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Delegations will find attached document SWD(2026) 616 final - Part 1/5.

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EUROPEAN
COMMISSION

Brussels, 17.7.2026
SWD(2026) 616 final

PART 1/5

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the documents

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC and Decision (EU) 2015/1814 as regards driving competitiveness and cost-effective decarbonisation

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{COM(2026) 616 final} - {COM(2026) 619 final} - {COM(2026) 620 final} - {SEC(2026) 616 final} - {SWD(2026) 617 final} - {SWD(2026) 618 final}

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GLOSSARY

Term or acronym	Meaning or definition
BECCS	Bioenergy with carbon capture and storage
CCfD	Carbon contract for difference
CCS	Carbon Capture and Storage: a set of technologies aimed at capturing, transporting, and permanently storing CO_2
CCUS	Carbon capture, utilisation, and storage
CBAM	Carbon Border Adjustment Mechanism
CDR	Carbon Dioxide Removal
CHP	Combined Heat and Power: a combined heat and power unit is an installation producing both electrical energy and heat
CO_2-eq	Carbon dioxide-equivalent: a measure used to compare quantities of different greenhouse gases in a common unit based on their global warming potential over a given period
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRCF	Carbon Removals and Carbon Farming framework, established under Regulation (EU/2024/3012)
CSCF	Cross-sectoral correction factor: a factor by which free allocation of emission allowances is reduced uniformly across all industry sectors, if the demand for free allocation exceeds the total amount of available free allowances
DACCS	Direct Air Capture with Carbon Storage
E-fuels	Liquid fuels produced based on hydrogen obtained from electricity via electrolysis.

EEA	European Economic Area
EIB	European Investment Bank
ESR	Effort Sharing Regulation
EU ETS	European Union Emissions Trading System covering stationary installations, aviation, and maritime transport
ETS2	Emissions Trading System covering Buildings, Road Transport and Additional Sectors in accordance with Chapter IVa of the ETS Directive
EUA	European Union Allowance: the tradable unit under the EU ETS, giving the holder the right to emit one tonne of CO_2-eq
GDP	Gross Domestic Product
GEM-E3	General Equilibrium Model for Energy-Economy-Environment interactions
GHG	Greenhouse gas
GT	Gross Tonnage
HWI	Hazardous waste incineration
ICC	Indirect carbon cost
IDB	Industrial Decarbonisation Bank
IF	Innovation Fund
IMO	International Maritime Organization
JRC	Joint Research Centre of the European Commission
LDC	Least developed countries

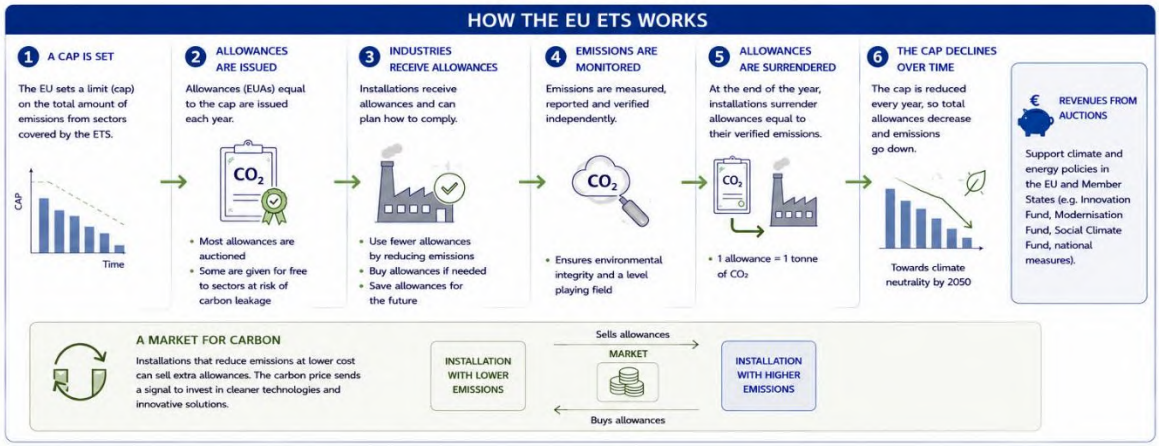
LRF	Linear Reduction Factor: a factor by which the ETS cap is reduced yearly
MF	Modernisation Fund
MSR	Market Stability Reserve
$MtCO_2$	Million tonnes of CO_2
MW	Megawatt
MWI	Municipal waste incineration
NECP	National Energy and Climate Plan
NIMs	National implementation measures under Article 11 ETS Directive
OPC	Open Public Consultation
PRIMES	Price-Induced Market Equilibrium System model
PRIMES-TREMOVE	Integrated transport component of PRIMES model
SAF	Sustainable Aviation Fuel
SME	Small and medium-sized enterprise
SIDS	Small island developing states
SWD	Staff working document
TNAC	Total number of allowances in circulation
UNFCCC	United Nations Framework Convention on Climate Change

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

The European Commission 2025 Foresight[1] report points out that climate change is a risk multiplier that should be addressed, and that the green transition for many countries can result in more independence and growth. Particularly for Europe, a successful transition to sustainable growth provides the opportunity to simultaneously enhance the Union's strategic autonomy. In the same vein, the Draghi Report[2] points out that *"if Europe's ambitious climate targets are matched by a coherent plan to achieve them, decarbonisation will be an opportunity for Europe. But if we fail to coordinate our policies, there is a risk that decarbonisation could run contrary to competitiveness and growth*."

The EU Emissions Trading System (EU ETS) is the cornerstone of EU climate policy. Directive 2003/87/EC (the 'ETS Directive') lays down the rules for greenhouse gas emission allowance trading within the European Union. The Market Stability Reserve (MSR) for the EU Emissions Trading System (EU ETS) was established by Decision (EU) 2015/1814 (the 'MSR Decision').

Figure 1: How the EU ETS works



Regulation (EU) 2021/1119 of the European Parliament and of the Council ('the European Climate Law')[3] sets a legally binding economy-wide target of net zero greenhouse gas emissions at the latest by 2050, and an intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. The 'Fit for 55' package of legislation under the European Green Deal makes all sectors of the EU's economy fit to meet

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1 European Commission, *Foresight Report 2025: Resilience 2.0: Empowering the EU to thrive amid turbulence and uncertainty*, 2025, Publications Office of the European Union, https://commission.europa.eu/strategy-and-policy/strategic-foresight/2025-strategic-foresight-report_en.

2 European Commission, *The Future of European Competitiveness: Part A: A competitiveness strategy for Europe*, 2024,https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf.

3 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1).

this target. The ETS Directive and the MSR Decision were revised by Directive (EU) 2023/958 and (EU) 2023/959[4] and amended in 2023 as part of that package.

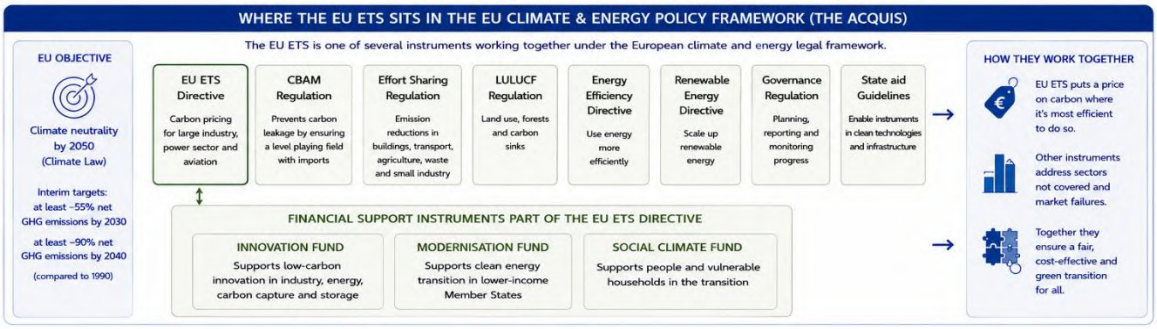
Most changes introduced by these amendments took effect from January 2024 or take effect from 2026. However, some have applied since the entry into force of Directive (EU) 2023/959 in June 2023.

The ETS Directive sets an emission reduction target of 62% for stationary installations, aviation and maritime (EU ETS) by 2030 compared to 2005. Stability and full implementation of the legislative framework in place for meeting the 2030 climate and energy targets is a precondition for the EU to stay on course to reach climate neutrality in 2050.

The evaluation of the EU ETS (see Annex 15) concludes that the EU ETS continues to be well aligned to the broader EU climate policies.

The ETS covered sectors delivered more economically efficient emissions reductions compared to non-ETS sectors. The EU ETS has effectively met its objectives, achieving over 50% emissions reductions by 2025, compared to the 43% target initially set in 2018 to be achieved by 2030, prior to the amendment in 2023. The EU ETS remains not only relevant for the future, but the key policy instrument to achieve the EU's climate goals for the next decade. The evaluation and recent report by the European Securities and Markets Authority (ESMA)[5] showed that the ETS functions in line with market trends and underlying fundamentals and ESMA did not identify any issue in the integrity or transparency of EU carbon markets.

Figure 2: EU ETS in the context of the EU's climate and energy policy framework



The EU has adopted a legally binding climate target of 90% reduction in net greenhouse gas (GHG) emissions for 2040. The 2040 climate target takes full account of the current economic, security and geopolitical landscape in alignment with the EU Competitiveness Compass[6],

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4 Directive (EU) 2023/958 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and the appropriate implementation of a global market-based measure (OJ L 130, 16.5.2023) and Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system (OJ L 130, 16.5.2023).

5 European Securities and Markets Authority, *ESMA Market Report: EU carbon markets 2025*, 2025, https://www.esma.europa.eu/sites/default/files/2025-10/ESMA50-481369926-30552_Carbon_Markets_Report_2025.pdf.

6 Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: A Competitiveness Compass for the EU, COM(2025) 30 final, 29.1.2025, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0030.

Clean Industrial Deal[7], and Affordable Energy Action Plan[8]. It provides the necessary predictability and stability for investments in the EU's clean energy transition and for driving industrial competitiveness.

The initiative seeks to ensure achievement of the climate targets in the European Climate Law. Therefore, this impact assessment includes the Commission's assessment of the consistency of the initiative with the European Climate Law's objectives, as required by Article 6(4) of the European Climate Law.

The 2040 target includes a possibility to use a limited quantity of high-quality international credits to make an 'adequate contribution' towards the 2040 target, starting in 2036. This amount can be up to 5% of 1990 EU net GHG emissions, corresponding to a domestic reduction of net GHG emissions of at least by 85% compared to 1990 levels by 2040. A pilot period in 2031-2035 may be considered.

International credits should be integrated to the future climate legislation in a way which ensures reaching the climate target cost-efficiently using high-quality and integrity credits. High credit integrity must be ensured taking the rules developed under Article 6.4 of the Paris Agreement as a baseline. The specific role and deployment of international credits will be based on a thorough impact assessment and subject to the development of Union law setting robust and high integrity criteria and other safeguards.

Nevertheless, this impact assessment concludes that a direct integration of international credits in the ETS is not appropriate. The EU has had experience of direct integration of Certified Emission Reductions (CERs) from the Clean Development Mechanism (CDM) into the EU ETS and discontinued this approach due to negative impacts on the effectiveness and integrity of the EU ETS. Repeating these results should be avoided. By contrast, adjusting the ETS cap equivalent to the amount of international credits that would be centrally purchased from mitigation outside of the EU under strict criteria and oversight, is a simpler, straightforward approach that aligns with the fundamental principles of the system, ensuring a clearly defined cap and environmental integrity, while still granting additional emission space to the EU ETS. Revenues associated with the additional allowances that can be auctioned could be earmarked to finance the international credits that justify the additional emissions space in the EU ETS.

This impact assessment therefore uses (modelled) scenarios aiming at an economy-wide reduction of net greenhouse gas emissions by 85% in 2040 as indicative of the domestic impacts of the Climate Law, in particular on EU ETS sectors. It could be decided later that less than 5% of international credits are used, which would enable more investment in domestic action. Consequently, the domestic reduction of net GHG emissions could be higher than 85%. However, this target was chosen as the basis for the impact assessment to consider the maximum potential use of the international credit flexibility allowed in the European Climate Law. The costs and full impacts of purchases of international credits are not included in this impact assessment. Allowing direct use of international credits for operators for their ETS

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[7] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The Clean Industrial Deal: A Joint Roadmap for Competitiveness and Decarbonisation, COM(2025) 85 final, 26.2.2025, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0085.

[8] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: Action Plan for Affordable Energy: Unlocking the True Value of Our Energy Union to Secure Affordable, Efficient and Clean Energy for All Europeans, COM(2025) 79 final, 26.2.2025, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52025DC0079.

compliance obligations as means to create additional emissions space is an option which cannot be implemented simultaneously with the adjustment of the ETS cap to the EU-wide 85% domestic ambition target.

The 2023 review under the Fit for 55 package introduced several review clauses relating to the EU ETS, under Article 3gg, Article 28b and Article 30 to assess potential adjustments to the system on aviation, maritime and stationary installations in 2026. In addition, Article 3 of the MSR Decision sets a legal obligation for a review of this instrument, with the next review due in 2026.

Following the 'evaluate first' principle, the ETS Directive and the MSR Decision should be evaluated before undergoing revision. A new emissions trading system covering CO_2 emissions from fuel combustion in buildings, road transport and small industry (ETS2) was created in the 2023 revision of the ETS Directive. As the ETS2 becomes fully operational in 2028, it is excluded from the scope of this impact assessment. Furthermore, the application of the ETS2 is due to be reviewed by 2028 and any assessment of the feasibility of integrating the sectors under ETS2 into the EU ETS is subject to a review clause due in 2031, as set out in Article 30i of Directive 2003/87/EC.

Based on the Climate Law and the Paris Agreement, all sectors of the economy must contribute to reducing emissions, including all the sectors covered by the EU ETS. This contribution risks being hampered by potential residual emissions from sectors where there is currently a lack of business case for decarbonisation technologies, notably in the energy intensive industries (EIIs) where many processes are 'hard-to-abate'[9]; from sectors with low incentives to shift to clean solutions due to incomplete internalisation of the climate cost; and from sectors where alternative low-carbon technologies remain constrained.

Aviation accounts for 2-3% of global CO_2 emissions[10] and is a source of non-CO_2 climate impacts at least as significant as those of CO_2. Aviation's share of EU transport emissions today is 13.9%, or around 4% of the EU's total CO_2 emissions. By 2050, aviation's share is expected to grow to around 90%[11]. Long-haul flights fuel this growth. Globally, the International Civil Aviation Organization (ICAO) projects that international aviation emissions will continue to grow, although Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) aims to offset most of that growth[12]. Aviation, like shipping, has important decarbonisation

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9 European Commission, *The Future of European Competitiveness: Part B: In-depth analysis and recommendations*, 2024, https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf.

10 European Union Aviation Safety Agency, *European Aviation Environmental Report 2025*, 2025, https://www.easa.europa.eu/en/domains/environment/eaer/downloads#download-2025.

11 Source: Figure 76, Direct CO_2 emissions from the EU transport sector by mode, Annex 8, and Section 1.5.5, page 97, in: European Commission, Commission Staff Working Document: Impact Assessment Report: Part 3: Accompanying the document: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Securing our future: Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society, SWD(2024) 63 final, 6.2.2024, https://eur-lex.europa.eu/resource.html?uri=cellar:6c154426-c5a6-11ee-95d9-01aa75ed71a1.0001.02/DOC_3&format=PDF.

12 ICAO notes that due to partial participation in CORSIA, international aviation emissions will continue to grow above the CORSIA baseline level (~500 $MtCO_2$ per year). Source: ICAO, *A42-WP/28 Report – Technical Assessments in Support of the 2025 CORSIA Periodic Review*, 2025, https://www.icao.int/sites/default/files/Meetings/a42/Documents/WP/wp_028_en.pdf.

challenges as a hard-to-abate sector, marked by long asset lifetimes, significant capital intensity, and a current scarcity of immediate alternatives to fossil fuels.

