emissions trading system replace allowances to be released, either in full or in part. If credits produced with permanent carbon removals fully replace allowances, the cap volume will remain the same but, since it is partly composed of removal credits, net emissions will be reduced.

Based on panel a) in Figure 7, the emission allowance price will decrease by approx. EUR 16/t$CO_2$ as a result of carbon removal integration. Whereas permanent carbon removals will only be produced in the future, this will reduce companies' need to bank emission allowances and, consequently, reduce the allowance price earlier. This will also have an impact on emissions. As we can see in panel b), Figure 8, cumulative net emissions in the ETS1 sector in 2025–2050 will be the lower, the higher the number of emission allowances to be released that are replaced with removal credits is. When the full amount of removal credits is used to increase the number of allowances, the cumulative net emissions in the ETS1 sector in 2025–2050 will increase by 791 Mt compared to current policy. A lower allowance price will reduce the number of allowances banked by companies, which will lead to a smaller Market Stability Reserve, cancellation of fewer allowances, and consequently to a higher effective cap. When removal credits are added to the allowances in full, the increase in the effective cap will exceed the amount of removal credits produced, which will increase the cumulative net emissions of the ETS1 sector.

Similarly, panel b) in Figure 7 shows how, when removal credits are used in full to reduce the number of emission allowances released, the cumulative net emissions of the ETS1 sector in 2025–2050 will decrease by 670 Mt compared to current policy. This is explained by the fact that, when removal credits are used in full to replace allowances, the cap does not change and the expected scarcity of allowances will remain the same as with current policy. In this case, there will also be no changes in the emission allowance price (Figure 8a) and, consequently, in the effective cap. As some of the allowances have been created with negative emissions, the reduction in cumulative net emissions in the ETS1 sector will equal the number of allowances replaced by removal credits.

The use of removal credits may also be limited by specifying a maximum share of the emissions that companies can offset with them. Without a limitation, companies can even offset all of their emissions with removal credits. If the maximum share of allowances that can be offset with the credits is limited, companies must cover a corresponding share of their emissions with emission allowances released by the Commission. Panel a) in Figure 8 shows how, when removal credits are used to increase the allowances in full, the emission allowance price will decrease rapidly as companies can cover an increasing share of their demand with these credits. Panel b) in Figure 8 shows how, when removal credits are used in full to increase allowances, cumulative net emissions will increase rapidly as a larger share of removal credits is allowed. When removal credits replace allowances, the opposite impact is seen: when companies are allowed to use more removal credits, the cumulative net emissions in the ETS1 sector will decrease.

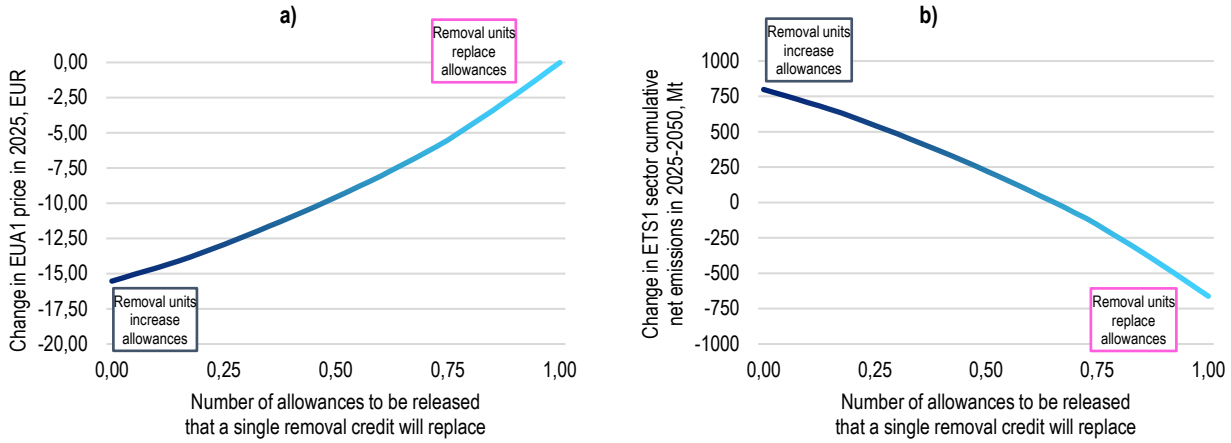


**Figure 7**. Changes in a) EUA1 price in 2025 and b) cumulative net emissions in the ETS1 sector at different parameter γ values in 2025–2050. Parameter γ determines the number of emission allowances to be released that is replaced by a single removal credit. When γ = 0, the removal credits do not reduce the number of allowances to be released at all; in other words, the amount of allowances is increased by the full amount of credits. When γ = 1, removal credits reduce the emission allowances to be released, replacing their full amount.

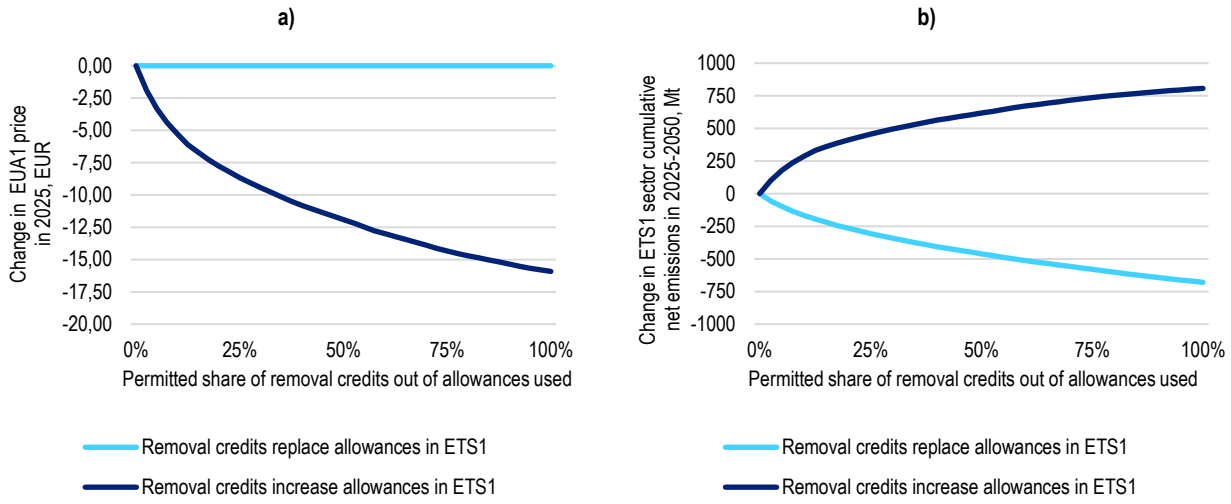


**Figure 8**. Changes in a) the price of allowances in 2025 and b) cumulative net emissions in the ETS1 sector with different values of parameter θ in 2027–2050 when removal credits either replace or increase the allowances. Parameter θ determines the share of removal credits operators are allowed to use in emissions trading each year in proportion to demand for allowances.

It is technically possible to integrate removal credits into ETS2 instead of ETS1. As we can see in panel a) in Figure 9, in this case the price of ETS2 allowances will decrease by approx. EUR 16/t$CO_2$, in other words the impacts are similar to those in ETS1. When removal credits are used in full to replace allowances, the initial price of the allowance in 2027 will always remain the same, regardless of the number of removal credits allowed. When removal credits are used in full to increase the allowances, the allowance price drops rapidly as the use of more removal credits is allowed in ETS2. This makes it possible to reduce the price of emission allowances by EUR 16. Panel b) in Figure 9 shows that cumulative net emissions in the ETS2 sector will not increase even if removal credits increase the

allowances. This is because unlike in ETS1, allowances in the Market Stability Reserve are not cancelled in ETS2. Consequently, increasing the supply of allowances with removal credits will always increase emissions by a figure that equals the negative emissions produced by permanent carbon removals. This means that the increase in the cap will always equal the amount of removal credits that companies are allowed to use. However, cumulative net emissions in ETS2 can be reduced by up to 512 Mt without increasing the allowance price if removal credits replace the allowances on the market.

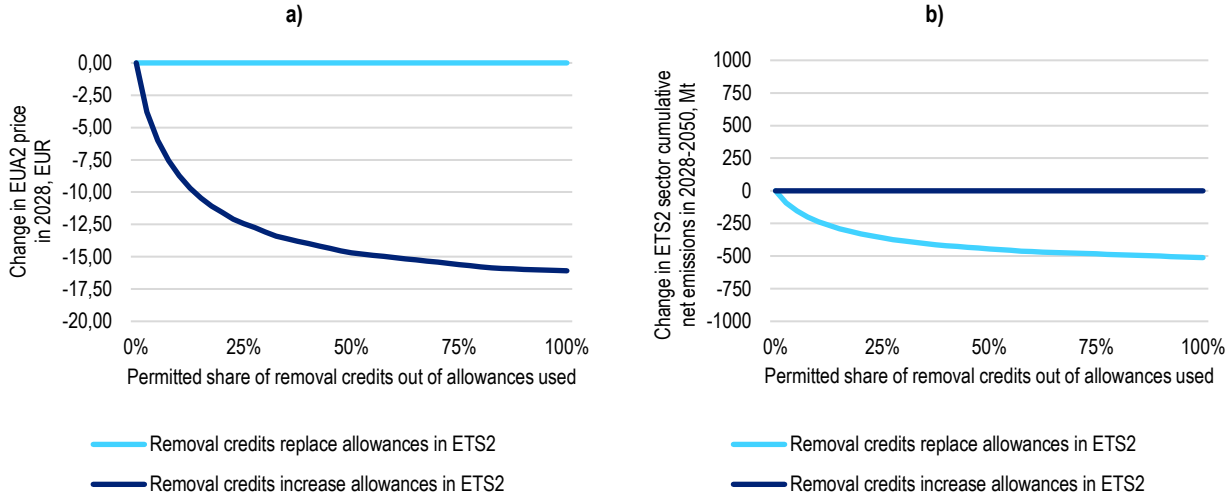


**Figure 9**. Changes in a) the price of allowances in 2028 and b) cumulative net emissions in the ETS2 sector with different values of parameter θ in 2028–2050 when removal credits either replace or increase the allowances. Parameter θ determines the share of removal credits operators are allowed to use in emissions trading each year in proportion to demand for allowances.

**Table 4**. Summary of the impacts of different ways of integrating permanent carbon removals into emissions trading system and a comparison between them and the baseline with current policy (scenario 1). (+) means that removal credits increase the allowances, while (-) means that they replace allowances. In all cases, the use of removal credits as allowances to cover all demand for allowances will be permitted.

| | Current policy | ETS1 + | ETS1 - | ETS2 + | ETS2 - |
|---|---|---|---|---|---|
| Net emissions reduction without additional measures (cf. 1990) | 85.7% | 85.2% | 86.6% | 85.9% | 86.6% |
| Additional measures needed to achieve the target for 2040 | 203 Mt | 228 Mt | 161 Mt | 196 Mt | 160 Mt |
| Cumulative net emissions of the EU in 2025–2050 | 28.7 Gt | 29.6 Gt | 28.1 Gt | 28.7 Gt | 28.2 Gt |
| Annualised auction revenues for the Finnish government in 2025–2050 | EUR 873 million | EUR 849 million | EUR 809 million | EUR 771 million | EUR 843 million |
| Annualised emission allowance purchases by Finnish companies in 2025–2050 | EUR 795 million | EUR 782 million | EUR 795 million | EUR 679 million | EUR 795 million |
| Annualised profits from sale of removal credits for Finland in emissions trading in 2025–2050 | EUR 0 | EUR 90 million | EUR 226 million | EUR 67 million | EUR 164 million |
| EUA1 allowance price in 2040 | EUR 150 | EUR 117 | EUR 150 | EUR 150 | EUR 150 |
| EUA2 allowance price in 2040 | EUR 160 | EUR 160 | EUR 160 | EUR 131 | EUR 160 |

See Table 4 for a detailed examination of the impacts these integration methods would have in comparison to the baseline with current policy (scenario 1). As we can see in the Table, scenario 2 describes the worst possible way of integrating permanent carbon removals into emissions trading in terms of climate targets, as a large number of removal credits are allowed in ETS1 and they push the emissions cap up. In this scenario, the cost pressure in emissions trading will be reduced, but less of permanent carbon removals will be produced due to weaker incentives, and the cumulative net emissions of the EU will increase. Whereas if permanent carbon removals are integrated into ETS1 in a system where removal credits replace allowances, cumulative net emissions in the ETS1 sector will decrease, and the need for additional measures to achieve the target for 2040 will be reduced. In ETS2, a higher emission allowance price creates a stronger economic incentive for permanent carbon removals than in ETS1. This reduces the need for additional measures required to achieve the target for 2040 when removals are added to ETS1.