Maritime transport represents around 14% of the total EU transport emissions, or around 4% of the EU's total CO_2 emissions. Its green transition will require the mobilisation of the whole EU maritime value chain and will require substantial investment in enhancing vessel efficiency, developing new sustainable propulsion technologies, and scaling up the production and distribution of sustainable renewable and low-carbon fuels, including the upgrade of port and energy infrastructures.

For aviation and maritime, complementary policies such as FuelEU Maritime and ReFuelEU Aviation work in synergy with the ETS's multiple incentives supporting the uptake of more sustainable fuels[13].

Over the coming decade and to achieve climate neutrality by 2050, industry has to go through a significant transformation to decarbonise and switch to cleaner and more energy efficient technologies, such as electrification, the use hydrogen from renewable sources, or deploying CCUS, as well as generating carbon removals. At the same time, it needs to remain competitive in a global market and ensure quality jobs consistent with the objectives of the Clean Industrial Deal. This transformation requires stepping up investments substantially. Scenario S2 in the 2040 Climate Target Impact Assessment, reaching -88% GHG reductions by 2040 compared to 1990, estimates the investment needs to transform the iron and steel sector at around EUR 80 billion between 2031 and 2040; at around EUR 330 billion for the five largest EIIs together (chemicals, basic metals, non-metallic minerals, and pulp and paper industry) for the same period[14].

The carbon price signal, together with the phase-in of the Carbon Border Adjustment Mechanism (CBAM) already provides an incentive for industrial decarbonisation, while protecting against carbon leakage. In addition, carbon pricing works hand in hand with regulatory measures such as targets and requirements on energy efficiency, renewable energy or decarbonised mobility and industry. In many sectors (e.g. steel, cement or chemicals), however, the price signal (together with regulatory framework) has not been strong enough to drive the transformational change and in the near future, investments will still be lacking a business case at prevailing and anticipated carbon prices and as the regulatory measures still need time to be fully implemented. This is why the Clean Industrial Deal Communication announced the Industrial Decarbonisation Bank (IDB) to address the scale-up and roll-out of more mature industrial decarbonisation projects, notably in EIIs across all Member States to be funded mostly by a dedicated part of ETS revenues[15]. With the IDB focussing on scale-up

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[13] For aviation, ReFuelEU aviation sets targets for fuel producers to supply an increasing share of sustainable aviation fuels, starting with 2% of certain biofuels in 2025, 6% in 2030 (of which 0.7% synthetic fuels). For the maritime sector, FuelEU Maritime sets maximum limits for the yearly average greenhouse gas (GHG) intensity of the energy used by ships above 5 000 gross tonnage calling at European ports, regardless of their flag.

[14] European Commission, Commission Staff Working Document: Impact Assessment Report, Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society, Part 3,pp.164-167,https://eur-lex.europa.eu/resource.html?uri=cellar:6c154426-c5a6-11ee-95d9-01aa75ed71a1.0001.02/DOC_3&format=PDF.

[15] The IDB will be placed within the governance of the future European Competitiveness Fund to ensure that both funding instruments are complementary. European Competitiveness Fund will also support decarbonisation of the EIIs. Considering the high investment needs of these sectors both instruments are

and roll-out, there is also need for continuation of the Innovation Fund (also funded by ETS resources) to continue supporting innovative and first of a kind technology that can address the sectors that currently do not yet have technically viable decarbonisation solutions. Importantly, the rollout of decarbonisation technologies in EIIs will lead to a significant increase in electricity demand so expansion of the power generation capacities will be needed.

The EU ETS thus supports the objectives of the Clean Industrial Deal by providing a clear and predictable carbon price, incentivising investment in decarbonisation solutions and funding the investments which still lack the business case or where decarbonisation solutions have yet to be demonstrated, while continuing to provide carbon-leakage protection and financial support from the auction revenues with more than EUR 260 billion generated since the start of the system. In the same way, the ETS will complement other initiatives in support of the Clean Industrial Deal objectives. Examples include: action to speed up permitting for industrial decarbonisation investments, build lead markets for European clean technologies and industrial products through the Industrial Accelerator Act; action to lower industrial energy costs through the Affordable Energy Action Plan, including the European Grids Package that will accelerate electrification and integration of cheaper renewables by enabling energy to flow efficiently across all Member States; and action to stimulate supply and demand for secondary raw materials, most notably through the Circular Economy Act.

GHG emissions from waste treatment are not subject to carbon pricing in most Member States. Waste accounts for about 3% of the EU's total greenhouse gas (GHG) emissions – excluding waste incineration with energy recovery (waste-to-energy), which is estimated to account for a further 2-3% of the EUs GHG emissions. In addition to losing valuable resources, waste can have significant negative impacts on human health and the environment. For example, incinerating waste can contribute to air pollution, while landfills might contaminate water and land. Waste sector emissions could decrease further once all current EU waste policies are fully implemented. However, new policy instruments, including the sector's inclusion in the ETS, could support GHG emissions reductions from the sector.

In addition, the EU ETS's contribution to the necessary emissions reductions may be hampered by market inefficiencies resulting from a decreasing market size, which is intrinsic to the system design. The MSR rules under the ETS aim to tackle structural supply-demand imbalances between the available allowances to emit CO_2 and the emissions of the compliance entities covered. The impact assessment therefore analyses whether the rules governing the operation of the MSR remain appropriate in the context of a declining supply of allowances. And more precisely, this involves: (i) ensuring that the market remains efficient and creates an incentive to invest in decarbonisation in the global context; and (ii) addressing specific challenges faced by covered sectors to facilitate the uptake of available solutions. This assessment is carried out in consideration of other legislative acts that facilitate the clean transition and the competitiveness of EU industry. The impact assessment also examines how to optimise the use of ETS revenues in support of decarbonisation investments.

In consequence, the impact assessment explores a broad variety of options compared to the baseline (in general terms, the continuation of the current EU ETS framework) for the following aspects. These aspects were selected because they correspond to the topics established in the review clauses introduced with the Fit for 55 package (Article 3gg, Article

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needed but should be designed as complementary in the support of technologies development, types of instruments offered and role in the project's investment journey. This will be also facilitated by the common governance framework.

28b and Article 30 of the ETS Directive) and the regular review of the MSR Decision (Article 3), and more broadly because they need to be reviewed to ensure that the EU ETS continues to contribute in the most cost-effective and economically efficient manner to the overall goal of reaching economy-wide carbon neutrality by 2050 and to the 2040 target, taking into account the broader policy framework and the need for all sectors to contribute to the EU climate efforts, while growing our economy and preserving competitiveness:

- **Carbon removals:** this covers the possible inclusion of domestic permanent carbon removals in the EU ETS. More specifically, it looks at (i) how the EU ETS could account for negative emissions resulting from GHGs that are removed from the atmosphere and safely and permanently stored (such as biogenic emissions with carbon capture and storage or direct air capture with carbon storage); (ii) how those negative emissions, if appropriate, could be covered by 'emissions trading', setting a clear scope and strict criteria; (iii) putting in place of safeguards to ensure that such removals do not deter necessary emissions reductions.
- **Market Stability Reserve:** the review considers the parameters of the reserve (intake and release rates, thresholds, and their potential alignment with a declining market) and analyses if the MSR is adequately designed for the ETS of the next decade, which will be characterized by a shrinking market.
- **Industrial Decarbonisation Bank:** the Clean Industrial Deal announced the Industrial Decarbonisation Bank, aiming for the budget of EUR 100 billion drawing on the ETS auction revenues and the revision of InvestEU so that a sizable impact can be made on the industrial decarbonisation in the EU. The policy options assessed concern: possible ways to allocate the support by the Bank; different forms that the support could take and measures to ensure the geographical balance in allocating the support. The IDB will operate alongside the Innovation Fund (IF) and the European Competitiveness Fund (ECF). This assessment also considers the role the IDB can play in addressing residual risks of carbon leakage for CBAM sectors. For the IF, the Fund's evaluation recommends the continuation of the programme with improvements, notably in terms of simplification without, however fundamental change to its operation and objectives (i.e. support for innovative, First-of-a-Kind projects).
- **Modernisation Fund**: the evaluation indicates that it is succeeding in supporting relevant investments to decarbonise the energy systems of Member States with high needs and low-income. The distinction between priority area and non-priority area and the rules attached to each category have proved effective to foster those investments most closely aligned with EU climate and energy targets, while allowing room for some investments in transitional technologies. The impact assessment considers the possibility to increase the scope of priority investment to more decarbonation technologies; to discontinue financing investments related to fossil fuels and waste-to-energy, the respective shares of priority/non-priority investments and the governance related to the confirmation of priority investments.
- **Aviation emissions**: While legally the ETS covers emissions from January 2027 from flights landing in (unless exempted) and departing from the European Economic Area (EEA), the EU has temporarily limited the scope to intra-EEA flights and departing flights to the UK and Switzerland. This is to encourage the development of an effective global carbon pricing scheme by ICAO. This impact assessment examines CORSIA in line with the ETS Directive assessment criteria and indications on geographical scope.

- **Maritime emissions**[16]: the impact assessment examines the possibility of a dedicated EU mechanism to directly support shipping companies with ETS allowances in their efforts to use sustainable fuels and clean propulsion technologies. Furthermore, it considers legislative improvements to ensure the effective implementation of ETS application to maritime transport, notably in relation to the possible risk of evasion/ circumvention. It also examines opportunities for simplification and other measures to enhance the robustness and effectiveness of the system's implementation, including in terms of alignment with other EU legislation and the need for derogations to maintain territorial continuity and connectivity. The impact assessment further examines design options to ensure coherence between the EU ETS and any global measure at the International Maritime Organization (IMO) implementing the 2023 IMO GHG Strategy, notably in order to avoid double payment of the same emissions. It also examines the feasibility and possible impacts of including emissions from small ships (i.e. below 5 000 gross tonnage but not below 400 gross tonnage).
- **Risk of carbon leakage:** this involves the assessment of measures that aim to protect industrial installations exposed to a risk of transfer of production or investments to other countries with laxer emission constraints as a result of having to pay for their greenhouse gas emissions (directly or indirectly), while ensuring the necessary incentives for emissions reductions. Carbon leakage can occur due to the cost of both direct emissions (ETS costs paid by installations) and indirect emissions (carbon costs in the power sector that are passed onto electro-intensive industries). The impact assessment will consider primarily carbon leakage protection options for emissions not covered by CBAM. For CBAM sectors CBAM's full but gradual implementation from 2026 and the corresponding gradual phase-out of free allocation to CBAM sectors provide for a change of mechanism to address carbon leakage risks. Nevertheless, this assessment will also consider the impacts of a slowdown of the phase-out of free allocation for CBAM sectors, addressing residual risks of carbon leakage. For indirect emissions, the impact assessment will consider how to address carbon leakage risk post-2030, in particular whether to continue to encourage Member States to provide indirect carbon cost compensation (ICC) through State aid, and/or whether to harmonise the provision of compensation through an EU instrument.
- **Thermal input thresholds:** this examines the feasibility of lowering the 20 MW total rated thermal input thresholds for the activities listed in Annex I from 2031 onwards (minimum threshold for inclusion in the ETS for several activities), considering ETS2.
- **Municipal waste incineration:** this considers the feasibility of including emissions from municipal waste incineration in the EU ETS from 2028 (with possible opt-outs until 2030). The Commission must also assess the possibility of including in the EU ETS other waste management processes, in particular landfilling, which creates significant methane and nitrous oxide emissions. The analysis on the possible scope expansion of the EU ETS to waste management processes must take into account the alignment with the waste hierarchy.
- **Non-permanent carbon capture and use** (CCU)**:** the impact assessment examines whether, in view of providing incentives for emission reductions, all GHG emissions covered by the ETS are effectively accounted for and whether double counting is

[16] Further detail in the Ricardo/WSP (forthcoming), *Support for the 2026 review of the ETS maritime study*

avoided, in particular regarding emissions considered to have been captured and utilised in a product that does not permanently chemically bind CO_2.

- **Linking with other carbon markets**: a standalone annex considers how effective links can be established between the revised EU ETS and other carbon market to realise the benefits of a reduced cost of emission abatement, an increased market liquidity, an effective mitigation of the risk of carbon leakage, without impeding achievement of the climate-neutrality objective and EU climate targets.

Overall, the impact assessment assesses the consistency with other EU legislative acts and possible simplification options, including evaluation of the administrative costs linked to ETS implementation and the risk of additional burden resulting from monitoring and reporting obligations. Impacts on third countries are catered for in current policies, such as the CBAM application based on effective EU ETS price, or assessed as part of separate dedicated processes, such as linking or EU enlargement frameworks.

2. PROBLEM DEFINITION

2.1. What are the problems?

Problem 1: Risk of not contributing cost-effectively (i) to the EU emissions reduction target in line with climate neutrality and the 2040 target, and (ii) to addressing the EU ETS's fair share of international emissions

The overarching objective of the EU ETS is to contribute to reduce GHG emissions cost-effectively through-out the EU economy, including its fair share of international emissions, in a way that is in line with the climate neutrality objective by 2050 and the intermediate 2040 climate target. However, there is a risk that the EU ETS is not contributing to these emissions reductions cost-effectively for several reasons:

- The current legislative framework was designed in view of the 2030 climate target, so the EU ETS cap trajectory is not aligned with the overall climate policy framework that ensures a balanced and cost-effective contribution of all sectors to greenhouse gas emission reductions and carbon removals towards the 2040 target.
- As the cap is reduced towards climate neutrality, the carbon price is expected to rise. In a market which functions perfectly otherwise, this expectation would be sufficient to guarantee long term investment. However, there are other market failures, such as insufficient incentive for investing in R&D&I as a public good, or the more myopic perspective of investors. Therefore, other risks remain:
  - Insufficient long-term investments will be made to decarbonise certain sectors, among other things, due to lack of sufficiently strong carbon price signal as perceived by investors. This risk is confirmed by the findings of the evaluation (see Annex 15). While the EU ETS has delivered significant emissions reductions in the power sector, the relatively low carbon prices, and high share of free allocation to industry reduced the incentives to invest in decarbonisation technologies.
  - Lack of funding mechanisms of sufficient duration and magnitude to support the business case for industrial decarbonisations and thus investments[17]. In this case, ETS risks leading to GHG emissions reductions mainly through a decrease

[17] In scenarios for reaching the 2040 climate target, investment needs are estimated at approximately EUR 30-50 billion annually between 2031 and 2040 for industry (around EUR 25-40 billion for energy-intensive industries).

in production levels rather than by a decrease in carbon emissions intensity of industrial activities.

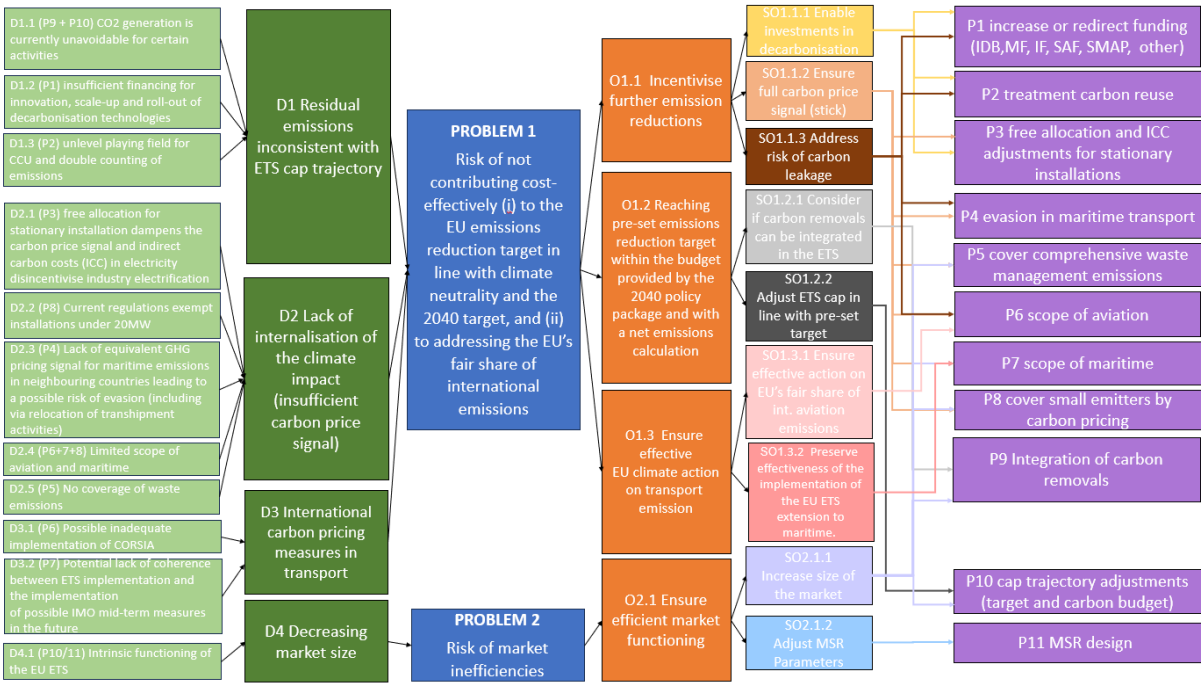
These issues are particularly acute for climate solutions which are not yet[18] market ready, or which require infrastructure to be built, such as carbon or hydrogen transport networks.

- The EU ETS risks not contributing cost-effectively to the reduction of the EU's fair share of international emissions, if there is a lack of implementation of or coherence between the ETS and global measures, for example in case transport is subject to double carbon pricing.

Problem 2: Risk of market inefficiencies

The EU ETS is designed as a cap-and-trade system, with the cap limiting the total amount of GHG that can be emitted by installations and operators covered under the scope of the system. As the price of allowances is determined by the market at the intersection of demand and a pre-determined supply, the European carbon market can be exposed to a certain risk of market inefficiencies (e.g. trading frictions, price volatility) as it becomes smaller.

Figure 3: Problem tree



2.2. What are the problem drivers?

Associated with Problem 1:

- **D1: Residual emissions inconsistent with EU ETS cap trajectory.** The climate neutrality objective is at the heart of the European Green Deal, and is a legally binding objective set out in the European Climate Law (ECL). The 2040 climate target is the EU's intermediate step after 2030 on the path to climate neutrality. In December 2025,

[18] For the bulk of technologies needed to reach the 2040 targets, the Technology Readiness Level already amounts to at least 8 (out of 9), meaning that they are in an advanced deployment stage. Examples include capture in cement production (TRL 9), low temperature industrial heat pump at TRL 9, while medium and high temperature industrial heat pumps are at lower TRL levels, as is some hydrogen-based direct iron ore reduction to produce steel (TRL 6-8).

the European Parliament and the Council reached agreement on amending the European Climate Law, introducing a binding intermediate climate target for 2040 of a 90% reduction in net greenhouse gas (GHG) emissions compared to 1990 levels. The agreement also sets out certain areas of flexibility to support the achievement of the 2040 target including on the contribution of high-quality international carbon credits to the target. However, there will still be residual emissions in industry, aviation and maritime that need to be abated in order to align to the carbon budget and target that are given by the cap trajectory.

The following sub-drivers have been identified:

- D1.1 (P9+10) CO_2 generation is currently unavoidable for certain activities, which needs to be recognised in the cap setting and/or role of removals.
- D1.2 (P1) Insufficient financing for innovation, scale-up and roll-out of decarbonisation technologies and clean fuels to address the lack of business case and high investment needs in carbon-intensive, in particular in low-income Member States.
- D1.3 (P2) Unlevel playing field for CCU and double counting of emissions.

- **D2: Lack of internalisation of the climate impact (insufficient carbon price signal).** The reason for setting a cap and letting the market put a price on carbon emissions is to trigger a behavioural and investment change that should result in reduced emissions in line with the climate change mitigation pathway. The price signal of the EU ETS adds to the cost of activities that generate greenhouse gases, 'internalising' the harmful effect on the environment, known as 'negative externalities', in accordance with the 'polluter pays' principle. When the EU ETS does not cover certain activities, it does not play a role in the internalisation of their carbon cost. As a result, they may lack the incentive to reduce their emissions, unless other regulatory measures achieve the reductions fully (e.g. targets or prohibitions). Lack of internalisation of carbon cost concerns for instance the emissions of small ships. It is estimated that all categories of small ships (below 5000 gross tonnage, but not below 400 gross tonnage) could add a total of 14.6 MtCO2 in the ETS scope. Similarly, measures to address carbon leakage (assigning allowances free of charge and allowing compensation for indirect emission costs) can also dampen the carbon price signal and reduce incentives to decarbonise. This is confirmed by the findings of the evaluation, which indicates, based on literature review, that the effect of the EU ETS prices on carbon efficiency and emissions reduction is more pronounced for sectors transitioning away from free allocation and into auctioning (see Annex 15, Section 4).

The following sub-drivers have been identified:

- D2.1 (P3) Free allocation dampens the carbon price signal. Indirect carbon cost (ICC) passed through in electricity disincentivises industry electrification.
- D2.2 (P8) Current regulations exempt small installations under 20MW
- D2.3 (P4) Lack of equivalent GHG pricing signal for maritime emissions in neighbouring non-EU countries leading to a possible risk of evasion (including via relocation of transhipment activities).
- D2.4 (P6/7/8) Limited scope of aviation and maritime
- D2.4 (P5) No comprehensive coverage of waste emissions

- **D3: International carbon pricing measures in transport.** In terms of interaction between the implementation of the EU ETS and the implementation of global measures to reduce emissions from aviation and shipping, the following sub-drivers have been identified:
    - D3.1 (P6) Possible non-implementation of CORSIA by third countries: A wide range of quantification scenarios would be possible, as the impact of the driver depends on which countries outside the EEA implement CORSIA, and how and to what extent (if any) it is strengthened. Table 5 compares emissions coverage in two key participation scenarios (PO1 and PO2/3, where assumed participation is the same), and Annex 10 Section 5 provides further context, including Table 19 which examines six participation scenarios.
    - D3.2 (P7) Potential lack of coherence between ETS implementation and the implementation of possible IMO mid-term measures in the future

Associated with Problem 2:

- **D4: Decreasing market size.** The decreasing market size can have a negative impact on trading. This is because a low market size entails the risk of thin or illiquid trading[19], which would in turn cause price volatility and uncertainty.

The following sub-driver has been identified:

    - D4.1 (P10/11) Intrinsic functioning of the EU ETS (as the cap reduces over time so will the size of the market), which, under certain circumstances, can lead to market failure.

The individual sub-drivers are further developed in Annex 7.

2.3. How likely is the problem to persist?

The risk that the EU ETS does not contribute cost-effectively to the EU emissions reduction target in line with 2050 economy-wide climate neutrality and the 2040 target and fails to address the EU's fair share of international emissions, is likely to persist because the current legislative framework was designed to achieve the 2030 climate target for the sectors covered. The continuation of the current provisions post-2030, in particular the cap trajectory, without adjustments risk market inefficiencies (e.g. trading frictions, price volatility) and excessive costs. These effects can be seen in the analysis of the baseline in Section 5.1.

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

Articles 191, 192 and 193 of the Treaty on the Functioning of the European Union empower the EU to act to preserve, protect, and improve the quality of the environment; protect human health; and promote measures at the international level to deal with regional or worldwide environmental problems. The legal basis of this impact assessment is in Article 192(1), as this impact assessment is action being taken to combat climate change and to serve the other environmental objectives specified in Article 191. The ETS has been operating on this legal basis since 2003. The European Parliament and Council adopted all amendments to the ETS Directive on this legal basis.

[19] Note that the concept of liquidity of the market, referring to the amount of allowances available for trading, should be differentiated from the concept of market tightness, which can occur regardless of the market size if the supply of allowances is very tight in relation to the demand of allowances (i.e. actual emissions).

3.2. Subsidiarity: Necessity of EU action

Climate change is a trans-boundary problem and both international and EU action can effectively complement and reinforce regional, national and local action. Adjusting the ETS to the 2040 target for EU GHG reductions will affect many sectors across the EU economy and coordinated action at the EU level is therefore indispensable and has a much bigger chance of leading to the necessary transformation, acting as a strong driver for cost-effective change and upward convergence. Furthermore, many of the policy elements assessed in this impact assessment have an important internal market dimension, in particular the options related to the carbon leakage protection and the low-carbon funding mechanisms. EU action can also inspire and promote the development of other market-based measures, including at global level.

3.3. Subsidiarity: Added value of EU action

As a carbon market, the ETS incentivises emission reductions made by cost-effective solutions first across the activities it covers, achieving greater efficiency by virtue of its scale. Implementing a similar measure nationally would result in smaller, fragmented carbon markets, risking distortions of competition and likely lead to higher overall abatement costs. The same logic holds for the extension of carbon pricing to new sectors.

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

To address the problems identified, the revision of the ETS Directive and the MSR Decision has a number of general objectives.

As regards the **risk of not contributing cost-effectively to the EU emissions reduction target in line with climate neutrality and the 2040 climate target including addressing the EU's fair share of emissions (problem 1)**, the impact assessment aims to:

- O1.1 Incentivise further emission reductions: to ensure the EU ETS contributes cost-effectively to economy-wide efforts (including transport) of achieving emission reductions of the EU in line with climate neutrality and to contribute cost-effectively to the EU's fair share of economy-wide emissions reductions. The following specific objectives have been identified for O1.1:
    - SO1.1.1 Enable investments in decarbonisation technologies (both innovative ones and those ready for scale-up/roll-out) that currently do not yet have the business cases.
    - SO1.1.2 Ensure full carbon price signal is applied to emissions sources which are currently not in the scope of the EU ETS but would be well suited for its coverage, and to sectors where currently dampened.
    - SO1.1.3 Address risk of carbon leakage.
- O1.2 Reach a pre-set emissions reduction target provided by the 2040 policy package and with a net emissions calculation: exploring if the EU ETS gross emissions could be increased without compromising the sectors' contribution to economy-wide net emission reductions in line with climate neutrality, including exploring if the emission reduction efforts could be complemented with carbon removals. The following specific objectives have been identified for O1.2:
    - SO1.2.1 Consider how carbon removals can be integrated in the EU ETS with sufficient environmental safeguards while preserving cost efficiency in achieving the ETS/EU climate objectives before 2040.

- SO1.2.2 Adjust EU ETS cap in line with pre-set climate target for 2040.

- O1.3 Ensure effective EU climate action on transport emissions.

  To ensure effective EU climate action means to ensure that there is a meaningful carbon price on the EU's fair share of international transport emissions.

  - For aviation, the objective is to ensure a meaningful carbon price on the EU's fair share of international aviation emissions, which can be a complement to CORSIA.
  - For maritime, the objective is to ensure coherence between any IMO mid-term measures and the EU ETS while addressing possible risk of significant double burden when (and if) payments are made due to IMO regulations in relation to emissions already priced under the EU ETS maritime, in a way that prevents environmental backsliding.

  The following specific objectives have been identified for O1.3:

  - SO1.3.1 Ensure effective action on EU's fair share of aviation emissions in the period 2031-2040
  - SO1.3.2 Preserve the effectiveness of the implementation of the EU ETS extension to maritime.

As regards the **risk of market inefficiencies (problem 2)**, the impact assessment aims to:

- O2.1 Ensure efficient market functioning: this means ensuring that, in spite of a decreasing market, there is sufficient liquidity in the market so as to prevent trading frictions and excessive price volatility. The following specific objectives have been identified for O2.1:
  - SO2.1.1 Increase size of the market until 2040.
  - SO2.1.2 Adjust MSR parameters to ensure a healthy supply-demand balance until 2040.

The specific objectives are further developed in Annex 7.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1. What is the baseline from which options are assessed?

The baseline of this impact assessment assumes the continuation of the ETS Directive as currently in legislation, and the continuation of all other relevant legislation, most notably Renewable Energy Directive[20], the Effort Sharing Regulation[21] (until 2030), the Waste

[20] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (OJ L 328, 21.12.2018, ELI: http://data.europa.eu/eli/dir/2018/2001/2024-07-16).

[21] Regulation (EU) 2024/1028 of the European Parliament and of the Council of 11 April 2024 on data collection and sharing relating to short-term accommodation rental services and amending Regulation (EU) 2018/1724 (OJ L, 2024/1028, 29.4.2024, ELI: http://data.europa.eu/eli/reg/2024/1028/oj

Framework Directive[22], the Landfill Directive[23], ReFuelEU Aviation[24], FuelEU Maritime[25] Regulations.

This means, most notably, a continuation of the legislated linear reduction factor of 4.4 % from 2028 onwards, leading to a 2040 cap of 69 Mt; the continuation of the current MSR parameters; application of EU ETS to departing and arriving flights from the EEA from the start of 2027 and ending of ETS SAF support in 2030; the Modernisation Fund runs up to 2030, and Member States receive all the allowances that are not issued for free, placed in the MSR or established as own resources; the maritime scope remains as legislated[26] with temporary derogations ending in 2030, while taking into account the effect of global policies and strategies at IMO; accounting of emissions that are captured in the EU ETS installations for utilisation in products (CCU) takes place upstream; the 20 MW threshold continues to apply; the incineration of municipal or hazardous or waste are generally excluded from the full scope of the EU ETS (with co-incineration, however, fully covered).

As an exception, the baseline for **free allocation** for sectors not covered by CBAM results from the continuation of the current rules post-2030, based on the provisions set out in Article 10a of the ETS Directive. This does not correspond to the legal default, as the provisions of Article 10a of the ETS Directive apply only until 2030. However, assuming a baseline of continued free allocation post-2030 allows for a more meaningful analysis of the proposed measures based on comparable scenarios. For the sectors covered by CBAM, free allocation is phased out up to 2034 in parallel with the gradual phase-on of CBAM. The quantity of allowances available for free allocation is based on 43% share of the baseline cap trajectory, resulting from the provision in Article 10 of the ETS Directive that 57% will be allocated via auctioning.

Equally, the baseline on **instruments to support investments** assumes continuation of the Innovation Fund (IF) as defined in the ETS Directive using existing instruments ('regular' grants and, to lesser extent, auctions and financial instruments) to address technology and early commercialisation risks across innovative decarbonisation technologies in the ETS covered sectors. The baseline also assumes the establishment of the Industrial Decarbonisation Bank (IDB) with a EUR 100 billion envelope as announced under the Clean Industrial Deal to focus addressing market risks for scale-up and roll-out of decarbonisation technologies in Energy Intensive Industries. The current ETS Directive foresees the ETS revenues to be set aside for the IF for the period 2031-40 that are sufficient serve both the IDB endowment and the IF continuation. In line with necessary specialisations of the two instruments – with the IF serving as the 'innovation pillar' and the IDB becoming the 'roll-out pillar' - and reflecting the

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22 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, ELI: http://data.europa.eu/eli/dir/2008/98/oj).

23 Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste (OJ L 182, 16.7.1999, ELI: http://data.europa.eu/eli/dir/1999/31/oj).

24 Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation) (OJ L, 2023/2405, ELI: http://data.europa.eu/eli/reg/2023/2405/oj)

25 Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport (OJ L 234, 22.9.2023, ELI: http://data.europa.eu/eli/reg/2023/1805/oj).

26 For maritime, the ETS Directive applies to ships of or above 5 000 gross tonnage. All emissions of voyages between EU ports, as well as emissions within EU ports are covered but only 50% of emissions of voyages between EU and non-EU ports. Methane and nitrous oxide emissions from maritime transport are covered under the ETS1 as from 2026 and emissions from large offshore vessels will be covered as from 2027.

expected technology deployment needs after 2030, the ETS revenues will be allocated between the two instruments.