## 3.4 SCENARIO 3: EMISSIONS TRADING SYSTEMS WILL BE INTEGRATED

In scenario 3, the separate emissions trading systems (ETS1 and ETS2) are combined into an integrated emissions market. The integration will be announced in 2030 and it will take place in 2035. In this scenario we assume that ETS1 allowances banked before the integration can, after it has taken place, also be used by ETS2 companies and vice versa. Before the integration, the allowance price in ETS2 is higher than in ETS1; this means that operators in the ETS1 sector will anticipate an increase in the allowance price, encouraging them to bank more allowances knowing that ETS2 sector companies will be willing to buy them after the integration. Similarly, ETS2 sector operators will anticipate a drop in the emission allowance price and bank fewer allowances, knowing that they will be able to buy more emission allowances from companies in the ETS1 sector in the future.

The rules of the integrated emissions trading systems and Market Stability Reserve operating policies will largely determine where the new price trajectory will settle, but the timing of the integration and the announcement concerning it will also be relevant. In most cases, the emission allowance price trajectory in the integrated emissions trading system will settle somewhere between the ETS1 and ETS2 price trajectories. However, in some cases the price trajectory may even end up at a level lower than the ETS1 trajectory or higher than the ETS2 trajectory, if the integration leads to the cancellation of a significantly smaller or larger amount of emission allowances. This scenario leads to a price trajectory that settles closer to the ETS2 trajectory (in 2040, separate prices EUR 150 in ETS1 and EUR 160 in ETS2, and EUR 159 in the integrated emissions trading system). For a detailed description of the rules of the integrated emissions trading systems and operating principles of the Market Stability Reserve, see the Appendix.

The final allowances will be released in the integrated emissions trading system in 2045, after which the generation of emissions will continue owing to banked allowances. The Market Stability Reserve will already have been depleted before this, as allowances totalling 610 million will be released from the reserve in 2041–2044. However, emissions in the integrated emissions trading sector will not reach zero by 2050, as aviation and maritime transport will continue to produce emissions, albeit at lower levels than with current policies.

### 3.4.1 ATTAINMENT OF CLIMATE TARGETS

See Figure 10 for the emission trend for EU (panel a) and for Finland (panel b in scenario 3). For clarity and comparability, ETS1 and ETS2 are shown separately in the Figure, even if they will be integrated in 2035. Before this, ETS1 sector will reach its 2030 target of a 62% reduction compared to the 2005 levels, with emissions falling by 72% by 2030. The effort sharing sector, which will still include ETS2, will achieve its 2030 target of 40% reduction in emissions compared to the 2005 levels, with a 41%

reduction in emissions. ETS1 emissions will be 141 Mt in 2040, which is 12 Mt less than with current policy. ETS2 emissions will be 305 Mt in 2040, which is 1 Mt more than with current policy. In total, emissions generated in the emissions trading sectors will be 11 Mt lower than with current policy in 2040. The cumulative emissions in the ETS1 sector in 2025–2050 will be 249 Mt less than with current policy, whereas the cumulative emissions in the ETS2 sector will increase by 11 Mt compared to current policy. Consequently, cumulative emissions generated in the two emissions trading sectors will decrease by 239 Mt compared to current policy.

Altogether, emissions trading and measures included in the WAM scenario in the remainder of the effort sharing sector and in the land use sector will be sufficient to reduce the EU's net emissions by 86% compared to 1990. In this case, the need for further actions to achieve the 2040 target will be 192 Mt, or 4% of the 1990 levels. This is 11 Mt less than what will be achieved with current policies. If the EU makes use of international carbon credits to account for 5% of this amount, the 90% target will be met. The cumulative net emissions of the EU in 2025–2050 will be reduced by 0.8% compared to current policy.

Emissions trading and reductions in keeping with KEITO's WAM scenario in the remainder of the effort sharing sector will be adequate to meet the targets set in the Finnish Climate Act for 2040, in which year the emissions will be 12 Mt excluding the land use sector, corresponding to a reduction of 83.1% from the 1990 levels. However, the fact that the land use sector will turn into an emission source will prevent the achievement of the carbon neutrality target set in the Climate Act for 2035, in which year the net emissions will be 32.9 Mt. Rather than meeting the obligation set by the EU to reduce emissions in the effort sharing sector by 50% by 2030 compared to the 2005 levels, Finland's emissions will decrease by 46%.

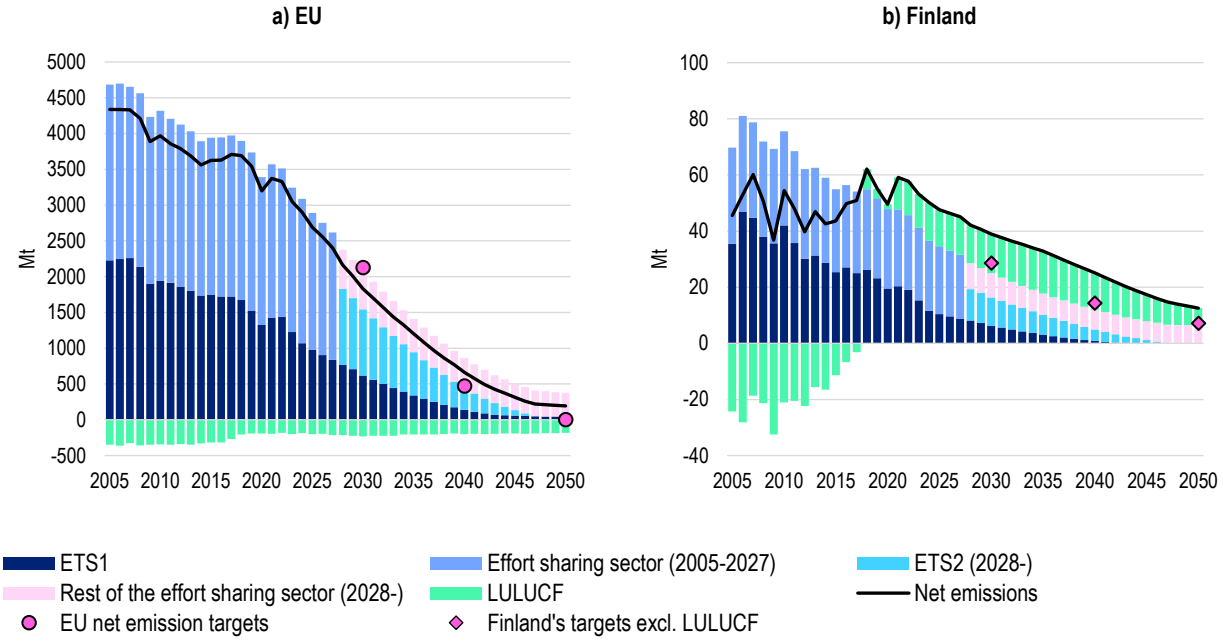


**Figure 10**. Emission trends in a) EU and b) Finland in 2020–2050, Scenario 3.

### 3.4.2 ECONOMIC IMPACTS ON FINLAND

See Figure 11 for economic impacts on Finland in scenario 3; as auction revenues for the government (panel a) and as emission allowance purchases for companies (panel b). Following 2035, or the year of emissions trading systems integration, auction revenues and allowance purchases have not been

broken down by sector between ETS1 and ETS2. The scenario assumes that Finland will also receive a standard share of the auction revenues after the integration as it has received in ETS1 and ETS2. We also assume that after the integration, free allocation will continue as before for ETS1 companies, and that there will be no free allocation for ETS2 companies.

The government's auction revenues and companies' emission allowance purchases will initially develop as shown in scenario 1 (Figure 5) if the emissions trading systems integration is not announced to the market before 2030. When announced in 2030, that the integration to take place in 2035, auction revenues from both ETS1 and ETS2 will drop slightly compared to current policy. For ETS1, this decrease is due that while the price of the allowance increases, more allowances will be transferred to the Market Stability Reserve, reducing revenues. Similarly, the drop in ETS2 revenues is explained by a decrease in the emission allowance price. However, the temporary dip in the revenues will be reversed in the early 2040s as a large number of allowances are released from the Market Stability Reserve, and a higher price than for ETS1 allowances under the current policy will be received for them.

Finnish companies' emission allowance purchases will decrease regarding both ETS1 and ETS2. In the ETS1 sector, this is explained by the high price sensitivity of companies: the decrease in the demand for emission allowances will, in relative terms, exceed the increase in the emission allowance price. For their part, ETS2 companies will increase the demand for emission allowances but their costs will decrease as the emission allowance price drops more in relative terms. Altogether, Finland's auction revenues will consequently increase, and the costs of buying emission allowances incurred by Finnish companies will be reduced compared to current policy.

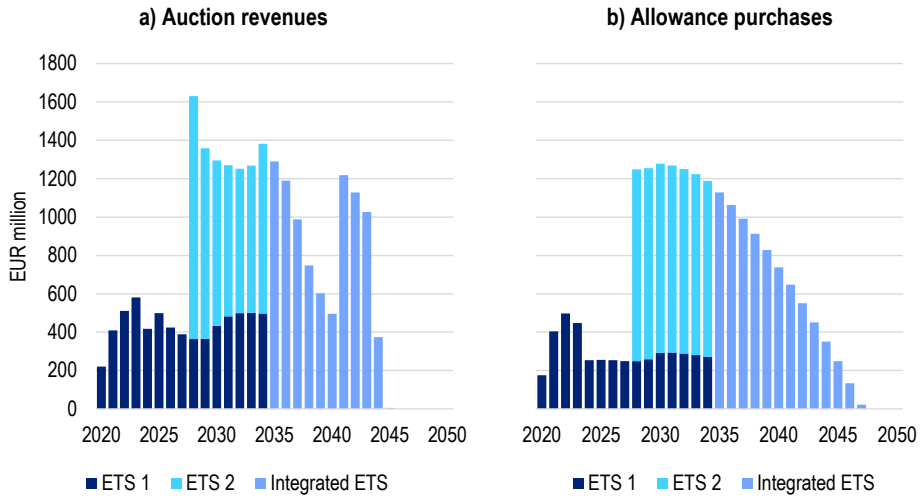


**Figure 11**. a) Auction revenues for the Finnish government and b) purchases of emission allowances by Finnish companies in scenario 3.

### 3.4.3 IMPACT OF THE TIMING OF THE ANNOUNCEMENT AND INTEGRATION

Scenario 3 assumes that emissions trading systems integration will take place in 2035 and that it will be announced in 2030, which has been assessed as a politically realistic timetable. The integration could also take place at other points in time, however, and announced even before the ETS2 launch. In this section, we compare the impact of different timings of the announcement and integration on the emissions market and achievement of climate targets. In all cases, we have assumed that the same

rules derived from the current ETS1 and ETS2 legislation will apply to the integrated emissions trading system and the operating principles of its Market Stability Reserve. For a detailed description of the rules of the integrated emissions trading system, see Appendix 6.7.