The Baseline described above needs to be distinguished from modelled 85% target scenarios which will be used in the quantitative sections of the impact assessment focused on economic impacts. These are model-based scenarios which optimise the technological investments required to hit an 85% net emissions reduction target by 2040 compared to 1990, and climate neutrality in 2050. However, this economy-wide optimisation does not provide sufficient information about detailed policies to achieve the necessary technology deployments. The reason to use these scenarios for further analysis is that they allow us to abstract out the economic impact of the change in the LRF, which would otherwise dominate all other policy measures. Furthermore, the key purpose of this impact assessment is not to assess the overall economy-wide ambition level, but to assess the policy measures through which the EU ETS could best contribute to attaining it. The ambition level as a whole was assessed in the impact assessment of the 2040 Climate Target[27].

5.2. Policy options

Three policy options have been developed that ensure that the ETS contributes cost-effectively to the EU emissions reduction target in line with climate neutrality and the 2040 target and to addressing the EU's fair share of international emissions. The options differ in the degree of change that they entail to the current system. *Policy option 1 Aligning ambition and improving incentives* includes the measures that, overall, lead to least change compared to policies in place in 2026. *Policy option 2 Aligning ambition and extending scope and corresponding incentives* includes measures that introduce moderate innovations or changes to the system. *Policy option 3 Aligning ambition and extending scope and incentives comprehensively* alters most substantially how the system works. Annex 7 explains why each measure was included in the relevant policy option. In addition, the concluding sections of Annexes 8 to 13 summarise the assessment of each measure. Not all the measures analysed for each topic in the annexes were included in the policy options.

The most impactful measures in the policy options are those related to scope (aviation and waste), ambition (cap, removals and MSR), and use of allowances (in particular, for the IDB and free allocation), impacting for example costs of production or the business case for investments in emissions reductions. Regarding the scope, the combined extension of the system to departing flights and all waste incineration installations and landfills of non-hazardous waste (PO3 – largest scope extension) could increase the size of the ETS by around 30% compared to PO1 in terms of cumulative budget over 2031-2040.

Regarding the ambition, all policy options include the same measure for the cap, meaning that the impact is driven by the integration of carbon removals and the MSR. This choice has been made for the pragmatic reason that the other measures, not related to the cap, need to be assessed without this assessment being affected by changes in overall ambition level. The cap section of Annex 8 and chapter 6 of this impact assessment will nevertheless show environmental and economic impacts of comparing CAP2 and CAP4 to CAP3.Various other caps and targets are also illustrated in the Annex. The *relative* impacts of the other measures, such as those on removals, carbon leakage or CCU, will not be affected by changes in cap trajectory: if a policy measure performs better under certain criteria than an alternative measure under CAP1, it can be expected to perform better under CAP3 as well. By keeping the same

[27] COM(2024) 63 final

CAP measure under all POs, such relative performance can be isolated, without being dominated by the environmental and economic impacts of changing the cap.

For removals, the differences in the degree of change among the policy options are not based on the level of the increase of the emissions space (all POs count on the same amount of removals being eligible for integration) but rather on the certainty on the net and gross emissions[28]. For the MSR, the differences between the policy options stem from changing from static parameters (PO1) to dynamic parameters (PO2-PO3), in which MSR parameters decline at a fixed proportional rate from 2028 onwards. This ensures a MSR design that dynamically accompanies the overall decreasing market of allowances. Regarding the use of allowances, the most impactful changes relate to the deployment of the 100 billion of the IDB (already in the baseline), and the changes to rules on free allowances – ranging from targeted improvements (PO1), to introducing their conditional use (PO2) and their phase-out (PO3). More in-depth analysis of options is provided in Annex 9.

The policy options all address the main risk that the ETS does not contribute cost-effectively to the EU emissions reduction target – this is because all options align the cap trajectory with the 2040 climate ambition of the EU. In all cap options, the reduction rate can continue at a slower pace than the currently legislated LRF. This means more allowances can be issued each year and new allowances will continue to be issued well beyond 2040. The integration of removals and adjustments to the MSR can also improve the cost-effectiveness of the ETS contribution to the EU's climate ambition, by increasing the emissions space in the system through removals and adjusting the MSR so it can maintain a healthy supply and demand balance. The stability of the system and its environmental integrity act as constraints to any changes on either topic. Beyond that, differences in achieving a cost-effective contribution depend mainly on the scope extensions and use of allowances. Broader scope extensions allow the system to contribute to more emissions reductions and increase market efficiency by making it larger, but this needs to be measured against the efficiency of the extension (emission reduction potential and implementation costs). Introduction conditions on free allocation or reducing free allowances can improve incentives to decarbonise and lead to greater emissions reductions, as long as it does not lead to carbon leakage. This carbon leakage risk is in turn mitigated in part by the financing support provided through the IDB. Regarding the risk of not contributing cost-effectively on the EU's fair share of international emissions, it is assessed whether the international scheme CORSIA is providing this contribution, or whether a complement through application of the ETS carbon price is required. Cost effectiveness is preserved through a deduction of CORSIA offsetting costs in case a complementary ETS price is applied, and additional financial support for aviation decarbonisation is provided.

Table 1: Overview of policy measures and policy options

Topic	Policy measure	PO1	PO2	PO3
Cap	CAP1: "Linear" measure - it follows a linear trajectory from 2030 to 2040 towards and 85% consistent target in 2040			

[28] PO1 providing relative certainty in both, under the condition that the public authority receives sufficient financing; PO2 providing certainty on net emissions; and PO3 providing certainty on gross emissions.

Topic	Policy measure	PO1	PO2	PO3
	CAP2: Default modelled trajectory to 85%: it follows the 2031-2040 trajectory of GHGs currently under ETS towards the estimated cost-effective contribution of the EU ETS to a reduction of economy-wide net GHGs by 85% in 2040. This option is illustrated by the scenario "85%".	X	X	X
	CAP3: Until 2035 it follows the trajectory of GHGs currently under ETS towards the estimated cost-effective contribution of the EU ETS to a reduction pathway for economy-wide net GHGs moving linearly towards 90% in 2040, but in the second half of the decade the trajectory flattens to move towards the estimated cost-effective contribution of the EU ETS to a reduction of economy-wide net GHGs by 85% in 2040. This option is illustrated by the scenarios labelled "9085".			
	CAP4: An accelerated version of CAP3, comparable to a non-linear pathway towards the 90% target in the first five years, then flattening to be compatible with an 85% target in 2040.			
	CAP5: "90% extended legal default", extending the legal default LRF until 2035, followed by a lower LRF to be compatible with the 90% target in 2040			
Removals[29, 30]	CR1: Limited operator integration on top of the cap		X	
	CR3: Limited operator integration under the cap (one-in-one-out)			X
	CR4: Public authority integration through regular auctions under the cap	X		
MSR	MSR1: Static parameters, new thresholds (Adjust current parameter values based on updated assessments of market conditions and hedging needs (e.g. reduced upper and lower threshold, buffer also for lower threshold))	X		

[29] As explained in Annex 8 – Part II, all measures consider only the inclusion of CCS-based permanent carbon removals certified under the CRCF (BioCCS and DACCS) generated inside or outside the ETS.

[30] On top of the cap, refers to when gross emissions are limited by the cap plus the number of allowable removal units; under the cap, to where the cap determined the gross emissions level and removal units do not generate additional emissions space. For further explanations see Section 2.1. of Annex 8 – Part II.

Topic	Policy measure	PO1	PO2	PO3
	MSR2: Dynamic parameters (MSR 1 + rates changing over time by the LRF)			
	MSR3: Dynamic parameters (Adjusted release rate, upper and lower at declining fixed rate)		X	X
IDB - allocation mechanism	AM 1: Multi-criteria call for proposals	X		
	AM 2: Auctions			X
	AM 3: First-in, first served administrative schemes		X	
IDB - form of support	FS 1: 'Regular' grants covering the funding gap	X		
	FS 2: Carbon Fixed Premium		X	
	FS 3: Carbon Contracts for Difference			X
IDB - ensuring geographical balance	GB 1: EU-level competition, no geographical balance measures	X		
	GB 2: balance between EU-level competition and national allocations for the overall IDB spending		X	
	GB 3: strong national allocations			X
Modernisation Fund - Eligibility of gas/Waste- to-energy	GAS/WtE1: PI: Exclusion. NPI: Status quo	X		
	GAS/WtE2: PI: Exclusion. NPI: Allowed under conditions.		X	
	GAS/WtE3: PI/NPI: Exclusion			X
Modernisation Fund - Respective shares of Priority (PI)/Non-Priority investments (NPI)	PI/NPI0: NPI share = 10%	X		
	PI/NPI1: NPI share = 5%		X	
	PI/NPI2: No NPI			X
Modernisation Fund - confirmation process of priority investments	GOV0: on rolling basis	X		
	GOV1: Status quo (as in current MF)		X	
	GOV2: vetting by Investment Committee			X
Aviation - Geographic Scope	AS1: clean cut – intra-EEA flights and departing flights to Switzerland and the UK	X		
	AS2: departing flights		X	X

Topic	Policy measure	PO1	PO2	PO3
Aviation - SAF support	SAF0: status quo	X		
	SAF1: medium extension		X	
	SAF2: larger extension			X
Maritime -Support for emissions reduction in the shipping sector	LCF0: No dedicated ETS support mechanism	X		
	LCF1: EU ETS support mechanism for Sustainable Maritime Alternative Propulsion (SMAP)		X	X
Maritime -Evasion Risk	RE0: Current measures on evasion	X		
	RE1: Revise the list of neighbouring container transhipment ports		X	X
	RE2: Ensure that offshore activities by ships operating in EU waters are covered, independently from their port of origin		X	X
Maritime - Simplification	SI1: Simplification, and targeted enhancement measures	X	X	X
Maritime - Derogations	DE0: no extension of derogations	X		
	DE1: Extension of derogations for limited time		X	X
Maritime – IMO adjustments	IMO0: No adjustment	X		
	IMO1: Deduction from the ETS surrendering obligations of emissions subject to pricing by IMO.		X	X
Maritime - Smaller Ships	MSS0: The existing scope in terms of ship categories and sizes remains unchanged	X		
	MSS1: Targeted extension of the scope of the EU ETS to emissions from smaller ships, by including ship categories emitting the most among small ship categories		X	
	MSS2: Extension of the scope of the EU ETS to all smaller vessels (from categories non-exempt from MRV, plus fishing vessels and non-commercial yachts)			X
Stationary installations - Carbon Leakage	CL1: Improved current approach	X		
	CL2: Conditional Free allocation for investments		X	

Topic	Policy measure	PO1	PO2	PO3
	CL3: No free allocation and partial surrender of allowances until 2034			X
Stationary installations - Indirect Cost Compensation	ICC1: Continue state aid encouragement	X	X	
	ICC2: Harmonised ICC			X
Stationary Installations - Waste	W0: No inclusion of additional waste management processes in the EU ETS.	X		
	W1: Inclusion of municipal waste incineration installations in the EU ETS		X	
	W3: Inclusion of all waste incineration installations and landfills of non-hazardous waste in the EU ETS			X
Stationary installations - CCU	CCU0: 'Upstream accounting' with current waste scope	X		
	CCU1: 'Upstream accounting' with MWI inclusion			
	CCU3 'Hybrid Downstream & Midstream accounting'		X	X

5.3. Options discarded at an early stage

Several measures were discarded to address the specific problems, as set out in the description the policy options with reference to Annexes 8 to 13. In addition, alternative options that could address the problem as a whole by replacing the ETS for another instrument, either harmonised at EU-level or for Member State implementation, instead of adjusting the EU ETS through the measures examined in the Annexes 8 to 13, were discarded at an early stage.

Beyond the theoretical advantages of the EU ETS over its alternative policies (e.g. carbon taxes or command-and-control measures), the discontinuation or narrowing of the EU ETS would lead to economic losses, weaken low carbon investments signals, penalise early movers, reduce investor confidence, distort competition, reduce revenues, reduce employment in affected firms, and jeopardise climate-related jobs in sectors. These sectors include clean tech, renewable energy, energy efficiency, and also monitoring and verification, consulting, and innovation support. At an international level, dismantling the EU ETS would undermine the EU's credibility in international climate diplomacy and weaken the EU's position on shaping global carbon pricing mechanisms and border adjustment instruments (see Evaluation Report in Annex 15, Section 6.3). Final impacts on the economy and on the credibility of the EU would depend on whether the EU ETS is replaced by another policy, by which, and the transition period for the new system to function. Feedback from the stakeholder consultation broadly confirms the findings. Respondents most frequently emphasised the EU's added value in harmonising implementation across Member States, avoiding a fragmented patchwork of

national schemes[31] and ensuring a common price signal. Similarly for maritime, discontinuation of EU ETS maritime would put at risk the fair contribution of the maritime sector to the EU's climate objectives and undermine the shipping companies that have already invested in cleaner vessels and fuels.

Beyond alternatives to the EU ETS as a whole, in relation to specific measures to modify the system, the implications of lowering the 20 MW threshold (the thermal capacity below which stationary installations are exempt from EU ETS) is considered in detail in Annex 12 of this Impact Assessment. Based on that assessment, the option of lowering the threshold is not taken further. Most emissions from small installations will be covered under EU ETS2, which will become fully operational in 2028 and is outside the scope of this impact assessment. Therefore, the environmental gains from lowering the threshold would be very small compared to the substantial increase in administrative effort.

As regards the Market Stability Reserve, the evaluation and impact assessment demonstrate that the MSR should remain a rule-based and transparent framework for supply adjustments in the EU ETS, able to respond to external shocks without discretionary and price-based interventions or political interference. Alternative far-reaching reforms such as a carbon central bank are therefore discarded as they represent departures from the MSR's established operational principles, would require multi-year preparatory timelines and hence are not feasible for implementation by 2028.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

6.1. Environmental impacts

This section assesses the main environmental impacts associated with the measures under each topic in Table 1. The focus of this assessment is on both the impact of the policy options on GHG emission reductions both within the EU (in terms of annual and cumulative emissions) and other environmental impacts. Additional details on the environmental impacts for each of the measures considered can be found in the thematic Annexes 8-13.

Based on the assessed environmental impacts for the individual policy measures, a summary is provided with an overview of the impacts per policy options scenarios.

6.1.1. Climate

6.1.1.1.Cap

All measures considered for the cap in Annex 8 reach the same ETS contribution to the 2040 objectives for gross and net emissions, as they are modelled on the basis of the same EU domestic climate target. In addition, all policy options use deliberately the same cap measure ('CAP2' the modelled cost-efficient trajectory to 85%), so they will follow a similar budget trajectory, differing as a result of the changes in scope. Nevertheless the 9085 and other pathways will also be illustrated here.

The below table shows the range of outcomes in the PRIMES and POTEnCIA models, rounded to five, in order to represent the uncertainty range resulting from using the different models:

[31] For an overview of carbon pricing instruments, see Annex B of World Bank, *State and Trends of Carbon Pricing 2025*, https://www.worldbank.org/en/publication/state-and-trends-of-carbon-pricing.

Table 2: Table showing approximate cap trajectories, when including extra EEA aviation in the target

EEA Caps (Mt), LRF (%) and Carbon Budget (Mt)	CAP1: Linear trajectory	CAP2: cost effective trajectory	CAP3: 90-85 pathway
2030	911	911	911
2035	620-645	580-670	560-605
2040	330-375	330-375	330-375
LRF 2030-2035	2.7-2.5%	3.1-2.3%	3.3-2.9%
LRF 2035-2040	2.7-2.5%	2.3-2.7%	2.1-2.1%
Carbon Budget 2031-2040	5915-6175	5705-6295	5605-5965

The table above shows that, for a given model, the two-step trajectory would have smaller total emissions (i.e. carbon budget) over the 2031-2040 period than either the linear or modelled trajectories unconstrained in 2035. However, we see that there is overlap in the ranges, due to the different models used.

Here it should be noted that this modelling has been performed under the assumption that (one-way) international extra EU aviation has been included in the EU target. See Annex 8 on a qualitative economy-wide assessment and modelling results on the caps if international extra EU aviation is not regarded as part of the target scope. The above numbers include the current scope of EU ETS, including international extra EEA aviation, and maritime non-CO2. They exclude waste and are set at gross emissions.

In terms of the inclusion of municipal waste incineration in PO2 and landfills and hazardous waste incineration in PO3, the environmental impact will depend on how the additions to the cap compare to hypothetical policies to reduce waste emissions outside the EU ETS (see Section 6.1.1.8.). Inclusion in the EU ETS would increase the (long term) certainty and investment signal that the sector contributes its share in emissions reductions by reducing emissions or paying for reductions elsewhere. The increases in the cap in the scenarios PO2 and PO3 are relatively generous compared to reductions by 2040 expected from other sectors.

In PO1, EU ETS includes intra-EU flights but not international extra EU flights, and the cap is therefore lower. Implicitly, other policies will apply to international aviation. In PO2 and PO3, outgoing international aviation is included in the EU ETS, as well as emissions from smaller ships.

However, there are other possible ways to design the cap measure, as described in Annex 8. If international aviation were to be excluded from the target, total emissions under the EU target would be lower. As international aviation is a hard-to-abate sector with lower reduction potential by 2040 than other sectors, this would nevertheless create additional emissions space of ca. 45 Mt for other sectors of the economy.

In addition, if the EU ETS is assumed to benefit from the total amount of industrial removals in the models, the cap can be decomposed into a more ambitious cap set at the level of net emissions plus an amount of removals-linked allowances, which together add up to a total

gross emissions carbon budget; this is in particular relevant to PO1. The result of both excluding international extra EU aviation from the cap, as well as the decomposition in net trajectory and removals-linked allowances is estimated below for the POTEnCIA model:

Table 3: Net caps trajectories for POTEnCIA, excluding international extra EEA aviation and with added removals linked allowances

EEA Caps (Mt), LRF (%) and Carbon Budget (Mt)	**CAP1: 85 linear trajectory**	**CAP2: 85 trajectory**	**CAP3: 90linear-85 pathway**	**CAP4: accelerated 90-85 pathway**
2030	847	847	847	847
2035	570	600	555	485
2040	290	290	285	285
LRF 2030-2035	-2.7%	-2.4%	-2.8%	-3.5%
LRF 2036-2040	-2.7%	-3.0%	-2.6%	-1.9%
Added removals-linked allowances	320	320	320	320
Carbon Budget 2031-2040	5720	5885	5640	5290

In PRIMES the emissions space would be lower for CAP1, CAP2 and CAP3: as an example, the gross emissions carbon budget for the modelled 85% trajectory would be 5205 Mt including 170 Mt of removals linked allowances. CAP4 is comparable to a non-linear pathway towards the 90% target in the first five years, then flattens to be compatible with an 85% target for the second five years. From all the net cap options in **Error! Reference source not found.** CAP4 shows the lowest carbon budget over the period, contributing with the highest emissions reductions.

6.1.1.2. Removals

- **Net and gross emissions**

The policy options in this impact assessment integrate removals as a way to provide additional emissions space. The policy options should ensure the generation of all the removals that are taken into account in the design of the cap:

1. for ETS to achieve its **net objective** and
2. for the ETS sectors to benefit from the emissions space that is represented by the relevant removals (i.e. the **gross objective**).

The net objective for each policy option is the gross emissions limit in that option minus an amount of eligible removals[32] modelled for the 85% scenario[33] of between 175 and 330 Mt.

[32] Eligible for inclusion based on the assessment carried out in Annex 8: removals from DACCS, and for BECCS stored underground and removals from biomass processing and stored underground (jointly called 'BioCCS').

[33] See Table 3 in Annex 8 – Part II.

This section assesses the likelihood that each policy option would reach the net and gross objectives.

PO1 includes measure CR4 ('*Public authority integration through regular auctions under the cap*'). As shown in Annex 8, the purchase of removal units and corresponding issuance of additional (removal-backed) allowances by the regulator would allow gross emissions in the ETS to increase, while maintaining the same level of net emissions, conditional on the purchase by the public authority of the relevant removals. The public authority would commit to the purchase of between 170 and 330 Mt of removals from BECCS and DACCS, pre-increasing the cap by that amount, and guaranteeing the gross emissions for the ETS sectors. Assuming the purchasing programme is endowed with sufficient budget and the expected supply materialises, there is thus, in principle, certainty on the achievement of both the net and gross emissions objectives[34]. Therefore, PO1 integration of removals should not generate uncertainty on reaching climate targets in comparison to the baseline scenario of an ETS without the integration of removals and reduces the risk of carbon leakage by increasing the gross emissions space. Moreover, modelling results in an overachievement of the removals objective, generating 222 Mt instead of 175 Mt as per the design of the measure, due to the certainty provided by the public commitment to purchase removals which in the model is represented by a lower discount rate. However, the modelling results are subject to significant uncertainty given the wide range of possible future technology costs and deployment constraints. In addition, if the public authority had a limited budget and/or carbon removal prices were higher than projected, there would be a risk of not attaining the net emissions target.

Meanwhile PO2, implementing CR1 ('*Limited operator integration on top of the cap*'), provides certainty in reaching net emissions, as the cap is set at the level of the targeted net emissions. However, in the absence of support measures, CR1 creates uncertainty on gross emissions (within bounds). Removals will only be used, providing additional emissions space on top of the net cap, when they become cost competitive. This could lead to lower investment in removals (due to uncertainty of the size of the market) and higher investment in mitigation (due to the uncertainty that removals will materialise and enable hitting the net target). Under these assumptions, represented by an increase in discount rates for removals (due to uncertainty), modelling shows 110 Mt tonnes of eligible removals come into the EU ETS on top of the cap). However, perceptions are hard to predict: an equilibrium in which there is underinvestment in mitigation (due to optimism about removals) and high investment in removals as a result thereof cannot be ruled out.

In PO3, implementing CR3 ('*Limited operator integration under the cap (one-in-one-out)*'), introduces an uncertainty that does not exist in the baseline, regarding the net contribution of the ETS – there is a maximum level of net emissions (how low net emissions can go) but not a minimum that would be reached. PO3 operates as PO1, with a pre-increase of the cap, but in PO3 the central regulator is not responsible for procuring removals, and their realization depends on market dynamics. Removals are remunerated at the prevailing EU ETS price, meaning that their volume remains uncertain and not guaranteed, introducing potential variability in both net emissions outcomes and investment behaviour. Modelling shows all the eligible carbon removals are generated as the model is constrained to hit the economy-wide 2040 and 2050 climate target. However, in reality, as long as removals are not cost competitive, there is a risk of insufficient removal being incentivised, causing the EU ETS to miss its net

[34] As shown in Annex 8 – Part II, by 2040 removals can cover 10-13% of the gross emissions of the ETS by 2040.

objective. This should be kept in mind when interpreting the results for PO3. The risk in PO3 is that the modelled assumptions would simply not be met.

Considering the price difference, the removals entering EU ETS in PO3 should be closer in quantity to those in PO2, or less, as the pre-increase of the cap should lower EU ETS prices, increasing the cost-differential. In the 85% scenario, removal units from BECCS are expected to become cost competitive vis à vis the allowance price in 2038, whereas DACCS removal units would not reach cost competitiveness within the period[35]. As with PO2 regarding gross emissions, the uncertainty on net emission in PO3 can be reduced if financing is provided to support removals, e.g. through contracts for difference[36].

Finally, from a broader perspective, it should be noted that funding from ETS revenues provided to support the integration of removals – in particular in PO1 which is designed with the funding as essential element - necessarily reallocates scarce fiscal resources away from other uses. An alternative use of ETS revenues can be mitigation and enabling investments, e.g. via the Innovation Fund or of Member State's climate spending. It raises a question of whether the subsidization of removals leads to crowding out cheaper emission reductions in the short term and potentially increasing the overall cost of achieving EU targets, while supporting the long-term objective of scaling up removals to make them cost-competitive.

- **Abatement deterrence**

We must distinguish the abatement deterrence (when carbon removals substitute otherwise expected emissions reductions) linked to expectations on carbon removals, from that happening immediately due to the introduction of carbon removals in EU ETS as a means to increase in the cap. PO1 and PO3 see an upfront increase of the cap. As a result, abatement efforts are reduced in both cases.

Meanwhile, abatement deterrence[37], can also result from the risk that the overoptimistic expectations of market participants on removals supply or prices in the future will lead them to excessively *reduce* or *delay* current abatement measures[38]. This is particularly relevant for the

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35 Based on technology costs from European Commission: Directorate-General for Climate Action, Ramboll Management Consulting, Witteveen, E., Marton, C., Bert, N. et al., *Carbon removals in the EU – Review of current carbon removal projects and early-stage financing*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2834/0004994.

36 PO2 and PO3 are designed without support measures because the private integration option allows for it, while the public authority integration, per definition does not. These differences in design allow testing the range of results. See Section 4.6.3 in Annex 8 – Part II for more details on how the support would operate.

37 Abatement deterrence lies at the heart of the Commission consideration of the possible inclusion of removals in the EU ETS. Article 30 paragraph 5(a) requires the Commission to consider "safeguards to ensure that such removals do not offset necessary emission reductions in accordance with Union climate targets laid down in Regulation (EU) 2021/1119". The effect by which removals could displace emission reductions is often referred to as 'mitigation deterrence'. However, 'mitigation deterrence' can be a misleading term, as CDR is also a type of mitigation action (Honegger et al., *Is carbon dioxide removal 'mitigation of climate change'?*, 2021, https://doi.org/10.1111/reel.12401). Therefore, the term abatement deterrence is used.

38 Abatement deterrence is not inherently a problem, provided that CDR delivers similar outcomes as compared to emission reductions with regards to climate and other societal objectives. The effect could also be desirable if, all things considered, removals are used to offset emissions that are prohibitively expensive to abate. However, several factors impact if removals deliver outcomes (climate and societal) that are similar or better than those of abatement: (1) risk of failure that would make it impossible to retroactively reduce emissions if these technologies do not materialise as expected; (2) delaying near-term emissions reductions in favour of future removals temporarily increases GHG concentrations; (3) carbon removal efforts may deliver fewer

ETS, where abatement in the short term is mostly only possible through a lowering of production volumes (which is undesirable). Abatement in the long run requires investment decisions that only lead to abatement after several years. As a result, long-run abatement and the ETS-price are highly dependent on future expectations. Integrating removals exposes the abatement investment decisions of ETS sectors to the long-term uncertainty of permanent carbon removals (e.g. limited/incomplete information on future costs and availability of BioCCS, DACCS). As the ETS is capped, the realisation of this risk (i.e., that the expected supply or lower prices of removals do not materialise as expected) would not translate in higher gross emissions but in an increase in prices and/or a lowering of production volumes, resulting in an avoidable lowering of economic output.

PO1 is shielded from this effect because the ETS market does not have direct access to removals. Thus, the expectation on removals supply or prices should not impact the abatement actions of ETS market participants, which are just determined by the cap. This is valid as long as the market trusts that the increase in the cap due to the integration of removals is done tightly linked to a realistic budget for the purchase of the removals. Alternatively, the market may expect that the cap will be further increased in the future, if that increase does not really depend on the availability of a budget to purchase removals.

Meanwhile, PO2 and PO3 are exposed to abatement deterrence due to the direct substitutability between abatement and carbon dioxide removals (CDR). This risk is moderated by limits, meaning that the CDR cost would not act as the price ceiling for the ETS once CDR becomes cost-competitive in the ETS.

In PO2, the volume of removals is not guaranteed by the regulator. This means EU ETS sectors could be incentivised to maintain sufficient abatement efforts in line with the net emissions target (the cap), because removal volumes would be uncertain. In economic terms, this is represented in the model by higher discount rates for investing in removals. As shown in Section 6.2.1.2, the modelling, higher removals costs lead to higher ETS prices in PO2 and higher abatement (translating in lower gross emissions). However, if the market would expect a high availability of cheap removals, some abatement, moderated by the limit, could be deterred.

PO3 should lead to a lower abatement deterrence risk, beyond the initial cap increase, because any removal used would lead to the cancellation of an allowance. Therefore, wrong expectations on removals volumes should not impact the expectations on gross emissions in the ETS, which would be similar as in PO1. However, the expectation that removals would become very cheap could potentially impact market dynamics if participants delay abatement in the overoptimistic expectation of purchasing (or creating) removals in the future, leading to a price spike later on. In addition, the absence of support measures to generate the additional removals space could lead to reduced political credibility by market participants of the

climate benefits than anticipated due to rebound effects; (4) substituting removals for emissions reductions in sectors with viable mitigation alternatives may deplete the removal potential needed for achieving future net-negative emissions targets; and (6) despite potential for some positive externalities, the large-scale deployment of some removal options in climate pathways may create significant negative externalities. In this regard, the European Scientific Advisory Board on Climate Change (ESABCC) notes that removals need to contribute to EU climate neutrality in a dynamically cost-effective way while avoiding the risk of mitigation deterrence. To this end, there is a need to support the early deployment of a portfolio of removal options, to consider the wider social costs and benefits of reduction and removal methods, and to avoid overreliance on future removal methods with uncertain costs and potential (ESABCC 2024, p. 83).

willingness of the regulator to increase the cap only under the condition that the removals are purchased, reducing credibility on the long-term stringency of the cap.

- **CDR support**

All options **support CDR development** to a greater extent than the baseline, which is a positive impact for the climate objective of net-zero in 2050[39]. The modelling generates 110 Mt of removals, but these are generated within the EU economy due to the model and not necessarily incentivised by the ETS.

Among the options, PO1 is much more likely to be effective in supporting CDR development and deployment than PO2 and PO3. The effective support in PO1 was the most frequently cited reason by stakeholders supporting this option. The modelling also shows the earlier deployment of removals during the period 2031–2040 in PO1 and (over-) achievement of the removals objective. The regulator can make strategic long-term investments in procuring initially expensive but promising engineered CDR to stimulate innovation and cost reductions, which could enhance overall economic efficiency in achieving deeper decarbonization goals in the future even if initially more expensive.

In PO2 and PO3, the operator integration of CDR in the EU ETS would expose CDR suppliers to the ETS price risk as well as to a lack of predictability in the timing of demand. These options lead to lack of early incentives from EU ETS demand towards development and deployment of CDR technologies, as can be seen in the modelling of the volumes of removals generated in PO2, as referred to above. PO2 and PO3 likely result in higher removal costs and a greater risk of under-delivery of removals during the 2031–2040 period, compared to PO1 that includes guaranteed removals volumes. Support for removals e.g. through contracts for difference could complement PO2 and PO3 to counter this effect.

6.1.1.3. MSR

Changes to the MSR alter the allowance supply over the assessment window via releases, providing more liquidity to the market and putting downward pressure on the carbon price. Depending on how this affects the timing of surrendering of allowances, this may in turn affect cumulative emissions. However, since any MSR release remains within the cap, the system's overall ambition is unchanged. The MSR measures are compared with a baseline that assumes no further changes to either EU ETS or the MSR.

Policy option PO1 is based on the MSR1 measure as described in Annex 8. Under this measure, parameters of the MSR design are then kept constant over the time until 2040.

Policy options PO2 and PO3 on the other hand, are based on the MSR3 measure, which assumes parameters decline at a fixed proportional rate from 2028 onwards. This ensures that all parameters under PO2 and PO3 are adapted on an annual basis to take account of the overall decreasing market of allowances.