Table 5 describes the impact of the selected announcement and integration years on emissions in the emissions trading sector and the need for additional measures to achieve the 2040 target. The modelled cases show that the earlier the emissions trading systems integration is announced, the less cumulative emissions will be generated. This is due that when the markets are informed about the forthcoming integration, ETS1 companies will start to anticipate a higher emission allowance price. They will then use fewer and bank more allowances to be able to sell them later to companies in the ETS2 sector. This will enhance the functioning of the Market Stability Reserve and increase the cancellation of allowances. Scenario 3 shows that the earlier the market becomes aware of the integration, the more emissions will decrease. If the announcement of the integration is postponed to the extent that changes in companies' banking behaviour will not have time to influence the functioning of the Market Stability Reserve, the integration will have no impact on the emission trend, even if it will change the allocation of emission allowances between the ETS1 and ETS2 sectors.

**Table 5**. Additional measures needed to achieve the EU's 2040 target with different announcement and emissions trading systems integration years (with current policy, 203 Mt). The change in net cumulative emissions in 2025–2050 compared to current policy is shown in brackets.

| | | **Year of integration 2030** | **Year of integration 2035** | **Year of integration 2040** |
|---|---|---|---|---|
| **Year of announcement** | **2025** | 200 Mt (-145 Mt) | 192 Mt (-374 Mt) | 200 Mt (-138 Mt) |
| | **2030** | 200 Mt (-77 Mt) | 192 Mt (-239 Mt) | 201 Mt (-62 Mt) |
| | **2035** | - | 190 Mt (-141 Mt) | 203 Mt (0 Mt) |

Another interesting observation relates to the choice of the integration year. Out of the modelled cases, the best year for the emissions trading system integration is 2035, as it always produces fewer emissions than an earlier or later integration. The reason for this is that the emissions trading system integration may reduce emissions through two mechanisms: 1) earlier announcement improves the efficiency of the ETS1 Market Stability Reserve operation, or 2) as allowances originally issued in ETS2 are cancelled in the Market Stability Reserve of the combined ETS. The latter mechanism will not be realised if the integration is postponed to the extent that the cancellation of allowances has already ceased, or if the cancellation of allowances originally issued in ETS2 is prevented by other means in the integrated emissions trading systems. Similarly, early integration will increase the cancellation of allowances originally issued in ETS2, whereas the benefits resulting from the increased efficiency of the ETS1 Market Stability Reserve described earlier will be reduced.

The precondition for finding an optimal integration year in terms of emission trends will consequently be striking a balance between the two mechanisms. However, as a guideline we can say that if the aim of the integration is not only to boost the cost-efficiency of climate policy but also to achieve higher emissions reductions, it is advisable to announce the emissions trading systems integration as soon as possible and postpone the actual integration closer to the mid-2030s. At that time, decision-makers and

companies will also have had time to accumulate knowledge of and competence in the functioning of the ETS2 market, which will be useful in policy planning.

## 3.5 SCENARIO 4: INTERNATIONAL CARBON CREDITS WILL BE INCLUDED IN EMISSIONS TRADING

In scenario 4, international carbon credits are included in ETS1 and increase the total number of emission allowances. In negotiations held in December 2025, the Parliament, the Commission and the Council agreed that the EU could make use of international carbon credits to account for 5% of the 2040 target. In this scenario, the maximum number of international carbon credits that can be used in emissions trading has been set at 3% compared to the 1990 levels in the EU, which means that at maximum 2% can be used outside the emissions trading sector.

Even after the trilogue negotiations, the role that international carbon credits will play in the EU's climate policy architecture remains unclear. In this scenario, we assume that international carbon credits will be included in ETS1. Similar flexibilities have previously been used in ETS1, as companies were allowed to use Certified Emission Reductions referred to in the Kyoto Protocol in 2008–2012 rather than covering all of their emissions with allowances. At that time, the Certified Emissions Reductions reduced the demand for emission allowances, contributing to the low price of emission allowances in the 2010s. Some Member States and interest groups may have the political will to include international carbon credits in the emissions trading system in order to avoid high costs and emissions reductions in these sectors. It should be noted that in 2008–2012, ETS1 did not have a Market Stability Reserve similar to the current one, which ensures that the emissions cap on the market is determined by the demand for emission allowances. This is why including international carbon credits in emissions trading system would have different impacts on market dynamics than in 2008–2012. After discussing the results of the scenario, we have a brief look at other ways of integrating international carbon credits and show that the method used in scenario 4 is detrimental to achieving climate targets.

### 3.5.1 ATTAINMENT OF CLIMATE TARGETS

See Figure 12 for the emission trend for EU (panel a) and for Finland (panel b) in scenario 4. ETS1 emissions will increase compared to scenario 1 as international carbon credits will relieve the scarcity of emission allowances towards the end of the 2030s, making the price trajectory of emission allowances less steep and consequently watering down the steering effect of emissions trading right from the late 2020s. ETS1 sector emissions will be 188 Mt in 2040, and 46 Mt including international carbon credits. Before this, the ETS1 sector will reach its 2030 target, or a 62% reduction compared to the 2005 levels, as emissions are estimated to fall by 68% by 2030. As in scenarios 1 and 2, ETS2 sector emissions will be 304 Mt in 2040. Prior to this, emissions in the effort sharing sector will decrease by 41% by 2030, reaching the emissions reduction target of 40% compared to 2005.

Altogether, emissions trading and measures included in the WAM scenario in the remainder of the effort sharing sector and in the land use sector will be sufficient to reduce the domestic net emissions within the Union by 85% compared to 1990. If international carbon credits are factored in, the net reduction will be 88%. In this case, the need for additional measures will be 96 Mt, or 2% of 1990 levels, which is 107 Mt less than what will be achieved with current policy. It should be noted that as 3% of international carbon credits have already been used in ETS1 in this scenario, only 2% remain for use elsewhere. The 90% target will be met, however, if the EU uses international carbon credits accounting for 5%. The EU's cumulative net emissions in 2025–2050 will increase by 2.5% compared to current policy.

The impact of including international carbon credits in the emissions trading system will be low in Finland, as the country's ETS1 sector is expected to clean up rapidly in the 2030s, and we have

assumed that the maximum number of international carbon credits per company will be tied to the demand for emission allowances. This is why Finnish companies would only rely on as little as 1.0 Mt of international carbon credits in 2040, which is a relatively small figure compared to other Member States. As in the EU as a whole, Finland's emissions will also increase slightly in this scenario in the early 2030s. Emissions trading, international carbon credits and reductions in keeping with KEITO project's WAM scenario in the remainder of the effort sharing sector will be adequate to meet the targets set in the Finnish Climate Act for 2040, in which year the emissions will be 12.5 Mt excluding the land use sector and international carbon credits, which corresponds to a reduction of 82.5% from the 1990 levels. Finland's net emissions will be 33.9 Mt in 2035, and the carbon neutrality target set in the Climate Act for 2035 will not be achieved. As in the other scenarios, rather than meeting the obligation set by the EU to reduce emissions in the effort sharing sector by 50% by 2030 compared to the 2005 levels, Finland's emissions will decrease by 46%.

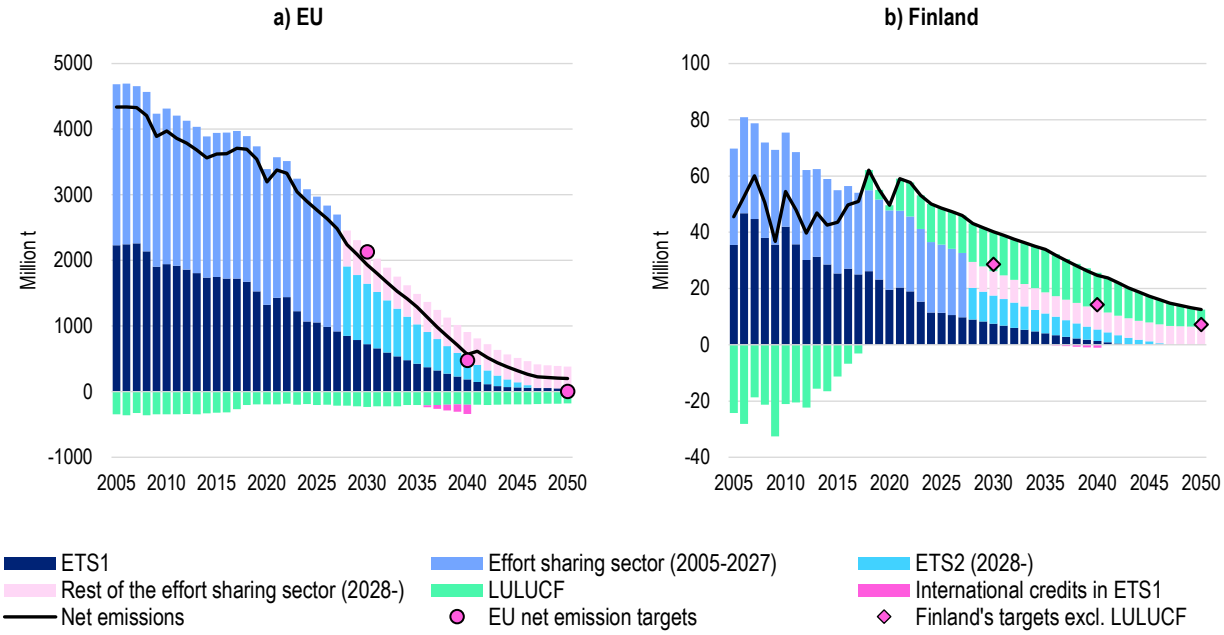


**Figure 12**. Emission trends in a) EU and b) Finland in 2020–2050, scenario 4.

### 3.5.2 ECONOMIC IMPACTS ON FINLAND

See Figure 13 for economic impacts on Finland in scenario 4; as auction revenues for the government (panel a) and as emission allowance purchases for companies (panel b). Compared to current policy (Figure 5), auction revenues will drop slightly as international carbon credits reduce the price of ETS1 allowances. Similarly, the costs of buying emission allowances incurred by Finnish companies will be slightly lower than with current policy, but in relative terms this change will be smaller than in the auction revenues, as the demand for emission allowances will increase when the price drops.

Panel b) in Figure 13 shows how in 2036–2040, Finnish companies will buy an increasing amount of international carbon credits worth EUR 60 million a year in total at the highest point. We assume that in this case, the price of the credits to be purchased will be lower or at most equal to the price of allowances. However, the costs of buying international carbon credits may be much lower than this if they are available at a significantly lower price than emission allowances. This has been seen historically, and it is expected to continue in the future (e.g. Swedish Energy Agency, 2022). The actual costs will depend on the criteria the EU sets for international carbon credits, however. Stricter criteria

will mean projects of a higher quality and consequently higher costs, while less stringent criteria will reduce costs.

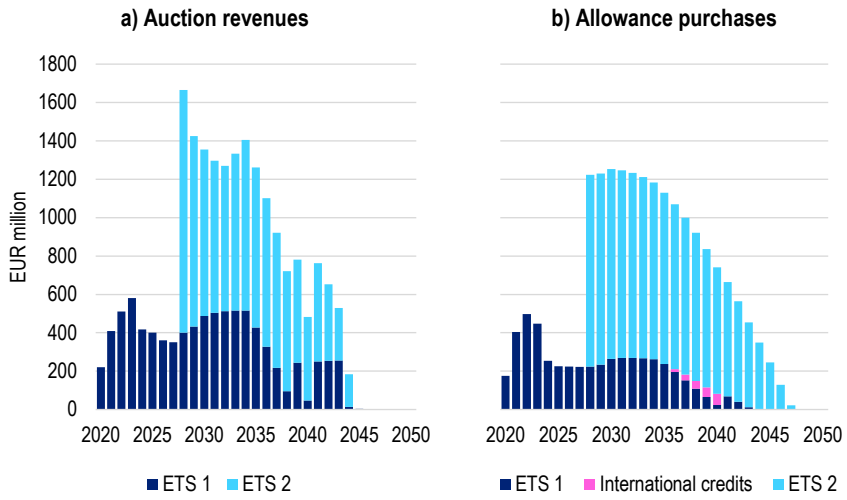


**Figure 13**. a) Auction revenues for the Finnish government and b) purchases of emission allowances by Finnish companies in scenario 4. Panel b describes the maximum number of international carbon credits purchased.