Results for cumulative emissions between 2026-2040 exclude waste, landfills and extra-EU aviation to ensure comparability across all the policy options. Overall, all policy options achieve similar emissions reductions over the period. However, PO2 and PO3 appear to deliver

[39] As a caveat, CDR stakeholders have noted that integration of removals so that ETS ambition is increased, rather than the space to emit, would allow CDR developers to leverage private financing on top of ETS prices that could support CDR development. However, precise impacts would depend on that private financing realising and forgone public support that may only be leverage if linked to an integration that increases the emissions space in the ETS.

slightly lower cumulative emissions than PO1. On this basis, PO2 and PO3 are considered the preferred option as they achieve comparable emissions reductions than PO1 whilst maintaining better economic performance, further explained in Section 6.2.1.2.

Table 4: PO environmental impact summary

	Baseline	**PO1**	**PO2**	**PO3**
Cumulative emissions over 2026-2040 ($MtCO_2$) – excl. waste, landfills and extra-EU aviation for comparability	9,687	10,690	10,598	10,598

6.1.1.4. Instruments to support investments

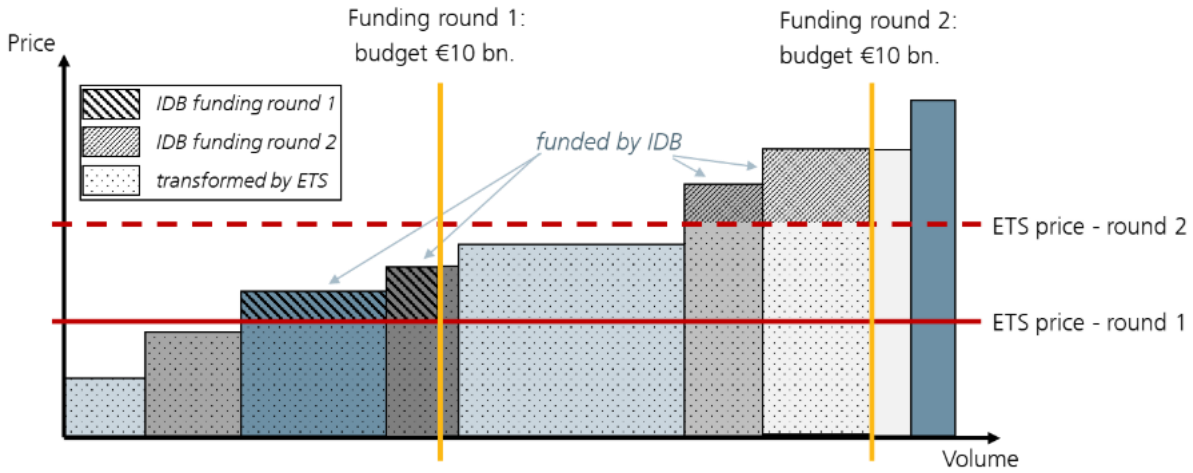
For the IDB, the assessment in terms of environmental and other impacts to be achieved is based on assessment of the Baseline size of the IDB (EUR 100 billion) which is defined in the Clean Industrial Deal. The differences among IDB options in terms of allocation method, support formats and geographical balance would only have marginal bearing on the impacts and such assessment would also require more granularity in terms of funding mechanism features ([40]). As a general rule, the allocation method options like auctions and variable premiums should be more cost-efficient, thus resulting in higher emissions savings, stronger private capital mobilisation and larger spillover benefits, although results will critically depend on the detailed implementation of the funding rounds and competitive dynamics achieved in all of them. In addition, the trade-off has to be considered between cost-efficiency (delivered by very competitive calls for proposals, auction and variable premia) and effectiveness (better delivered by administrative schemes with fixed premia that could allow a more robust financial model for projects, increase likelihood of projects materialising and better diversification of portfolio). In general, the mechanisms that bring high level of competition are better suited to more mature technologies that operate on deep and liquid markets, which should progressively become the case for many decarbonisation technologies. Administrative schemes should be needed in the early years of the IDB operation when uncertainties are the highest and the business case the most difficult.

The analysis performed for this Impact Assessment is a simulation of the impact of the IDB once it operates through competitive calls for proposals/auctions and using as inputs the main results of 2040 climate target modelling (e.g. electricity or carbon prices). This analysis indicates a cumulative GHG emission abatement of 1630 $MtCO_2$ over a ten-year period, based on a total budget of EUR 100 billion allocated across ten yearly auction rounds, each of EUR 10 billion funding volume. The support would target, among others, process heat electrification both for medium and high temperature applications. It will also support low-carbon primary steel production via hydrogen-based direct reduction, as well as carbon capture and storage solutions in energy-intensive sectors such as cement and lime. Over the assumed support period of ten years, the resulting weighted average awarded support amounts to EUR 60/tCO_2 abated. In the early years when the administrative schemes are applied, the impact would likely be lower. This analysis is illustrative because the actual impact of the IDB will depend on the final IDB design, the specific design of funding rounds as well as necessary infrastructure availability, demand for low-carbon products and project delivery risks.

[40] Typically, the Commission conducts an internal assessment of the project pipeline and likely impacts of the IF auctions, but this can only be done when the specific auction's Terms & Conditions are nearly finalised.

The calculation of impacts is based on the assumption that the IDB support bridges the remaining cost gap (covering both CAPEX and OPEX) of the low-emission technologies deployed in IDB-funded projects compared to their fossil fuels-based incumbent technologies. The IDB support accounts for the average ETS price[41] faced by the incumbent fossil-based alternative (conventional technology).

Figure 4: Illustration of support logic for two consecutive funding rounds of the IDB



Note: Each bar represents the GHG emission abatement costs for each relevant industrial sector in one particular Member State.

Source: Fraunhofer

In the absence of the IDB, the ETS revenues are set aside solely for the IF, which would imply broader eligibility (beyond the EIIs) and focus on innovation with continuation of the existing allocation mechanism and support formats of the IF. The needs of the decarbonisation technologies roll-out for EIIs would not be fulfilled, there could be also a diminishing attractiveness of the IF calls for proposals considering that large share of the decarbonisation technologies would be entering the roll-out phase post-2030.

For the Modernisation Fund, all considered Policy Options, which maintain the **Modernisation Fund** after 2030, would have positive impacts on the reduction of GHG emissions. Those impacts are expected to be comparable to the benefits reported in the MF evaluation, which found that the MF will deliver an annual average reduction of about 84.8 $MtCO_2eq$, corresponding to roughly 32% of 2020 emissions from the electricity, gas, steam and air-conditioning sector in beneficiary Member States (265 $MtCO_2eq$). In the absence of Modernisation Fund, the additional auctioning allowances received by beneficiary Member States[42] would be spent by all Member States under the broader scope of uses that applies to the general pool of auctioning revenues. However, MF investments are concentrated in low-income countries where the challenges to decarbonise are higher and in sectors where the resulting GHG reductions are economy-wide and structural.

Through allocating revenues for investments in energy efficiency (including in buildings, transport, etc), renewables deployment and modernisation of the energy grids, the Fund would continue its contribution to lowering greenhouse gas emissions in Member States with high carbon intensity under both the ETS and the non-ETS sectors. The fund would also contribute

[41] ETS prices are an assumption in this calculation and are derived from 2040 climate target modelling.

[42] The number of EU ETS allowances received by MF beneficiary Member States due to the MF is increased by 11% compared to the situation without the MF.

to modernising the power sector. Energy efficiency measures in ETS2 sectors would address the investment needs that lower income Member States still face to continue their industrial decarbonisation efforts (including buildings and all types of transport), as compared to the Social Climate Fund which only covers very small businesses and most vulnerable households. The deployment of renewable energy still needs support in certain Member States, either through grid reinforcement or energy storage deployment, and it did not reach its full potential. The MF evaluation shows that although the progress in the deployment of renewables differs across Member States, there is an overall deployment gap for many of them to reach the 2030 renewable energy target of 42.5% and that their energy mix still largely relying on fossil fuels[43]. Decarbonising heating and cooling is still a major challenge for the 13 beneficiary Member States.

EU ETS allowances spent in the context of the Modernisation Fund are subject to ex-ante verification at EU level through both state aid compliance check and a review by the EIB as an outcome of which the EIB confirms that the investments proposed by beneficiary Member States are in line with the objectives of the ETS Directive. For priority investments, this includes falling into the priority areas defined by the Directive. For non-priority area, this includes a due diligence and assessment of planned GHG emissions reductions.

Furthermore, all policy options considered increase the level of climate ambition in terms of reducing GHG emissions insofar as they all exclude support to investments involving natural gas and waste-to-energy as priority investments. Expanding the scope of the Fund to CCS and direct electrification for industry across all policy options is expected to reinforce the positive impact on GHG reductions. PO3 brings the highest climate benefits in terms of potential GHG emissions reduction insofar as it excludes all types of investments involving gas and waste-to-energy, including as non-priority investments, while bringing the share of priority investment to 100%. PO2 also brings high climate benefits as it importantly restricts the share of non-priority investments (to 5%) while excluding any support to gas infrastructure or any support to waste-to-energy which would not be in the conditions of high efficiency combined heat and power.

Finally, PO1 brings more limited benefits in terms of GHG emissions reduction potential compared to the current MF set up – but still important ones compared to the baseline where the MF is absent – as it still allows for 10% of non-priority investments and the possibility to fund investments supporting gas and waste-to-energy with these 10%.

6.1.1.5. Aviation

If SAF is counted as zero emissions[44], we expect aviation's global international CO_2 emissions to reduce by 14% between 2024 and 2040. Without accounting for the use of SAF, these aviation emissions are projected to grow around 12% in the same timeframe. EASA reports[45] confirm this upward trend, which is in place since the 1990s. In particular, emissions from international aviation are expected to increase through 2040, 2050 and beyond[46]. Alongside

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[43] European Environment Agency, *Share of energy consumption from renewable sources in Europe*, 2025, https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from.

[44] Most SAF has residual emissions, but in line with the ETS Directive it is counted as zero emissions, supporting the price incentive in favour of SAF use.

[45] For departing flights: 147 Mt CO_2 in 2019, 228 Mt CO_2 in 2050. Source: EASA, *European Aviation Environmental Report 2025*, 2025, https://www.easa.europa.eu/en/domains/environment/eaer/downloads#download-2025, p.14.

[46] ICAO, *Environmental Trends in Aviation to 2070*, https://www.icao.int/sites/default/files/sp-files/environmental-protection/Documents/EnvironmentReport-2010/2025/Envreport2025_9.pdf, p. 28.

carbon pricing, deployment of clean aircraft and innovative operations, SAF use at global scale is key to reduce emissions. This section examines the effects of carbon pricing and SAF use.

- **Carbon pricing**

The policy options assessed differ on the extent to which the effect of aviation CO_2 emissions on the environment is internalised. Airlines can directly reduce their emissions or use market-based measures outside the aviation sector[47]. The options have different coverage of emissions by CORSIA and the EU ETS[48], resulting in different price signals, and different levels of support for the uptake of eligible SAF. This environmental impact of the policy options is considered for CO_2 emissions of global international aviation[49]. What amount of CO_2 emissions would remain unaddressed by carbon pricing (ETS, CORSIA) under each option is also shown. Not considered are aviation's non-CO_2 emissions: in-depth analysis considers that aviation's non-CO_2 emissions have at least double climate effect of aviation CO_2 emissions alone (so CO_2 emissions figures would need to be multiplied by three to obtain the full climate impact).

In the baseline and all options, global international aviation CO_2 emissions decrease between 2024 and 2040 by 13-15%, both for extra-EEA departing flights and global international aviation when discounting the impact of projected SAF uptake in Europe and globally[50]. In the baseline most flights are covered by the EU ETS carbon price, and emissions are lowest. Emissions are highest under PO1, where the ETS geographic scope of 2026 continues to apply, and no extra support for the uplift of SAF is set aside.

Global international aviation emissions have the biggest climate impact and the highest level of CO_2 emissions[51]. They are defined as: CO_2 emissions from flights inside Europe, and from international flights outside Europe. Flights inside Europe include departing flights to Switzerland and the UK. Examples include flights from Berlin to Munich, Sofia to Brussels and Madrid to London. International flights outside Europe include flights from Paris to Toronto, or from Beijing to Dubai (but they exclude domestic flights outside Europe, such as Toronto to Vancouver). **Currently, the ETS carbon price applies within Europe and to departing flights to Switzerland and the UK, but not to other third countries**. **Policy options differ in how they address CO_2 emissions from flights to other third countries.** In PO1, the ETS carbon price does not apply to international emissions, but CORSIA applies to a part of these emissions[52]. In PO2 and PO3, the ETS carbon price addresses emissions from flights that depart from Europe (Paris to Toronto, but not Toronto to Paris, and neither Beijing to Dubai). In PO2 and PO3, the ETS scope is the same as the ReFuelEU Regulation[53], which mandates increasing production of SAF and requires airlines to uptake fuel at Union airports.

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47 ETS: airlines can buy, trade and surrender allowances; CORSIA: they can buy and cancel eligible offsets.

48 On the differences, see Annex 10, in particular Sections 1 and 5.

49 The scope considered is intra-EEA emissions (domestic and non-domestic, including departing flights to Switzerland and the UK) and international aviation emissions, i.e. between Europe and other third countries and between two third countries, but not the emissions within third countries.

50 ReFuelEU Aviation for flights departing from Union airports. For arriving flights, SAF uptake increases in line with the global fuel scenario F1 presented in the Long-Term Aspirational Goal report of ICAO.

51 Eurocontrol, *Think Paper #22: Decarbonising long-haul flights by 2050: Is there a pathway through sustainable aviation fuel use, fleet renewal and green energy upscaling?*, 2024, https://www.eurocontrol.int/publication/eurocontrol-think-paper-22-decarbonising-long-haul-flights-2050.

52 CORSIA exempts ~500 Mt CO_2 each year, CO_2 emissions above that level should be offset. See Annex 10, Section 5.1.

53 Nearly identical but ReFuel covers departing flights from Union airports (a subset of EEA airports defined in ReFuelEU), whereas in PO2/3 the ETS would cover departing flights from any EEA airport, but not to all destinations (exempt are flights to Least Developed Countries and Small Island Developing States).

Use of SAF reduces emissions significantly, but industry have claimed they may fail to meet ReFuelEU mandates, unless they receive additional financial support[54]. ReFuelEU is a separate regulation, not part of the ETS Directive, and therefore outside the scope of this review. Our modelling assumes ReFuelEU mandates are met, with the resulting emissions reductions having a larger impact than the carbon price alone.

A larger scope of application of the ETS carbon price slightly reduces **global international aviation emissions**. Most emissions growth is projected to occur outside Europe[55], i.e. for flights that neither take off nor land in an EEA country and is therefore not affected by the ETS price signal or ReFuelEU.

The Commission review focuses on flights that are connected to the European territory, i.e. take off in Europe, and can be directly affected by our policies. It is therefore interesting to single out CO_2 emissions of **extra-EEA departing flights**, because that is a key difference between policy options. Impacts of policy options follow the same pattern as for global international emissions but are more pronounced. In the baseline, ETS scope is broadest, and CO_2 emissions decrease most. Under PO1, ETS scope is smallest (it does not apply at all to departing flights), resulting in the smallest reduction. Table 5 below presents the policy options and modelled CO_2 emissions rounded to the nearest 5Mt.

Table 5: Policy options and global international aviation emissions (inside Europe: domestic and international; outside Europe: international only)

2024 emissions 690 Mt CO_2	**Emissions 2030 in Mt CO_2**	**Emissions 2035 in Mt CO_2**	**Emissions 2040 in Mt CO_2**
Baseline	590	600	590
Return to full legal scope, where the EU ETS applies to flights within Member States, between Member States and extra-EEA flights to and from Member States. Flights to-, from and between Outermost Regions are included from January 2031.			
PO1	605	605	600
Continuation of clean-cut subject to CORSIA implementation: Existing EU policy implementation: the EU ETS applies to flights within Member States and between Member States, as well as to departing flights to the UK and Switzerland. Flights to-, from and between Outermost Regions are included from January 2031. CORSIA is implemented by others under high participation assumption (all those who should implement CORSIA from 2027 do so, and all those who voluntarily participate in 2025 do also implement CORSIA).			
PO2	600	605	595

[54] Reuters, *European Airlines will miss green jet fuel targets, CEOs warn*, 2025, https://www.reuters.com/sustainability/climate-energy/european-aviation-falling-behind-risks-missing-green-fuel-targets-ceos-say-2025-03-27/.

[55] See ICAO, *Initial assessments in support of the 2025 CORSIA periodic review*, 2024, https://www.icao.int/sites/default/files/environmental-protection/CORSIA/Documents/CORSIA%20Periodic%20Review/CAEP_Inputs-to-2025-CORSIA-periodic-review-C232.pdf, p. 23: CO_2 emissions growth rates of 1.8%-2.3% for Middle East, Asia Pacific, Africa and Latin America & Caribbean, vs 0.4% for Europe for the period 2019-35.

Departing flights & SAF support extension by a medium amount: The EU ETS applies to flights within Europe, and to departing international flights. Flights to-, from and between Outermost Regions are included from January 2031. CORSIA is implemented by others, and offsetting costs can be deducted on relevant routes. ETS-financed SAF support is extended by a medium amount.			
PO3	600	605	595
Departing flights & SAF support extension by a larger amount: The EU ETS applies to flights within Europe, and to departing international flights. Flights to-, from and between Outermost Regions are included from January 2031. CORSIA is implemented by others, and offsetting costs can be deducted on relevant routes. ETS-financed SAF support is extended by a larger amount.			

International impact

- *Least Developed Countries and Small Island Developing States*

No impact: No carbon pricing applies to flights to-, from- or between those countries, unless they voluntarily apply it. They are exempt from CORSIA and the ETS in all policy options.

- *Switzerland and the UK*

No change: Flights from Europe (meaning EEA countries) to Switzerland and the UK are currently covered by the ETS carbon price and remain so in all options.

- *Other third countries*

The options differ in the choice of carbon pricing tool(s) that apply to CO_2 emissions from flights departing from Europe to these countries. In any case, an effective carbon price should apply to those emissions, either if CORSIA satisfies the requirements of Article 28b ETS Directive (Policy Option 1), or through a combination of ETS and CORSIA (Policy Options 2 and 3). See detail in Annex 10. In Policy Options 2 and 3, some third country reactions can be expected, because due to equal treatment on routes, the ETS carbon price would apply in the same manner to all departing flights, independent from the nationality of the airline. This equal treatment on routes maintains a level playing field. All policy options take CORSIA into account – demonstrating continued EU support for CORSIA. ETS-financed SAF support would continue to be available to any airline covered by ETS carbon pricing: airlines are treated equally regardless of their home country.

Environmental effectiveness of carbon pricing tools: CORSIA has global reach, but analysis finds several limitations (see detail in Annex 10, Section 5).

- **Structural limitation:** CORSIA addresses emissions growth and exempts around 500 Mt CO_2 emissions each year. Table 6 below shows that in PO1, CORSIA covers more emissions than the EU ETS. However, in PO2 and PO3, it covers less despite its broader geographic scope. In PO1, high participation is assumed[56], which is needed to meet the

[56] *PO1*: All countries that should apply CORSIA from 2027, plus all countries who volunteer now continue to do so. Dominica and Viet Nam in from 2026, Mauritius out. Brazil, China, India, Russia in from 2027. *Baseline/ PO2/ PO3*: All countries who volunteer now continue to do so. Viet Nam in from 2026; Brazil, China, India, Russia out.
Participation also influences the amount of emissions that CORSIA does not address: Both the baseline and the emissions taken into account in the offsetting calculation are determined annually by the collective emissions in that year. The growth in emissions above the baseline level determines the offsetting required for each operator under in CORSIA:

emissions coverage test in Article 28b of the ETS Directive. As CORSIA is set to end in 2035, its emissions coverage is assumed as zero thereafter.

- **Quality of offset credits:** Environmental effectiveness depends also on the quality of units (offsets) used, i.e. a tonne purchased is a tonne reduced, and this reduction is permanent and counted only once. However, as of March 2026, analyses find significant challenges with CORSIA-eligible offsets. For example, emissions reductions may be overestimated (airlines would pay for a reduction of 1 tonne CO_2 but, in reality, no reduction or a much smaller reduction takes place). See Annex 10, Section 5.1.
- **Enforceability:** The 2021 IA gives a legal analysis of why CORSIA is not binding unless implemented in national law. Analysis in Annex 10, Section 5.2 demonstrates that national implementation in ICAO member states varies widely and does not include major emitters like China, Russia or India, based on most recently available implementation data. According to this analysis, 21 countries have penalties for CORSIA non-compliance in place in 2025 (apart from EEA countries). This means that the certainty of the environmental impact is greater under options where EU ETS emissions coverage is greater (PO2 and PO3). It is the greatest in the baseline.
- **Fuels**: Instead of relying on offsets, airlines can use SAF to meet CORSIA offsetting requirements. However, it is far cheaper for airlines to rely on offsets[57].

Table 6: Global international aviation CO_2 emissions

Global international aviation CO_2 emissions					
Policy Option *All emissions per year in $MtCO_2$*	**Year**	**Global emissions**	**ETS coverage**	**CORSIA coverage**	**Non-priced emissions**
Baseline (full scope)	**2035**	600	170	60	365
	2040 (87%)	590	155	0	435
PO1 (clean cut)	**2035**	605	50	140	415

1. Participation determines the overall amount of emissions taken into account in the offsetting calculation, leaving all other international emissions below or above the floating baseline uncovered. More participation means more emissions are taken into account in the offsetting calculation, and therefore less emissions fully excluded.
2. Participation determines the level of the baseline (the amount of CO_2 emissions not offset) within the amount of emissions taken into account in the calculation.
   Participation also determines the amount of socialisation of the growth above the baseline. A decision by a large, emerging economy with a faster growing aviation sector than in Europe to implement and continue to participate in CORSIA would for example lead to Europe offsetting a larger share of emissions. The extent of implementation and continued participation in CORSIA and its enforcement by participating states has a larger impact than oil or carbon price on the outcomes of the options. More detail in Annex 10, Section 5.1.

[57] ICAO estimates: The cost of abatement (CORSIA eligible fuel premium compared to kerosene/tCO_2 abated) around \$600-800 per tCO_2. The cost of abatement for using offsets at around \$10-40 per tCO_2. This means it is 15-80 times cheaper for airlines to buy CORSIA eligible offsets than to use CORSIA eligible SAF. There are a number of uncertainties around prices and also in CORSIA one tonne of eligible SAF is not counted as one tonne of emissions reduced, decreasing the incentive to use fuels. See ICAO, *Assembly Working Paper 28*, August 2025, https://www.icao.int/sites/default/files/Meetings/a42/Documents/WP/wp_028_en.pdf.

	2040 (87%)	600	45	0	555
PO2 (departing flights, medium SAF support)	**2035**	605	110	75	420
	2040 (87%)	595	95	0	500
PO3 (departing flights, larger SAF support)	**2035**	605	110	75	420
	2040 (87%)	595	95	0	500

Global international aviation emissions cover inside Europe: domestic and non-domestic; outside Europe: non-domestic only. The far-right column shows emissions that remain without a carbon price. Numbers rounded to the nearest 5Mt.

- **SAF use**

On **support for the uptake of eligible fuels**, between 2028 and 2035, around 40 Mt of sustainable aviation fuel (including 6 Mt of synthetic fuels) compliant with ReFuelEU Aviation Regulation would be used. This SAF use decreases the emissions covered by EU ETS allowances by 130 Mt[58]. All options assume uptake and use of SAF on flights departing the EEA in line with the ReFuelEU Aviation mandates. While ETS-financed SAF support may incentivise higher uptake of SAF, this is not modelled given large uncertainties in this nascent market, high price differentials with fossil kerosene, and to avoid overestimating available supply. However, under PO2 and PO3, the extension of SAF support offers an additional incentive over PO1, making PO3 with a larger amount of SAF support the option with the highest potential for impact on emission reductions. In the modelling, this impact is offset by an overall increase in traffic, so when comparing PO2 and PO3, overall PO3 leads to higher emissions. This is because SAF is mixed with Jet-A (kerosene), and the kerosene emissions are greater than savings from the use of SAF at least until 2040.

6.1.1.6. Maritime

For maritime, the environmental impacts of the baseline and of **PO1** are the same. In both cases, GHG emissions from the maritime sector follow a decreasing trajectory driven by regulatory measures at EU level (as currently legislated) along with future mid-term measures at IMO (once adopted), in line with the IMO 2023 GHG Strategy. By 2050, policy option PO1, which does not cover emissions from smaller vessels, results in residual emissions estimated at 20 $MtCO_2e$, the majority of which come from small vessels (14 out of 20 $MtCO_2e$).

The recycling of part of the ETS revenues in shipping in PO2 is expected to accelerate the uptake of GHG mitigation measures in the sector. The establishment of a Sustainable Maritime Alternative Propulsion mechanism (SMAP) would directly support the use and production of renewable and low-carbon maritime fuels by reducing the price gap compared to fossil fuels and support the uptake of clean propulsion technologies, which are both key to unlock the decarbonisation of the sector. This may however come with trade-offs between investment in

[58] Due to the zero-rating of SAF under EU ETS, the fuel is considered to emit 0 CO_2/tonne of fuel. However, in reality, these fuels still have upstream emissions.

a hard-to-abate sector and possible other revenue uses for more cost-efficient emission reductions in the short-term.

As regards **anti-evasion** measures, the lowering of the container transhipment incidence threshold to 50% contemplated in PO2 would marginally increase the ETS maritime scope in the short-term (+0.2% compared to current situation). The other anti-evasion measure regarding **offshore ships**, is expected to lead to an overall small net reduction in ETS scope emissions.

The extension in PO2 of the current maritime **derogations** beyond 2030 for ice-class vessels, small islands, outermost regions and transnational public service contract or public service obligation, would lead to 5 $MtCO_2e$ per year being excluded from the ETS scope (corresponding to around 5% of all ETS scope maritime emissions in 2024).

The **IMO deduction measure** included in PO2 to address the risk of double payment in case payments for emissions are made at IMO level is not expected to alter the environmental integrity of the ETS system as the measure comes together with an obligation to cancel a similar amount of ETS allowances. The IMO deduction measure is applicable to all ships without discrimination, which are subject to EU ETS and whose emissions would be priced under a future IMO global measure. The deduction is expected to have positive environmental impacts at international level as it ensures that the EU ETS is adjusted in coherence with the IMO decisions. At the same time, the application of the EU cap-and-trade system to the EU maritime emissions not priced by a future IMO measure allows the EU to deliver on its climate targets and on international climate contributions in the UNFCCC context, including the EU submission of an updated Nationally Determined Contribution (NDC) for 2035.

The **extension of the ETS to most emitting categories of smaller vessels** in option **PO2** would increase the ETS scope by 11.3 $MtCO_2e$ (13%). Overall, PO2 would result in much lower residual emissions by 2050 (-41.3% in comparison to PO1) and it would lead to a cumulative reduction in GHG emissions of around 5% over the period 2030-2050 in comparison to PO1 and the baseline (considering all vessels above 400 GT). It would also lead to an increase in the uptake of renewable fuels in the sector, by around 2% by 2040 and 5% by 2050.

The environmental impact of option PO3 for maritime is relatively comparable to the outcomes of PO2. The main difference is driven by the extension of EU ETS to more smaller vessels (including fishing vessels and non-commercial yachts), which would increase the ETS scope by 14.6 $MtCO_2e$ (+17%). Overall, PO3 would lead to a cumulative reduction in GHG emissions of 6.2% over the period 2030-2050 compared to the baseline.

In **sum**, the extension of the ETS to smaller vessels in PO2 and PO3 would increase the scope of emissions under ETS whereas the IMO deduction measure would diminish it (depending on the scope of emissions priced under a future IMO measure). Extending derogations (the same for PO2 and PO3) would diminish the emissions under ETS further by some 5 $MtCO_2e$ per year.

6.1.1.7. Carbon leakage prevention

The impact of the policy options on carbon leakage is assessed via the GEM-E3 model. The GEM-E3 model only partially considers the increased scope of the EU ETS envisaged under PO2 or PO3, via the inclusion of waste emissions under the EU ETS, but it is not able to consider the particular effects of other measures in the policy options. Given that each of the policy options include different free allocation distributions across industry, the model run from GEM-E3 provides insights into how each policy option results in different impacts in terms of carbon

leakage. Additionally, the extension of EU ETS sectoral coverage is examined to include also waste emissions in PO2 and PO3. PO2 includes only municipal waste incineration (MWI) in EU ETS while PO3 includes all waste emissions under EU ETS.

The evaluation findings confirmed that in the previous period there was little evidence of carbon leakage due to the relatively low carbon price and the high share of free allocation compared to emissions. However, this also has the effect of reducing the incentives to reduce emissions and invest in the decarbonisation. The revision of free allocation rules for Phase IV already moved in that direction to balance the need for carbon leakage protection and the need to encourage the reduction in emissions by developing a more targeted carbon leakage list, more ambitious benchmarks, and the introduction of adjustments to allocation to better consider changes in activity levels. The reforms to free allocation considered in this assessment continues in this direction, aiming to ensure a fair balance between safeguarding current competitiveness of European industry and encouraging emissions reductions and investments to promote long term competitiveness. The following reforms to free allocation are reflected in the policy options:

- In PO1, free allocation is reformed in accordance with the CL1 measure, which assumes a continuation of free allocation for non-CBAM sectors based on the existing rules, but with some streamlining and simplification.
- In PO2, free allocation is reformed in accordance with the CL2 measure, which assumes that a progressive share of free allocation is conditional on investments with two variants of compliance modelled (i.e. 90% compliance and 50 % compliance). This policy options also includes a revision of the CBAM phase-out factor.
- In PO3, free allocation is reformed in accordance with the CL3 measure, which assumes that free allowances are phased out for non-CBAM sectors at the same rate as for CBAM sectors so that from 2034 onwards no further free allocation is provided to industry.

In addition, scenario variants for PO1 and PO3 marked with R include revised revenue recycling assumptions where analysed, while scenario variants marked with C for PO2 refer to variants with a slow-down of the phase-out of free allocation for the sectors under the scope of CBAM. A more detailed description of the scenarios used in the GEM-E3 analysis can be found in Annex 12, Section 1.4.1.

These reforms to the provision of free allocation that are included within the policy options are compared to the baseline scenario, which considers a phase out of free allocation until 2040.

The conventional approach for carbon leakage assessment considers the emissions that increase in one (not regulated) region whilst decreasing in another regulated region and can be expressed by the following simple formula: *Carbon leakage rate = increase in foreign emissions / decrease in domestic emissions.* However, EU27 EU ETS GHG emissions increase from baseline levels in all policy options, as the ambition level is reduced. Within the limitations of the GEM-E3 model, the results show that as these emissions increase, the ETS sectors covered are not threatened by carbon leakage risks. Instead, the impacts on EU, non-EU and global GHG emissions are presented to discuss environmental implications both at the EU level and beyond.

Emissions are influenced both by the number of free allowances allocated and by the carbon price required to meet the EU ETS cap. In PO2—and especially in PO3—the inclusion of waste emissions in EU ETS results in an increase of the cap, which leads to higher emissions across all EU ETS sectors. In addition, the increase of the cap for PO1 and PO2 result in higher

allocation of free allowances compared to the baseline, thus providing additional protection against carbon leakage. Overall, EU27 emissions increase across most scenarios, driven by three main factors: 1) the number of free allowances allocated in EU ETS sectors; 2) the carbon price required to meet the EU ETS cap and 3) the increase in economic activity observed in all scenarios. At the level of the total economy, EU27 emissions increase because of higher overall activity across all scenarios. The economy wide increase of EU27 emissions ranges between an additional 7 $MtCO_2eq$ in 2040 under PO2, 50 and 46 $MtCO_2eq$ under PO3, compared to the baseline. In terms of sectoral results, the most significant increase of emissions is recorded for the non-metallic sector, with up to 10 $MtCO_2eq$ in 2040 under PO3. Additional details, including figures and insight for selected sectors can be found in Annex 12, Section 1.4.4.1.