### 3.5.3 COMPARISON OF DIFFERENT WAYS OF INTEGRATING INTERNATIONAL CARBON CREDITS

In scenario 4, the amount of international carbon credits to be used in emissions trading system corresponds to 3% of the 2040 target (approx. 140 Mt), but this amount could be either smaller or larger. Panel a) in Figure 14 shows that, if international carbon credits do not reduce the number of emission allowances to be released, increasing the number of credits will rapidly decrease the emission allowance price. Permitting the use of international carbon credits to account for just 3% of the target will immediately reduce the price of emission allowances by EUR 14, as companies will bank fewer allowances for the future. Increasing the permitted amount to 5% would reduce the price by as much as over EUR 20. Similarly, ETS1 emissions will increase rapidly in a scenario in which allowing the use of international carbon credits to account for 3% will increase the cumulative net emissions in the ETS1 sector by 715 Mt in 2025–2050 through the Market Stability Reserve's operation.

International carbon credits used in ETS1 can replace allowances and hence do not need to increase the cap, if the number of new allowances is simultaneously reduced. Figure 15 shows how cumulative net emissions in the ETS1 sector in 2025–2050 will remain at the level indicated by the current policy if the number of emission allowances to be released per each international carbon credit used in the ETS1 sector is reduced by approx. 0.66 credits. If international carbon credits are used in full to reduce the emission allowances to be released, the cumulative net emissions in the ETS1 sector will decrease by 426 Mt, in other words by an amount that equals the use of international carbon credits. In this case, the emission allowance price will remain the same, but companies' costs may decrease if international carbon credits meeting the criteria are available at a lower price than emission allowances.

Consequently, the impacts of the different ways of integrating international carbon credits on ETS1 emissions and the emission allowance price are like those of permanent carbon removals (see Figures 7 and 8). In both cases either the scarcity of allowances is reduced, resulting in a lower allowance price and increased emissions, or the amount of allowances to be released is adjusted, in which case the allowance price stays the same and emissions are reduced. International carbon credits can

consequently also be integrated into ETS1 without increasing emissions, as long as the emission allowances to be released are reduced accordingly. However, it should be noted that when integrated into the ETS, the international carbon credits would compete against permanent carbon removals produced within the EU.

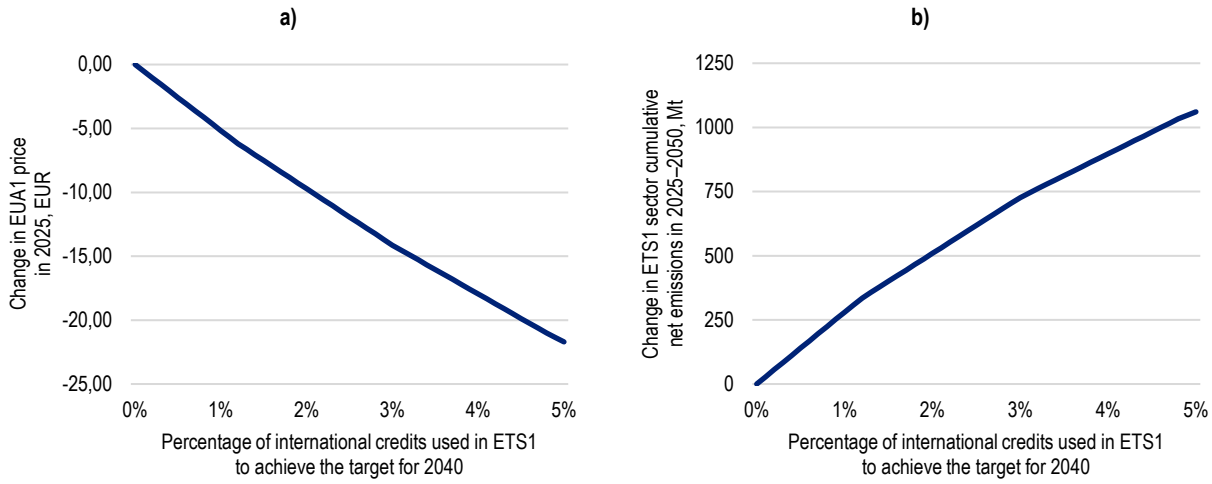


**Figure 14**. Changes in a) emission allowance price in 2025 and b) cumulative net emissions in the ETS1 sector at different parameter η values in 2027–2050. Parameter η describes the share of international carbon credits used in ETS1 to achieve the EU target for 2040.

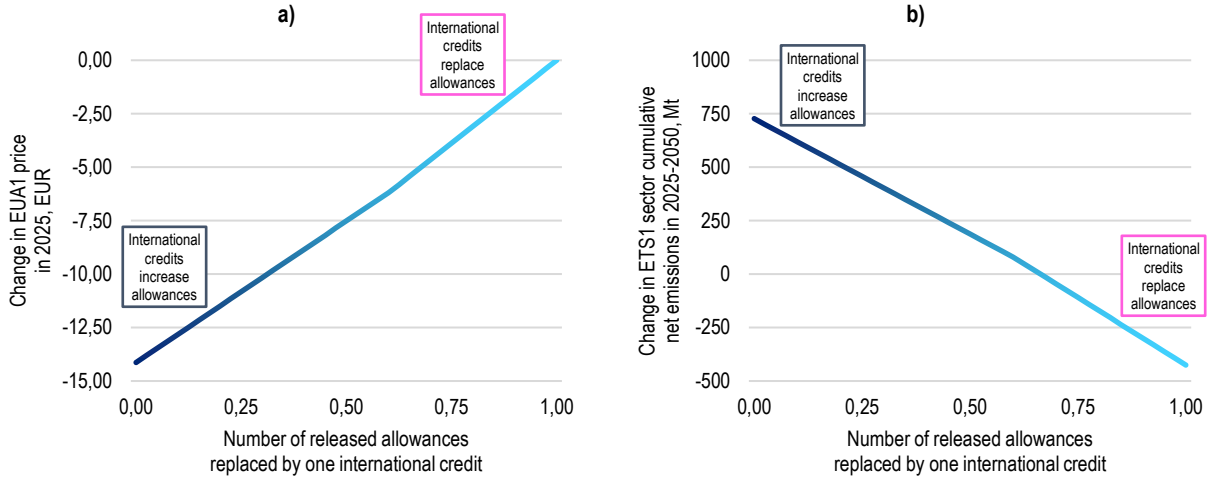


**Figure 15**. Changes in a) emission allowance price in 2025 and b) cumulative net emissions of the ETS1 sector at different parameter σ values in 2025–2050. Parameter σ determines the amount of emission allowances to be released that will be replaced by one international carbon credit used in ETS1. When σ = 0, international carbon credits will not reduce the number of allowances to be released at all; in other words, the amount of allowances is increased by the full amount of credits. When σ = 1, the credits reduce the emission allowances to be released; in other words, their full amount is used to replace allowances.

## 3.6 SUMMARY OF THE SCENARIOS

See Figure 16 for the predicted EU net emission trends according to scenarios 1–4 until 2040, at which time the EU target is a net emissions reduction of 90% compared to 1990 levels. Without additional measures, all scenarios will lead to a net emissions reduction of 85% to 88% in the EU. The highest level of emissions throughout is seen in scenario 2, where both net cumulative emissions and the need for additional measures are the greatest. Scenario 3 produces slightly faster emissions reductions than current policy (scenario 1), and the cumulative net emissions are the lowest in this scenario. In scenario 4, the emissions reductions are initially slower than with current policy (scenario 1), but the use of international carbon credits will push the emissions trajectory strongly down from 2036 on.

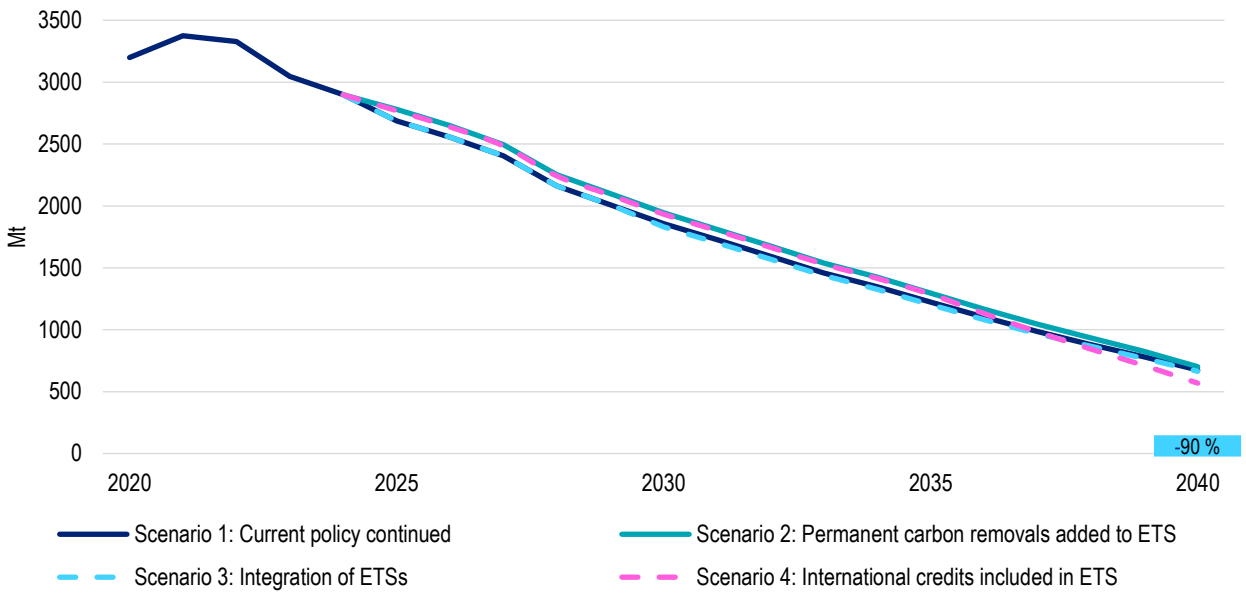


**Figure 16**. Net emission trends in EU according to different scenarios in 2020–2040.

However, Table 6 shows that scenarios 1–3, in which international carbon credits are used outside the emissions trading system achieve a higher net emissions reduction than scenario 4. Compared to current policy, the cumulative net emissions increase in scenarios 2 and 4, in which the scarcity of emission allowances in ETS1 are relieved by additional removal credits and international carbon credits. In scenarios 2 and 4, the lower price of emission allowances in ETS1 reduces the government's auction revenues compared to current policy, while it also reduces the costs of purchasing emission allowances incurred by companies. Scenario 3 produces the least amount of cumulative net emissions, and when international carbon credits are factored in, brings the EU closest to achieving the target for 2040. The emissions trading systems integration in scenario 3 increases the government's auction revenues without pushing up companies' costs.

In all scenarios, Finland achieves the target set in the Climate Act of reducing emissions by 80% compared to the 1990 levels by 2040, excluding emissions from the land use sector. Finland will not achieve the target of carbon neutrality by 2035 as set in the Climate Act in any of the scenarios without significant additional national measures since the land use sector becomes an emission source, and

further the achievement of carbon neutrality is delayed in all scenarios. Rather than meeting the obligation set by the EU to reduce emissions in the effort sharing sector by 50% by 2030 compared to 2005 levels, Finland's emissions reductions remain at 46% in all scenarios.

**Table 6**. Summary of scenarios 1–4.

| | **1 Current policy will be continued** | **2 Permanent carbon removals into ETS1** | **3 Integration of ETS1 and ETS2** | **4 International credits added to ETS1** |
|---|---|---|---|---|
| Domestic reduction in net emissions by 2040 compared to the 1990 levels (incl. 5% international credits) | 85.7% (90.7%) | 85.2% (90.2%) | 86.0% (91.0%) | 85.0% (90.0%) |
| EU's cumulative net emissions without additional measures 2025–2050 (cf. scenario 1) | 28.7 Gt | 29.6 Gt (+2.8%) | 28.5 Gt (-0.8%) | 29.5 Gt (+2.5%) |
| Finland’s net emissions in 2035 | 33.1 Mt | 34.0 Mt | 32.9 Mt | 33.9 Mt |
| Finland’s emissions reduction (excl. LULUCF) in 2040 compared to 1990 level | 83.0% | 82.4% | 83.1% | 82.5% |
| Annualised auction revenues for the Finnish government in 2025–2050 | EUR 873 million | EUR 849 million[3] | EUR 903 million | EUR 854 million |
| Annualised emission allowance purchases by Finnish companies in 2025–2050 | EUR 795 million | EUR 782 million | EUR 793 million | EUR 775 million |

To ensure that EU climate policy would support not only the achievement of the EU 2040 target but also Finland’s progress towards its own national targets, scenarios’ results and their interpretation shows that the EU should 1) integrate the emission trading systems, announce the integration as soon as possible and postpone it to the mid-2030s, 2) integrate permanent carbon removals into the emissions trading system in a system where removal credits produced for the market reduce the number of allowances released, and 3) keep international carbon credits outside the emissions trading system.

## 3.7 PLANNING OF FINLAND’S NATIONAL CLIMATE POLICY AND ITS COORDINATION WITH EU CLIMATE POLICY

With the emissions reductions shown in scenarios 1–4, Finland will remain approximately 33 to 34 Mt short of the carbon neutrality target set in the national Climate Act for 2035. However, Finland will achieve the target of reducing emissions by 80% set for 2040 in the Climate Act compared to the 1990 levels, excluding in the land use sector. The modelling shows that emissions reductions in Finland will reach 82% to 83% in 2040. From this perspective, Finland may also wish to achieve an emission level lower than this nationally. The modelling indicates that emissions at the EU level will decrease by 81% to 82% by 2040, excluding the land use sector.

[3] Depending on the arrangements in the carbon removal credit market, either the Finnish government or Finnish companies will additionally receive EUR 90 million in annual profits from sale of removal credits in ETS1.

When Finland plans and implements its national climate policy for the 2030s, measures can be sought in the areas itemised below.

1. ETS1 sector: Additional measures to reduce emissions, cancellation of EUA1 allowances.
2. Effort sharing sector: Additional measures in ETS2 sectors or the remainder of the effort sharing sector, cancellation of EUA2 allowances.
3. Permanent removals: Production of permanent carbon removals.
4. Land use sector: Measures that increase the sink in forest land, in particular.

According to the modelling produced for this report Finland's emissions will be 17.6 to 18.7 Mt in 2035, excluding the land use sector. By then, the potential of permanent carbon removals will remain rather limited, or 1.8 Mt according to the KEITO project's WAM scenario. Correspondingly, the land use sector will be an emission source amounting to 15.3 Mt in the KEITO WAM scenario in 2035. For Finland to achieve the carbon neutrality target by 2035, emissions must be equal to removals. The carbon neutrality target can consequently only be attained if the sinks in the land use sector are strengthened. The extent of the measures needed in the land use sector depends on the volume of emission reductions elsewhere. Note that if measures excessively target the emissions trading and effort sharing sectors, the cost-efficiency of climate policy will suffer, and the pursuit of carbon neutrality will become more expensive. Therefore, strengthening the sinks in the land use sector is not only a prerequisite for achieving carbon neutrality but also improves the cost-efficiency of climate policy.

This report’s modelling shows that Finland's emissions will be 0.8 to 1.4 Mt in the emissions trading sector and 11.2 Mt in the effort sharing sector in 2040. ETS2 will at that time cover around 37% of the emissions in Finland's effort sharing sector which will be approx. 4.1 Mt. according to the modelling. Emissions in the remainder of the effort sharing sector will decrease more slowly and be 7.1 Mt in 2040 according to KEITO project's WAM scenario. Consequently, the effort sharing sector outside ETS2 accounts for 58% of all emissions in Finland, excluding the land use sector. As emissions decrease, improving cost-efficiency will become more important, since achieving new emissions reductions will be more difficult. If Finland decided to increase the ambition of its national target for 2040 to match or exceed the EU target, it is likely from the perspective of cost-efficiency that cheapest emissions reductions are found in the non-ETS2 effort sharing sector, where the pricing of emissions fluctuates.

Next, we examine how Finland’s national climate policy can be coordinated with the EU climate policy so that emissions reductions in Finland will also promote the achievement of EU targets.

### 3.7.1 ADDITIONAL MEASURES IN THE EMISSIONS TRADING SECTOR

Due to the operation of the Market Stability Reserve, the ETS1 cap is endogenous; this means that the final level of emissions will be determined by not only the number of allowances released by the Commission but also the demand for and banking of allowances on the market. This is due to the Market Stability Reserve and the cancellation of allowances in it. The impact of additional national measures on EU level emissions will depend on their impact on the Market Stability Reserve dynamics. Additional measures may either reduce or increase emissions, depending on their timing and whether they target the demand for or supply of allowances.

Finland can strive to reduce emissions by taking measures that overlap with the emissions trading sector, which could include raising the national carbon tax. If the additional emissions reductions take place in the years when allowances are still being transferred to the Market Stability Reserve (in the modelling, this will be up till 2033–2035), the surplus of emission allowances resulting from reduced

demand will be transferred to the Market Stability Reserve and can be cancelled. The future scarcity of emission allowances will not change, which means that there will also be no changes in the allowance price, consequently the demand for emission allowances will not increase elsewhere. Thus, the 'waterbed effect' will be avoided, and the additional emissions reductions achieved in Finland will also actualize as reduced emissions at EU level (Perino, 2018; Gerlagh et al. 2021).

The situation may change if additional emissions reductions are only made after the transfer of allowances to the Market Stability Reserve has ceased. If there are primary knowledge that additional emissions reductions will be made later, markets will start to anticipate a situation where allowances are less scarce. This will decrease the emission allowance price, and the demand for the allowances will increase elsewhere even before the additional measures are taken. If the increasing demand leads to fewer allowances being cancelled in the Market Stability Reserve, additional national measures may, at worst, increase total emissions at EU level. However, the concern over the waterbed effect is less acute in Finland, as the clean-up of the Finnish emissions trading sector will mainly take place before the transfer of allowances to the Market Stability Reserve ceases (the modelling indicates that in 2035, the emissions will only be 3.1 to 4.2 Mt). This is why additional measures can be taken in the ETS1 sector without the likelihood of increasing emissions elsewhere.

It is also possible for Finland to refrain from auctioning part of the allowances and to cancel them (Böhringer and Fischer, 2023). This will produce the opposite impact. If Finland cancels allowances while they are still being transferred to the Market Stability Reserve, Finland’s additional cancellations will be reflected on the number of allowances to be cancelled directly in the reserve, and emissions will not decrease at EU level. Similarly, if Finland only cancels allowances after the transfer of the allowances to the Market Stability Reserve has ceased, this will not replace cancellations made in the reserve. This would mean that Finland's cancellations will genuinely reduce emissions at EU level. If the markets start to anticipate a greater scarcity of emission allowances earlier, the emissions reduction at EU level may exceed the cancellations multiple times.

### 3.7.2 ADDITIONAL MEASURES IN THE EFFORT SHARING SECTOR

Under the current legislation the ETS2 cap would be endogenous, similarly to ETS1, but as a result of changes to be made in it (European Commission, 2025d), the cap will be exogenous. This means that cumulative emissions in the ETS2 sector will be determined by the allowances released on the market. Even if the demand for allowances decreases in an individual sector, emissions will not decrease at EU level, as these allowances would be used elsewhere. Hence, the waterbed effect would be perfect in ETS2.

Finland may decide to take additional measures in the transport sector that will reduce the demand for ETS2 emission allowances. Such measures could include raising the distribution obligation beyond the previously agreed level. The relative scarcity of allowances will decrease as the demand is reduced, while the supply remains unchanged. This will reduce the allowance price. In this case, Finland aimed emission reduction would not fully actualize on the EU level: the emissions of Finnish transport sector are reduced but with EU ETS, they are transferred to other countries and sectors. However, a lower emission allowance price may increase the acceptability of the system as overlapping policy instruments keep the price of ETS2 emission allowances low. If Finland sought to secure the full impact of overlapping instruments at EU level, ETS2 allowances should be cancelled correspondingly. As the ETS2 cap is exogenous, unlike the ETS1 cap, the timing of cancellations does not affect the end result, and emissions will always be reduced at EU level, equalling the number of cancellations.

In the effort sharing sector outside ETS2, this waterbed effect will not come into play. As the price of ETS2 emission allowances is expected to settle at a relatively high level, in terms of acceptability of

climate policy it is advisable to search reductions in effort sharing sector emissions also in other areas of this sector. On the other hand, from the perspective of the cost-efficiency of emissions reductions, it is advisable to promote extensive and uniform pricing of emissions, in which case Finland should use emissions trading system carbon pricing as extensively as possible across sectors.

# 4. CONCLUSIONS

**Pricing of emissions promotes cost-effective emissions reductions.** The importance of cost-efficiency will be stressed when the more stringent EU and Finland climate targets come into play and the low-hanging fruits have already been picked in reducing emissions. Expanding the pricing of emissions, either by expanding emissions trading system or by means of taxation or subsidies, will promote the cost-efficiency of climate policy. While the emissions trading systems will cover around 80% of EU emissions in 2028, the importance of non-ETS sectors will increase as year 2040 approaches. In 2040, the non-ETS effort sharing sector will cover roughly a half of EU level emissions, unless more efficient policy instruments than those shown in the WAM scenario are introduced.

Emissions trading creates a price on emissions and, consequently, provides an incentive for companies to reduce their emissions. If companies manage to reduce their emissions, they can in some cases even benefit from emissions trading, either through free allocation or if the emission allowance price is partially passed on to the price of the final product, such as electricity (Bushnell et al., 2013; Colmer et al., 2025). An individual country can similarly benefit from emissions trading if its emissions decrease faster than those of others. Whereas Finland's emissions trading sector emissions (ETS1) have decreased faster than in the rest of the Union, Finland’s auction revenues are determined as a fixed share of the EU’s auction revenues. Finland benefits from emissions trading because the auction revenues gained by the state do not decrease at the same rate as purchases of emission allowances based on Finnish companies' emissions and the resulting costs.

**Permanent carbon removals should be integrated into emissions trading with caution.** Permanent carbon removals can be added to the emissions trading system by allowing removal producers to create removal credits, which polluting companies can buy and use in the same way as emission allowances. If they are integrated into emissions trading, the production of permanent carbon removals will only start once the price of emission allowances has risen sufficiently. The modelling shows that this would only happen in the late 2030s. In the early stages, it might be appropriate to support permanent carbon removals nationally, for example through aid allocated based on a tendering process or carbon contracts for difference, as the emission allowance price does not provide a sufficient incentive for investments and the risk of fluctuations in the allowance price may slow down investments.

The integration of permanent carbon removals in emissions trading system may have two types of impacts on emissions, depending on how it is done. If permanent carbon removals are linked to emissions trading without taking them into account in the number of released emission allowances, the modelling indicates that they will reduce the emission allowance price by approx. EUR 16/t$CO_2$. In this case companies will bank fewer allowances, which will undermine the efficiency of the Market Stability Reserve and increase emissions. However, if the EU reduces the number of allowances to be released in proportion to the anticipated volume of removals incorporated in the ETS, the allowance price will not drop, and the permanent removals will reduce total emissions. Another option is to limit the use of removal credits produced by permanent carbon removals at company or branch level and possibly only permit their use in selected sectors.

The like-for-like principle should be applied to the permanent carbon removals: fossil emissions covered by emissions trading system should only be replaced with permanent carbon removals, in other words

direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS). Finnish companies have significant potential especially in the capture of biogenic carbon dioxide, and integrating permanent carbon removals into emissions trading will consequently create an incentive and a potential source of income for companies. However, this potential will only be realised if Finland meets the sustainability criteria for permanent carbon removals, and in this respect, the sustainability of biomass plays an important role for BECCS. Finland should consequently ensure the sustainability of biomass by introducing the necessary policy instruments for the land use sector to guarantee that this sector will again become a carbon sink rather than an emission source.

**The long-term aim should be at integration of the emissions trading systems.** The EU's existing emissions trading system (ETS1) and the system for transport, heating of buildings and additional sectors (ETS2) will operate as separate systems from 2028 on. This is justified in the early stages to make it possible to learn about the operation of the ETS2 market without jeopardising ETS1 operation. In the long term, however, the price difference between the systems will undermine cost-efficiency, and keeping the systems separate will no longer bring significant benefits. At that time, the systems should be integrated by allowing free access to allowances between the sectors covered by both systems. The integration is likely to increase the price of ETS1 allowances and consequently strengthen incentives for reducing industrial emissions, and similarly to reduce the price of ETS2 allowances and promote the acceptability of the scheme.

The emissions trading systems integration could take place in the mid-2030s. If the integration is announced in advance, converge of emission allowance prices is likely to begin rapidly. This would enhance the cost-efficiency of the policy even before the actual integration takes place. The integration would additionally reduce total emissions more quickly by making the ETS1 Market Stability Reserve's operation more effective as ETS1 companies would bank more allowances in order to sell them later at a higher price to ETS2 companies. It is also possible that allowances originally released in ETS2 would be cancelled in the integrated emissions trading, which would further reduce emissions.

**International carbon credits should not be linked to emissions trading.** The EU has decided to allow the use of international carbon credits to account for no more than 5% towards achieving the climate target. The EU should basically achieve its net emissions reduction target of 90% through domestic measures. Analyses show that while an emissions reduction target set at closer to 95% combined with international climate cooperation would enhance the global fairness of the target, the 90% to 95% emissions reduction does not fully correspond to the EU's fair share of global mitigation (ESABCC, 2024; Finnish Climate Change Panel, 2023).

If, nevertheless, international carbon credits are to be used, the EU should only use high-quality credits and create its own system to ensure their quality. International carbon credits should not be linked to emissions trading. The modelling shows that integrating all international carbon credits (5% the 1990 levels) would reduce the price of emission allowances by more than EUR 20/tCO2, which would significantly reduce industry’s incentives for emissions reductions. Such a price impact was previously observed in 2008–2012 as the EU allowed the use of carbon credits referred to in the Kyoto Protocol in the emissions trading system. In addition, international carbon credits would probably replace more expensive permanent carbon removals, and lower emission allowance prices would consequently undermine incentives for producing these removals.

**National climate action continues to play an important role.** The EU climate policy and the 90% emissions reduction target set the minimum level for the Member States' climate policy. Member States can aim for more ambitious emissions reductions on a voluntary basis. The scenarios show that, excluding the land use sector, Finland’s emissions will decrease to the level of 17–19 Mt by 2035, but

because of the land use sector, Finland will not reach its carbon neutrality target. Instead, the emissions reduction target set in the Finnish Climate Act for 2040 (80% compared to the 1990 levels, excl. LULUCF) appears modest in the light of the EU target for 2040 and the modelled scenarios. National emissions reductions exceeding the EU climate policy and targets can be achieved in different sectors. The most cost-effective measures can be found in the land use sector, and to achieve the carbon neutrality target, the land use sector must be become a clear carbon sink. Emissions reductions in the emissions trading sector (ETS1) will genuinely also reduce emissions at the EU level through the operation of the Market Stability Reserve. This impact may not be full, but it can be enhanced by cancelling allowances. Measures in the effort sharing sector that overlap with the emissions trading system for buildings, road transport and additional sectors (ETS2) will not reduce EU-level emissions unless emission allowances are also cancelled. To secure emissions reductions, additional national measures should be targeted at the non-ETS effort sharing sector.

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# 6. APPENDIX

The appendix describe the material used for the report and the emissions trading model that illustrates emissions trading under current legislation (scenario 1) and its possible changes (scenarios 2–4).

## 6.1 BASIC DYNAMICS OF THE EMISSIONS TRADING SYSTEM MODEL

The basic dynamics of the emissions trading system (ETS) model corresponds to the model presented by Gerlagh et al. (2021). See Table 7 for the equations that describe the model's dynamics.

**Table 7**. Description of the ETS model's basic dynamics.

| Description | Equation | Notes |
|---|---|---|
| Annually released allowances | $S_t = \sum_i S_{i,t}$ | Allowances will be reduced based on a linear factor and other rules |
| Demand | $D_t = \sum_i D_{i,t}$ | See Table 8 for the parameters of demand functions for individual sectors |
| Market Stability Reserve | $M_t = M_{t-1} + M_t^{in} - M_t^{out} - I_t$ | In ETS1 $M_{2024} = 808{,}744844$[4], in ETS2 $M_{2026} = 600$[5] |
| Banked allowances (TNAC) | $B_t = B_{t-1} + S_t - D_t - M_t^{in} + M_t^{out}$ | In ETS1 $B_{2024} = 1148{,}049585$[6] and $B_{2050} = 0$ in ETS2 $B_{2027} = 0$ and $B_{2050} = 0$ |
| Emission allowance price | $\tau_t = \tau_{t-1} \times (1 + \delta)$ | In ETS1 $\tau_{2025} = 72$[7], in ETS2 $\tau_{2028} = 89{,}25$[8], $\delta = 0{,}05$ in both |

## 6.2 SELECTION OF DISCOUNT RATE AND CALIBRATION POINTS

As a scarce resource, emission allowances can be compared to non-renewable natural resources, and the Hotelling Rule (1931) can be applied to their price trajectory. This means that the allowance price increases each year by the discount rate. Selecting the discount rate is critical for the results: a low rate generates more cancellations of allowances in the Market Stability Reserve and consequently less emissions, while a high rate reduces cancellations and increases emissions. This effect has been observed in various studies (Osorio et al., 2021). In this report, we use a discount rate of 5%, the level

[4] Source: Communication from the Commission C/2024/3415
[5] Source: Decision (EU) 2015/1814
[6] Source: Communication from the Commission C/2025/3180
[7] Estimated based on actual average price between January and November 2025 (EEX, 2025).
[8] Estimated based on futures price (ICE, 2025) and earlier modellings (incl. Günther et al., 2025).

of which corresponds to the rate used in other literature (e.g. Beck and Kruse-Andersen, 2020; Gerlagh et al., 2021). Price development in the futures market would support the use of a lower discount rate, whereas a higher rate would reflect market uncertainty better, and 5% consequently works as a kind of compromise between the two perspectives.

The demand functions for individual sectors were calibrated to produce the desired initial price for emission allowances in the model. The calibration point for ETS1, EUR 72 in 2025, is based on the average price at auctions held in 2025 (EEX, 2025). The selection of the calibration point for ETS2 is associated with major uncertainties. Futures have been traded since May 2025, but the volume has been small and the price has fluctuated considerably. The price of futures fell sharply in October 2025 as changes to ETS2 were announced (European Commission, 2025e). However, a stable price of EUR 85 recorded in summer 2025 was selected as the calibration point, and by applying the discount rate, EUR 89.25 was obtained as the price for 2028. The sudden change in the price of futures in October 2025 was consequently ignored, as the initial price of ETS2 still involves major uncertainties and previous modellings (e.g. Abrell et al., 2024; Günther et al., 2025; Rickels et al., 2023) support a higher EUA2 price.

## 6.3 MARKET STABILITY RESERVE'S OPERATING PRINCIPLES

ETS1 and ETS2 have Market Stability Reserves aimed at regulating the Total Number of Allowances in Circulation (TNAC), thereby mitigating the fluctuation in the market price of the allowance. However, the main impact of the Market Stability Reserve on ETS1 and ETS2 is different. In ETS1, the Market Stability Reserve reduces allowances in circulation, increasing their price. In ETS2 the reserve has the opposite impact, as it increases the number of allowances on the market and reduces their price.

The operating principles of the Market Stability Reserve for ETS1 laid down in Decision 2015/1814 are as follows:

- When TNAC ≤ 400 Mt, 100 Mt of allowances ($M^{out}$) are released from the reserve to be auctioned.
- When 833 Mt < TNAC ≤ 1,096 Mt, allowances equalling the difference between TNAC and the 833 Mt threshold are transferred to the reserve ($M^{in}$). When TNAC > 1,096 Mt, allowances corresponding to 24% of TNAC (12% from 2030) are transferred to the reserve.
- Allowances (I) exceeding the 400 Mt threshold are cancelled in the reserve.

The operating principles of the Market Stability Reserve for ETS2 laid down in Decision 2015/1814 are as follows:

- When TNAC < 210 Mt, 100 Mt of allowances ($M^{out}$) are released from the reserve.[9] In addition, if the allowance price exceeds EUR 45 in 2028–2030, 40 Mt of allowances will be released from the reserve for auction.[10]
- When TNAC > 440 Mt, 100 Mt of allowances are transferred to the reserve ($M^{in}$).

[9] The Commission has additionally proposed that allowances be also released from the reserve when TNAC is between 210 and 260 Mt (European Commission, 2025d). This was ignored in the modelling, however.
[10] In Directive 2003/87/EC, the threshold is linked to the Harmonised Index of Consumer Prices of 2020. This was ignored in the model, however, as the threshold will be exceeded by a long shot anyway. 20 Mt of allowances are released at a time, and this can be done twice a year. In the model, we assume that this will be the case.

- No allowances are cancelled (I).[11]

## 6.4 SUPPLY OF EMISSION ALLOWANCES

We assume that no changes will be made to the linear reduction factors and that allowances will be released annually as stated in Directive 2003/87/EC.

The linear reduction factor for ETS1 will be 4.3% until 2027 and 4.4% from 2028. A total of 1,322 million allowances are released in 2025. While the final allowances for stationary installations will be released in 2038, the issue of new allowances for aviation and maritime transport will continue in the 2040s until 2043 and 2045.

In ETS2, the linear reduction factor is 5.38%. In 2028, 1,266 million allowances will be released, including a 30% increase in the first year as stated in Directive 2003/87/EC. A number corresponding to this increase will be deducted from emission allowances released in 2030–2032. The last allowances will be released in 2043.

## 6.5 DEMAND FOR ALLOWANCES

The demand for emission allowances is modelled using linear demand functions for individual sectors that depend on time and the emission allowance price.

We assume that the demand function for a commodity generating emissions is expressed as $\dot{Q} = \dot{a} - \dot{b}p$, in which $\dot{a}$ is demand when the product price is zero, $\dot{b}$ is price sensitivity, and $p$ is the product price. The price flexibility of the commodity in this case is $\varepsilon = -\dot{b}p/(\dot{a} - \dot{b}p)$, of which the solved price sensitivity is $\dot{b} = \dot{a}\varepsilon/p(\varepsilon - 1)$. When these values are placed in the demand function, the result is $\dot{Q} = \dot{a} - p\dot{a}\varepsilon/p(\varepsilon - 1)$. We presume that the unit-specific emissions of the commodity are $\rho$ and that the emission allowance price is reflected fully in the commodity price. The demand for emission allowances that corresponds to the demand for the commodity can now be expressed as

$$\rho\dot{Q} = \rho\left[\dot{a} - \frac{\dot{a}\varepsilon}{p(\varepsilon-1)}(p + \rho\tau)\right].$$

By rearranging the equation, we get

$$\rho\dot{Q} = \rho\left[\frac{\dot{a}}{1-\varepsilon} - \frac{\dot{a}\varepsilon}{p(\varepsilon-1)}\rho\tau\right].$$

When there is no price on emissions, they are $a = \rho\dot{a}/(1 - \varepsilon)$. Price sensitivity for the emission price is $b = |\varepsilon|\rho/p$. We express this as $\rho\dot{Q} = Q$. This way, the demand function of emission allowances, accounting for relative change in demand over time, can be expressed as

$$Q(t,\tau) = (a - b_t a\tau)(1 + ct),$$

[11] Decision 2015/1814 states that all allowances in the reserve should be cancelled in 2030. In line with the proposal of the European Parliament and the Council (European Commission, 2025d), we however assume that this cancellation will not take place.

in which $a$ is the theoretical maximum demand for allowances (in other words, emissions when the allowance price is zero), $t$ is time, $b_t$ is price sensitivity at a point in time $t$, $\tau$ is emission allowance price, and $c$ is relative change in demand over time.

The demand functions for individual sectors were calibrated with estimates based on literature and the available data.

### 6.5.1 Energy production and industry

Price sensitivity is based on a study by Gerlagh et al. (2021), and we assume that it remains constant. Theoretical maximum demand was determined separately for Finland and the rest of the EU. To achieve this, price sensitivity, the actual average price of emission allowances in 2024 (EEX, 2025) and sector-specific emissions (EEA, 2025b) were used. The relative change in demand was calibrated to produce the price of EUR 72 for 2025 in the model[12].

### 6.5.2 Maritime transport

Price sensitivity was derived from the results of a study by Mundaca et al. (2021). To determine the theoretical maximum demand, we used price sensitivity, the actual average price of emission allowances in 2024 (EEX, 2025) and sector-specific emissions (EEA, 2025b). The relative change in demand was calibrated by combining the impact of the FuelEU Maritime Regulation (Regulation (EU) 2023/1805) with the baseline of emissions (EEA, 2024). Maritime transport will be incorporated in ETS gradually from 2024 on a schedule where operators in this sector must surrender allowances corresponding to 40% of their verified emissions in 2024, 70% in 2025 and 100% from 2026 on.

### 6.5.3 Aviation

Price sensitivity was derived from the results of studies by Fageda and Teixidó (2022) and Colmer et al. (2025). To determine the theoretical maximum demand, we used price sensitivity, the actual average price of emission allowances in 2024 (EEX, 2025) and sector-specific emissions (EEA, 2025b). The relative change in demand was calibrated by combining the impact of the ReFuelEU Aviation Regulation (Regulation (EU) 2023/2405) with baseline emissions (EEA, 2024).

### 6.5.4 Transport, buildings and small industry (ETS2)

The theoretical maximum demands for individual sectors in the rest of Europe are based on the WAM scenario (EEA, 2025c). We assume that emissions in the effort sharing sector are distributed between different sectors in the same proportion as the actual emissions in 2024. Finland's itemised shares were deducted from the emissions of the Union. We assume that small industry in the ETS2 sector accounts for 58% of industry in the effort sharing sector (Rickels et al., 2023). Price sensitivities of transport and heating of buildings were determined based on general price flexibilities, which were estimated drawing

[12] Estimated based on actual average price (EEX, 2025).

on fuel carbon dioxide content[13], distribution obligations[14], price[15] and literature (Seppänen et al., 2022). We assume that the price sensitivity of small industry is the same as that of ETS1 sector industry (Colmer et al., 2025; Karlsson, 2025). Price flexibility is assumed to increase linearly from 2025, reaching its long-term value in 15 years, or by 2040.

The theoretical maximum demands in individual sectors in Finland were determined from KEITO project's (2025) WAM scenario, assuming that sector-specific emissions will be reduced from 2025 till 2027 linearly with a slope determined by reductions achieved in 2020–2025. Emissions from small industry in Finland are considered to consist of those from mobile machinery and other processes and products. The relative change in demand was calibrated separately for Finnish transport, buildings and small industry so that emissions in these sectors in 2040 correspond to emissions in KEITO's (2025) WAM scenario (transport 2.91 Mt, buildings 0.32 Mt and small industry 2.05 Mt), with an emission allowance price of EUR 105.

Regarding transport, separate heating of buildings and small industry in the rest of Europe, we assume that the relative change in demand is the same in different sectors. It was calibrated to produce an emission allowance price of EUR 89.25 in 2028 in the model[16].

See Table 8 for the parameters of demand functions for individual sectors.

**Table 8**. Parameter values for emission allowance demand functions.

| Sector | Parameter | Value | Source |
|---|---|---|---|
| Energy production and industry (ROE) | $a_{energia\ ja\ teollisuus\ ROE}$ | 1,288.60 | Authors' calculations based on EEA data (2025a) |
| Energy production and industry (FIN) | $a_{energia\ ja\ teollisuus\ FIN}$ | 16.29 | Authors' calculations based on EEA data (2025a) |
| Aviation | $a_{lentoliikenne}$ | 65.94 | Authors' calculations based on EEA data (2025a) |
| Maritime transportation | $a_{meriliikenne}$ | 89.36 | Authors' calculations based on EEA data (2025a) |
| Transportation (ROE) | $a_{liikenne\ ROE}$ | 654.39 | Authors' calculations based on EEA WAM scenario (2025c) |
| Transportation (FIN) | $a_{liikenne\ FIN}$ | 8.98 | Authors' calculations based on KEITO WAM scenario (2025c) |
| Buildings (ROE) | $a_{rakennukset\ ROE}$ | 409.17 | Authors' calculations based on EEA WAM scenario (2025c) |

[13] Estimated as a weighted average based on the actual fuel shares in Finland in 2020–2024 (Statistics Finland, 2025a) with a carbon dioxide content of 2.34 kg/l for petrol and 2.60 kg/l for diesel. This produces 2.51 kg/l as an estimate for a representative fuel. The fuel for heating buildings in the rest of Europe was assumed to be natural gas, which has a carbon dioxide content of 55.3 kg/GJ.
[14] Expected distribution obligations for Finnish transport and buildings under current legislation (446/2007, 418/2019). We assume that the distribution obligation of 29% for transport in the rest of Europe under the directive amending RED III (2023/2413) will be in force already from 2028.
[15] Estimates used for Finland were EUR 1.80/l for transport and EUR 1.30/l for buildings (Statistics Finland, 2025b). The estimates regarding the rest of Europe were EUR 1.50/l (European Commission, 2025g) for transport and EUR 30/GJ for buildings (Eurostat, 2025).
[16] Estimated based on the prices of futures sold for December 2027 (ICE, 2025).

| | | | |
|---|---|---|---|
| Buildings (FIN) | $a_{rakennukset\ FIN}$ | 1.19 | Authors' calculations based on KEITO WAM scenario (2025c) |
| Small industry (ROE) | $a_{pienteollisuus\ ROE}$ | 150.52 | Authors' calculations based on EEA WAM scenario (2025c) |
| Smal industry (FIN) | $a_{pienteollisuus\ FIN}$ | 3.04 | Authors' calculations based on KEITO WAM scenario (2025c) |
| Energy production and industry (ROE) | $b_{energia\ ja\ teollisuus\ ROE}$ | 0.00451571 | Gerlagh et al. (2021) |
| Energy production and industry (FIN) | $b_{energia\ ja\ teollisuus\ FIN}$ | 0.00451571 | Gerlagh et al. (2021) |
| Aviation | $b_{lentoliikenne}$ | 0.00130956 | Fageda and Teixidó (2022), Colmer et al. (2025) |
| Maritime transportation | $b_{meriliikenne}$ | 0.001625 | Mundaca et al. (2021) |
| Small industry (ROE) | $b_{pienteollisuus\ ROE}$ | 0.00451571 | Gerlagh et al. (2021), Karlsson (2025), Colmer et al. (2025) |
| Small industry (FIN) | $b_{pienteollisuus\ FIN}$ | 0.00451571 | Gerlagh et al. (2021), Karlsson (2025), Colmer et al. (2025) |
| Transportation (ROE) | $\varepsilon^{ST}_{liikenne\ ROE}$ | 0.2 | Authors' estimate based on report by Seppänen et al. (2022) |
| Transportation (ROE) | $\varepsilon^{LT}_{liikenne\ ROE}$ | 1 | Authors' estimate based on report by Seppänen et al. (2022) |
| Transportation (FIN) | $\varepsilon^{ST}_{liikenne\ FIN}$ | 0.2 | Authors' estimate based on report by Seppänen et al. (2022) |
| Transportation (FIN) | $\varepsilon^{LT}_{liikenne\ FIN}$ | 1 | Authors' estimate based on report by Seppänen et al. (2022) |
| Buildings (ROE) | $\varepsilon^{ST}_{rakennukset\ ROE}$ | 0.2 | Authors' estimate based on report by Seppänen et al. (2022) |
| Buildings (ROE) | $\varepsilon^{LT}_{rakennukset\ ROE}$ | 1 | Authors' estimate based on report by Seppänen et al. (2022) |
| Buildings (FIN) | $\varepsilon^{ST}_{rakennukset\ FIN}$ | 0.2 | Authors' estimate based on report by Seppänen et al. (2022) |
| Buildings (FIN) | $\varepsilon^{LT}_{rakennukset\ FIN}$ | 1 | Authors' estimate based on report by Seppänen et al. (2022) |
| Energy production and industry (ROE) | $c_{energia\ ja\ teollisuus\ ROE}$ | -0.051397 | Calibrated to produce the average price in 2025 (EEX, 2025) |
| Energy production and industry (FIN) | $c_{energia\ ja\ teollisuus\ FIN}$ | -0.051397 | Calibrated to produce the average price in 2025 (EEX, 2025) |
| Maritime transportation | $c_{lentoliikenne}$ | -0.01711 | Authors' calculations based on Regulation 2023/2405 and the baseline (EEA, 2024) |
| Maritime transportation | $c_{meriliikenne}$ | -0.02621 | Authors' calculations based on Regulation 2023/1805 and the baseline (EEA, 2024) |
| Transportation (ROE) | $c_{liikenne\ ROE}$ | -0.04926 | Calibrated to produce the price based on futures (ICE, 2025) |
| Transportation (FIN) | $c_{liikenne\ FIN}$ | -0.04930 | Authors' estimate based on KEITO (2025) WAM scenario |

| | | | |
|---|---|---|---|
| Buildings (ROE) | $c_{rakennukset\ ROE}$ | -0.04926 | Calibrated to produce the price based on futures (ICE, 2025) |
| Buildings (FIN) | $c_{rakennukset\ FIN}$ | -0.05140 | Authors' estimate based on KEITO (2025) WAM scenario |
| Small industry (ROE) | $c_{pienteollisuus\ ROE}$ | -0.04926 | Calibrated to produce the price based on futures (ICE, 2025) |
| Small industry (FIN) | $c_{pienteollisuus\ FIN}$ | 0.02160 | Authors' estimate based on KEITO (2025) WAM scenario |

## 6.6 REMOVAL CREDITS

Permanent carbon removals can be included in the ETS model. In this discussion, we limited the supply of permanent carbon removals to BECCS, as its production costs have been estimated to be significantly lower than those of DACCS (e.g. ESABCC, 2025b). The supply of BECCS carbon removal credits is described separately for Finland and the rest of the EU. The function for removal credit supply is expressed as:

$$CRC(\tau,t) = max\left\{[c_0 + c_t(t-n)]\left[d + \frac{k-d}{1+\left(\frac{\tau}{r}\right)^z}\right], 0\right\}.$$

The function for the Finnish supply was adapted to VTT's estimate of the marginal costs of BECCS based on literature (Kujanpää et al., 2023; Kujanpää et al., 2024), see Figure 17. See Table 9 for the parameters. The supply function for the rest of the EU was formulated by scaling Finland's supply function, in which the total BECCS production capacity of the EU in 2050 corresponds to a conservatively estimated maximum capacity of 120 Mt determined as the average of estimates of the lower limit (ESABCC, 2025b). In the time-dependent components of the supply functions, we assume a gradual increase in BECCS production capacity from 2030 onwards. We assume that the production capacity is initially 4% of the maximum and grows by 4.8% per year, reaching full capacity in 2050.

However, the use of removal credits as allowances will be restricted each year in relation to the demand for allowances as follows:

$$CRC_{ETS}(\tau,t) = min\{CRC(\tau,t), \theta \times D(\tau,t)\}, 0 \le \theta \le 1.$$

As the supply of removal credits is expressed in separate supply functions for Finland and the rest of the EU, it is also possible to model the economic impacts of removal credit production for Finland. For this purpose, we assume that Finnish operators will produce a share of the removal credits used as emission allowances that corresponds to Finland's share of the total EU BECCS production capacity. The following share of the removal credits produced in Finland can then be used as emission allowances

$$CRC_{ETS\ FIN}(\tau,t) = min\left\{CRC_{FIN}(\tau,t), \theta \times D(\tau,t) \times \frac{d_{FIN}}{d_{FIN} + d_{ROE}}\right\}.$$

Two extreme ways of including removal credits in the ETS can be used (Rickels et al., 2021):

1) The removal credits replace allowances to be released under the current rules, in which case the number of allowances on the market will not change. This means adapting the cap.

2) The removal credits are added to allowances to be released under the current rules, in which case the number of allowances on the market will increase. This means that the cap is not adapted.

Scenario 2 describes the impacts of the latter way, or non-adapted cap (in other words $\gamma = 0$) on the functioning of the emissions market. The impact of the removal credits added to the ETS on the total supply of emission allowances can be generally expressed by the equation

$$S_t^{tot} = S_t + (1 - \gamma) \times CRC_{ETS}(t, \tau), 0 \leq \gamma \leq 1.$$

This changes the dynamics of the TNAC as follows

$$B_t = B_{t-1} + MSR_t^{out} - MSR_t^{in} + S_t^{tot} - D_t.$$

The way in which the removal credits are integrated into the supply of allowances has significant impacts on the functioning of the emissions market. The reason for this is that the effective cap in the ETS is formed endogenously. When the removal credits are added to emission allowances ($\gamma = 0$), the scarcity of allowances is relieved and the allowance price drops. This reduces the banking of allowances and the size of the Market Stability Reserve. If allowances are cancelled in the Market Stability Reserve on the basis of its size (as in ETS1), fewer allowances will be cancelled, which means that the effective cap will increase more than by the amount of removal credits introduced into the ETS. This will increase the cumulative net emissions of the emissions trading system. If allowances are not cancelled in the Market Stability Reserve (as assumed in ETS2), the effective cap will only increase by the amount of removal credits introduced into the ETS, without any change in the cumulative net emissions of the ETS. When removal credits replace allowances ($\gamma = 1$), the scarcity of allowances will not change and the allowance price will stay the same. Consequently, there will also be no change in companies' banking behaviour and the size of the Market Stability Reserve. The number of cancellations will also remain the same, and the effective cap will not change. In this case, however, the net cumulative emissions of the allowance system will decrease as part of the effective cap is covered by removal credits.

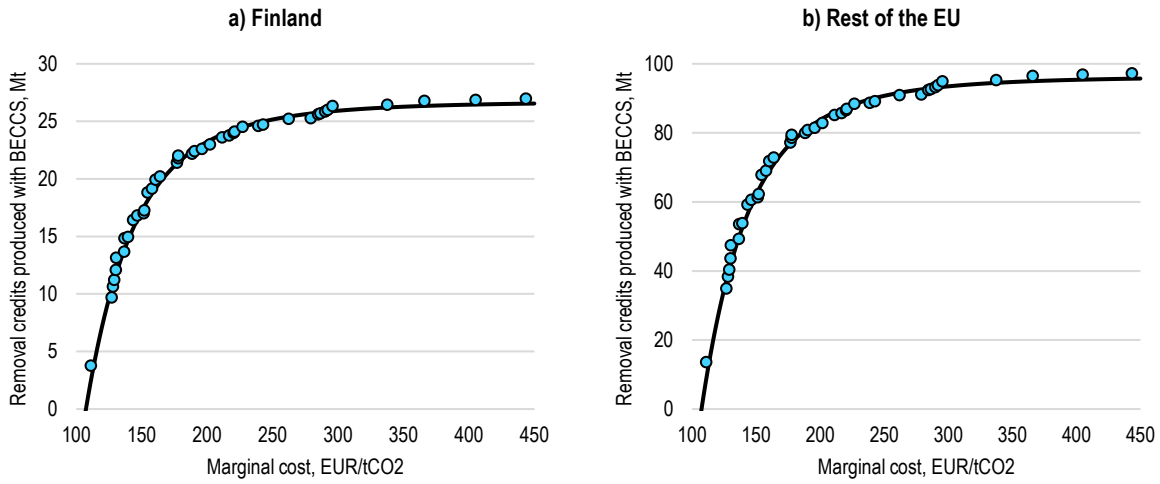


**Figure 17**. The marginal cost of BECCS removal credits a) in Finland and b) in the rest of the EU.

It should nevertheless be noted that if removal credits replace allowances, at some point the number of removal credits introduced into the ETS may exceed the total supply of allowances, or $CRC_{ETS}(t, \tau) >$

$S_t^{tot}$. In this situation $S_t < 0$, and the Commission will release a negative number of allowances. To put it simply, the Commission will be seeking to buy emission allowances rather than releasing them, and it must purchase some of the produced removal credits for itself. This problem does not arise in scenario 2, which is why the examination of the question is left open in this respect.

**Table 9**. Parameter values for the supply function of removal credits.

| Parameter | Description | Value |
|---|---|---|
| $d_{ROE}$ | Supply of removal credits from other EU countries when $\tau \to \infty$ | 96.3839 |
| $d_{FIN}$ | Supply of removal credits from Finland when $\tau \to \infty$ | 26.7303 |
| $k_{ROE}$ | Supply of removal credits from other EU countries when $\tau \to -\infty$ | -311.9528 |
| $k_{FIN}$ | Supply of removal credits from Finland when $\tau \to -\infty$ | -78.8012 |
| $r_{ROE}$ | Emission allowance price at which the supply of removal credits from other EU countries is $\frac{k_{ROE}+d_{ROE}}{2}$ | 77.8461 |
| $r_{FIN}$ | Emission allowance price at which the supply of removal credits from Finland is $\frac{k_{FIN}+d_{FIN}}{2}$ | 80.0880 |
| $z_{ROE}$ | Slope of the supply curve of removal credits from the rest of the EU when $\tau = r_{ROE}$ | 3.6387 |
| $z_{FIN}$ | Slope of the supply curve of removal credits from Finland when $\tau = r_{FIN}$ | 3.6836 |
| $c_{2030}$ | Relative production capacity of removal credits in 2030 | 0.04, when $t < 2050$, otherwise 1 |
| $c_t$ | Annual increase in the relative production capacity of removal credits | 0.048, when $t < 2050$, otherwise 0 |
| $n$ | Year in which removal credits are included in ETS | 2030 |
| $\theta$ | Share of the demand for allowances that can be covered by removal credits | 0.9995[17] |
| $\gamma$ | Number of allowances to be released that is replaced by one removal credit used as an allowance | 0 |

## 6.7 ETS INTEGRATION

ETS1 and ETS2 can be combined by permitting the use of allowances across existing sectoral boundaries and merging separate Market Stability Reserves into a single reserve. We assume that the integration of ETS1 and ETS2 in 2035 will be announced in 2030. Two consecutive modellings are then

[17] In scenario 2, when $\gamma = 0$, $\theta < 1$ must be true. If $\theta = 1$, companies will use up the emission allowances too soon. When TNAC is zero, the Hotelling Rule will not apply, which means that the price of the emission allowance will no longer follow the same trajectory. While the difference is technical and consequently not essential for the results, it is necessary for the modelling exercise.

run: 1) separate baseline models for ETS1 and ETS2 up till the announcement of the ETS integration, and 2) initial values from the baseline modelling are used to model the integrated emissions market.

We assume that in this integration, arbitrage will be complete, information symmetrical and transaction costs zero. On this basis, we can assume that the prices of ETS1 and ETS2 allowances will converge immediately as the integration of the emissions markets is announced and, after the integration, the allowance price will continue to follow the trajectory determined by the Hotelling Rule. In reality, it is likely that the prices would change more slowly after the announcement, with futures prices converging slightly faster than auction prices.

We assume that the number of allowances released in the integrated ETS will be the same as in separate ETSs. We assume that the Market Stabilisation Reserve has the following operating principles:

- The reserves will operate in the separate ETSs with the current rules until 2034. In 2035, the reserves will be integrated.
- When TNAC < 610 Mt, 200 Mt of allowances are released from the reserve for auction.[18]
- When 1,273 Mt < TNAC < 1,536 Mt, allowances corresponding to the difference between TNAC and the 1,273 Mt threshold are transferred to the reserve.[19]
- When TNAC > 1,536 Mt, allowances corresponding to 24% of TNAC (12% from 2030) are transferred to the reserve.
- Allowances exceeding the 610 Mt threshold are cancelled in the reserve.

Otherwise, the basic dynamics of the model correspond to the models for separate ETSs.

The model can easily be modified by integrating the emissions markets earlier or later (e.g. in 2030 or 2040). In this case, the TNACs and Market Stability Reserves of ETS1 and ETS2 will be kept separate until the year in which they are integrated. The model can also be changed by announcing the ETS integration to the markets either earlier or later (e.g. in 2025, 2035 or 2040). Two consecutive modellings are then run: 1) separate baseline models for ETS1 and ETS2 up till the announcement of the ETS integration, and 2) initial values from the baseline modelling are used to model the integrated emissions market. No further changes to the model are made in these cases.

## 6.8 INTERNATIONAL CARBON CREDITS

International carbon credits can be included in the model. In estimates (incl. Swedish Energy Agency, 2022) the price of international carbon credits is low compared to the price of EU emission allowances. On this basis, we assume that the demand for international carbon credits will not depend on the allowance price. When the use of carbon credits is restricted, the maximum permitted number of them will be used, irrespective of the allowance price.

In trilogue negotiations held in December 2025, the Parliament, the Council and the Commission agreed that the EU will make use of international carbon credits to account for at most 5% the 2040 target. The maximum number of carbon credits that can be used will increase linearly from 2036 onwards. However, there is no clarity about how carbon credits will be used after 2040. We nevertheless assume that international carbon credits will only be used in 2036–2040. The position of the Parliament and the Commission has been that international carbon credits should not be integrated into the emissions trading system. However, scenario 4 examines the consequences of the opposite

[18] The threshold was determined as the sum of the thresholds for ETS1 (400 Mt) and ETS2 (210 Mt).
[19] The thresholds were determined as the sum of the thresholds for ETS1 (833 Mt, 1,096 Mt) and ETS2 (440 Mt).

policy, in which international carbon credits are used to reduce the allowance price in ETS1, with their maximum amount corresponding to 3% of the EU's 2040 target. The maximum number of carbon credits used in ETS can be expressed by the following equation:

$$ICC_t = \eta \times \frac{t-2035}{5} \times E_{1990}, kun\ t \in [2036, 2040], \text{otherwise } ICC_t = 0.$$

As described in the section on removal credits, there are two extreme ways of adding international carbon credits to the ETS: 1) international carbon credits reduce the number of allowances released on the market under the current rules and the number of allowances on the market will not change, or 2) international carbon credits do not reduce the number of allowances released, and they increase the number of allowances on the market. Scenario 4 describes the impacts of the latter way (see $\sigma = 0$), but the impact of international carbon credits on the overall supply of emission allowances can be generally expressed by the equation:

$$S_t^{tot} = S_t + (1-\sigma) \times ICC_t, 0 \leq \sigma \leq 1.$$

Consequently, the TNAC dynamics will also change as follows:

$$B_t = B_{t-1} + MSR_t^{out} - MSR_t^{in} + S_t^{tot} - D_t.$$

No further changes to the model are made in this scenario. See Table 10 for the parameters.

**Table 10**. Description of the parameters for the supply function of international carbon credits.

| Parameter | Description | Value |
|---|---|---|
| $\eta$ | Share of international carbon credits permitted in the ETS of the reference level | 0.03 |
| $E_{1990}$ | Reference level, EU net emissions in 1990 | 4,726 |
| $\sigma$ | Number of allowances to be released that is replaced by one international carbon credit used as an allowance | 0 |