Indirect carbon cost (ICC) compensation can provide substantial environmental benefits, since electrified technologies have the potential to provide up to 90% of Europe's industrial heat demand by 2035. Electrification, combined with decarbonisation of electricity supply, therefore delivers a climate benefit. The extent of the benefit depends on the mixture of fossil-based industrial processes that are replaced, as well as the emissions from increased electricity demand. ICC compensation supports the business case for electro-intensive industrial processes by reducing their carbon costs. It is particularly relevant for electrified industrial processes that face an indirect carbon cost and compete with non-electrified processes that emit CO_2 directly and benefit from free allocation. Conceptually, the environmental benefit of ICC compensation is therefore a combination of:

- *Carbon leakage protection:* addressing the risk of electro-intensive industries relocating, due to indirect carbon costs, to areas with less strict climate governance.
- *Incentivising electrification:* supporting the business case for electrification relative to direct emissions, for industries that could electrify their processes.

Under continuation of current policies, the ETS Directive would continue to encourage Member States to provide ICC compensation. Article 10a(6) would continue to apply, outlining the key features of Member States' compensation measures (e.g. they should be based on indirect emission benchmarks corresponding to the most efficient available technologies and emissions of the relevant European electricity production mix). Future State aid rules (which are not the subject of this Impact Assessment) would determine more detailed parameters such as sectoral eligibility and any other conditions that beneficiaries would have to meet.

Policy option ICC1 would continue the State-aid-based approach and propose limited amendments to the ETS Directive's ICC provisions.

In policy option ICC2, an ICC Fund would be established to provide compensation at an EU-level on a harmonised basis in order to reduce distortion of the single market and provide a level playing field for industry. Due to competing claims on ETS auction revenues (see Section 6.1.1.4) the proposed scale of the fund (e.g. 5% of the average revenue for 2031-2040) would be smaller than the potential scale of ICC compensation if all Member States were to provide State aid post-2030 using schemes similar to those currently in place post-2030 (at least 11%, see Annex 12 for analysis of ICC drivers). As a result, Member States would retain the option to provide ICC compensation as State aid, up to the level permitted in the guidelines.

The options' potential environmental benefits would be similar. However, the benefit of ICC2 could be slightly larger since some beneficiaries from an EU fund may not otherwise have received State aid under ICC1.

6.1.1.8. Waste

All sectors in the economy need to decarbonise to achieve climate neutrality in 2050. Under the baseline, emissions from waste incineration and landfills would continue to be mainly covered by the Effort Sharing Regulation until 2030 and are not driven by a carbon price, with post-2030 coverage subject to future review. Emissions from municipal waste incineration are expected to continue increasing at least into the early 2030s in line with recent trends, planned capacity increases and absent additional abatement incentives, while emissions from landfilling are projected to continue to gradually decrease, albeit slower than stipulated due to lagging implementation of the current regulatory framework and remaining responsible for the largest share of waste sector emissions.

Extending the scope of the EU ETS to activities in the waste management sector would increase accountability for emissions in this sector – representing up to 3% of EU GHG emissions depending on the scope of the policy options considered – and provide for increased certainty in delivering GHG emissions reductions, since the cap sets a limit on the emissions that economic operators can account for by surrendering allowances. Such certainty is not possible through other types of measures.

Compared to the continuation of current policies, policy option PO1 would not substantially improve the environmental outcome, only implementing legal clarifications to improve certainty on the current scope.

Policy option PO2 would extend carbon pricing to municipal waste incineration (MWI), driving the largest decrease in cumulative emissions from waste incineration, of -53 MtCO2eq or -22% over the period 2031-2040 compared to the baseline, with most of the decrease projected to occur in the second half of the decade. The carbon price would provide an economic incentive to reduce emissions cost-effectively at different stages of the waste value chain, through a combination of improved waste prevention, reduction and pre-collection sorting at source and improved post-collection mixed-waste sorting and recycling in the shorter-term, and carbon capture for residual emissions in the medium- to longer-term (as of mid-decade). Both increased recycling and carbon capture provide dual climate benefits in the waste management sector. Increased recycling reduces GHG emissions from waste disposal and generates recycled materials displacing more carbon-intensive virgin materials, while carbon capture reduces fossil emissions in combination with generating biogenic carbon removals. Similar to other hard-to-abate sectors, targeted policy and investment support can advance the business case for carbon capture and strengthen planning and investment predictability. Complementary waste policies under the future Circular Economy Act will contribute to ensure a comprehensive approach by stimulating the single market and demand for secondary materials and circular products, supporting investment in recycling capacity, reducing the landfilling and incineration of used raw materials, and rolling-out upstream producer-oriented policies such as eco-design requirements and strengthened Extended Producer Responsibility (see Annex 13, Section 1.3 for a detailed assessment of how the carbon price can drive behavioural changes, costs and opportunities contributing to emissions reductions). The inclusion of municipal waste incineration installations under PO2 and PO3 will also support the efforts to promote a more circular economy via the use of captured CO2 as a feedstock through a hybrid downstream accounting for non-permanent CCU products (see Section 6.1.1.9.) by accounting for the downstream emissions associated with non-permanent CCU products.

In policy option PO3, the scope of the EU ETS would also be extended to CO2-emissions from hazardous waste incineration (HWI) and to methane emissions from non-hazardous landfilling,

leading to a higher amount of overall GHG emissions reductions but a lower amount of municipal waste incineration emissions reductions compared to PO2. How much higher ultimately depends on when, how, and which GHG emissions from landfilling would be included within the scope, i.e. only from future disposal in active landfills or also from historical deposits. Cumulative emissions from waste incineration (MWI and HWI) would decrease compared to the baseline, by -29 MtCO2eq or -11% over the period 2031-2040, but substantially less compared to PO2. This is mainly due to landfills being the primary driver of overall emissions reductions in this policy option because of the regulatory waste policy framework already in place and a comparatively higher cost-effective abatement potential (see Annex 13, Section 1.3). The Landfill Directive, if fully implemented and enforced, is projected to lead to significant emissions reductions from landfills in the order of -45% by 2040 compared to 2030 and of -55% compared to 2025 (GAINS)[59], with limited further technical abatement potential for additional emissions reductions. The primary benefit of inclusion of landfills in EU ETS would be to deliver increased certainty and complementary financial incentives supporting the achievement of these emissions reductions[60]. Uncertainty in the quantification of emissions from HWI and landfills under PO3 remains high, including due to the diffuse, long-term and site-specific nature of methane emissions in the latter case. Harmonised monitoring and reporting frameworks to collect standardised, robust and verified emissions data prior to inclusion would be important to ensure a high degree of integrity in the system.

The waste-specific risk of emissions leakage (distinct from the risk of carbon leakage for industry in general discussed in other sections and assessed separately from the environmental risk of waste diversion in Section 6.1.2.5.) associated to waste diversion to other waste disposal processes or third countries is considered limited under all policy options. Under PO2, the risk of emissions leakage to landfills is contained by the zero-rating of biogenic emissions in incineration, limiting the incentive to divert organic waste to landfills – the main source of methane emissions – to circumvent the carbon cost. PO3, by including methane emissions reductions in landfills, would address any residual risks of organic waste diversion from incineration to landfills. Emissions leakage risks to hazardous waste incineration are limited by technical and operational constraints, higher costs, and strict regulatory requirements under PO2 and would be absent under PO3. Finally, the risk of emissions leakage to third countries is limited by the strict regulatory framework on waste exports in place (Waste Shipment Regulation – see Annex 13, Section 1.5).

6.1.1.9. Carbon Capture and Utilisation

The policy options that include an extension of the scope of EU ETS to include the waste sector (i.e. PO2 and PO3) are also accompanied by new accounting measures related to the storage and utilisation of captured CO_2 as a feedstock in non-permanent CCU products. In comparison to the baseline, PO2 and PO3 both include the implementation of the policy measure CCU3 providing a hybrid downstream accounting for non-permanent CCU products other than e-fuels and midstream accounting for e-fuels, as explained in Section 6.2.7.

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[59] Emissions from landfilling could not be modelled in the PRIMES model as the scope covers CO_2 emissions only, whereas landfill emissions are mainly driven by CH4. Landfill emissions have been separately modelled in GAINS.

[60] GAINS does not allow to separately model the disaggregated contribution of the carbon price to emissions reductions from non-hazardous landfilling under PO3.

The inclusion of such accounting options under PO2 and PO3 will support the efforts to promote a more circular economy via the more efficient use of materials that will also have a downward impact on GHG emissions. Numerous sectors and services rely on carbon, so they cannot be "decarbonised." The use of captured CO_2 as a feedstock can provide a source of carbon for producing fuels, chemical and materials and ensure that these sectors can eventually be de-fossilised. The transition to alternative source of carbon is, therefore, an important part of reaching the EU's climate targets[61].

However, the accounting approach included PO2 and PO3 also leads to the possibility of creating loopholes risking the ETS integrity. In case the downstream emissions associated with non-permanent CCU products take place outside of the ETS scope, then those emissions are not accounted and priced within the scope of the ETS system, creating a potential loophole to the EU ETS.

A detailed analysis on the potential risk of loopholes is presented in Section 2 of Annex 13. The results of the analysis found that most potential non-permanent CCU products, such as synthetic polymers or plastics, are not likely to lead to any significant loopholes as regards the integrity of the EU ETS. Under PO2 and PO3, the downstream emissions from these non-permanent CCU products that are combusted in waste incinerators or other ETS installations will fall within the scope of EU ETS. If these non-permanent CCU products receive a different end-of-life treatment, such as recycling or landfilling, they would not be altered chemically and the CO_2 embedded in them is likely not to be released throughout the waste management process.

CO_2 used to produce e-fuels will also not represent a loophole risk, as their combustion will mostly occur within the scope of the EU ETS, in sectors such as maritime and aviation. E-fuels are also subject to specific certification requirements and are easily tracked across the value chain. However, to avoid undercounting of emissions used to produce e-fuels would necessarily mean that it is not possible anymore to zero-rate the emissions from the combustion of these fuels.

When specific loopholes are identified and are associated with clearly identifiable CCU products or applications, the risk can be best addressed by applying the upstream accounting as a derogation to a general rule or setting additional requirements or limitations to the use of such products to minimise the risks. Nevertheless, addressing all possible loopholes risks is not feasible in practice without severely restricting the use of non-permanent CCU applications, and therefore limiting their development and foregoing the benefits they bring. Given the low volumes of CCU products currently being produced, these risks are only hypothetical. Therefore, it is preferable to adopt an approach that regularly assesses the effective risk posed by non-permanent CCU to the integrity of the ETS and introduces corrective mechanisms if and when such risks start having a material impact. For a more detailed analysis of the risks of undercounting emissions, see Annex 13.

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[61] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards an ambitious Industrial Carbon Management for the EU, COM/2024/62 final, 6.2.2024, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52024DC0062.

6.1.2. Other environmental impacts (e.g. biodiversity and pollution)

6.1.2.1. Removals

Broadly speaking, the more effective a measure is at incentivizing CDR deployment (see Section 6.1.1.2), the higher the effect of additional biomass use is expected to be. In PO2 and PO3, the operator integration routes would likely see little effect on additional biomass use during the 2031-2040 period, except if further CDR policy support is put in place. PO3 would have the additional effect of the reduced scarcity in the system by setting a gross cap with 1-in-1-out approach, making technologies such as BioCCS even less competitive. In the presence of CDR support outside the ETS however, these measures would see an increase in biomass demand in line with biomass eligibility criteria and the relative cost competitiveness across CDR technologies, bounded by the CDR limit. PO1 would provide more predictable support through the public purchasing programme, and thus affect biomass use accordingly. However, the primary levers in addressing risks from biomass over-reliance lie not in measure selection, but primarily on the establishment of strict sustainability criteria, accounting for indirect land-use change, and effectively internalizing externalities from biomass use, which are under different regulatory frameworks. Under the CRCF operators generating carbon removals need to comply with the do no significant harm principle and additional specific requirements related to the type of carbon removal activity they are operating (see Annex 8 – Part II, Section 3.1.2.4). Additional sustainability criteria beyond the CRCF methodologies are not considered for the removal units to be included in the ETS. However, in a wider context, the incentive structure for biomass should be reviewed. NGO's OPC responses highlighted this as a general concern regarding the integration of carbon removals in the EU ETS.

6.1.2.2. Instruments to support investments

The IDB is expected to generate broader environmental co-benefits beyond greenhouse gas emission reductions, including lower air pollutant emissions (such as NO_x, SO_x and particulate matter), reduced resource and water use, and less waste generation. It can also improve the environmental performance of industrial sites and support more circular production models, while potential local trade-offs are managed through existing environmental safeguards and permitting. However, the differences among IDB options in terms of allocation method, support formats and geographical balance would only have marginal differences.

Under the current ETS Directive, the Modernisation Fund is instrumental in phasing out solid and liquid fossil fuels in Member States which are heavily reliant on them for the provision of electricity and heating. Under the baseline scenario (discontinuation of the MF in 2030), investments available to such activities can be expected to diminish.

Under all considered policy options, the Modernisation Fund would continue to support beneficiary Member States in reducing their dependency on fossil fuels, with an even greater impact on the reduction of liquid fossil fuels, which would be either fully excluded or strictly limited. All options also reduce support to waste-to-energy.

Phasing out fossil fuels and support to waste-to-energy has positive co-benefits for health and the environment through increased air quality and reduced air pollution control costs.

6.1.2.3. Aviation

The baseline has the lowest NO_x, $PM_{2.5}$ and overall climate costs, calculated in line with PRIMES external costs for non-road transport and the carbon values of the Commission handbook of external costs of transport (2019) see Table 7 for details. Costs from CO_2 in 2040 are 4% above the baseline for PO1, and 2% above the baseline for PO2/3.

Table 7: Total estimated externality costs

Total estimated EEA externality costs (PM and NO_x include all non-road transport), cumulative costs for 2024-2040				
Policy option	**Costs in EUR bn (2023)**			
	Local NO_x	$PM_{2.5}$	CO_2	Total
Baseline (full scope)	12,720	79	674	13,472
PO1 (clean cut)	12,871	79	699	13,650
PO2 (departing flights, medium SAF support)	12,864	79	687	13,630
PO3 (departing flights, larger SAF support)	12,880	80	689	13,649

6.1.2.4. Maritime

As regards **air quality** and related emissions of $PM_{2.5}/PM_{10}$, NO_x and SO_x, from maritime transport**,** PO2 and PO3 have a marginally lower air pollution impact of -0.06% and -0.05% respectively, in comparison to option PO1 and Baseline, in terms of monetised air pollution impact over the period 2030-2050. The drivers for the air pollutant emission reduction are the switching to fuels with lower local emissions (e.g. LNG, renewable and low-carbon fuels, or electricity), as well as the energy efficiency improvements of the ships within the smaller vessels segment. The very small differences between PO1, PO2 and PO3 are consistent with the nature of the proposed measures, considering that the focus is on ETS coverage, compliance rules and governance aspects.

6.1.2.5. Waste

Action is needed at different levels to move waste up the waste hierarchy. Many Member States are currently not on track to achieve their 2025 and 2030 recycling and recovery targets under the EU's environmental policy framework.

Extending carbon pricing to GHG emissions from municipal waste incineration (PO2) can provide an important complementary financial incentive supporting the circular economy by making waste prevention, recycling and reuse more financially competitive through the application of a carbon price on waste management processes further down the waste hierarchy. PO2 is additionally projected to lead to improved air quality for citizens, as increased waste reduction, prevention and recycling incentivised by the carbon price signal reduces harmful emissions by reducing or diverting materials like plastics and organics from incineration, thereby lowering the formation of air pollutants and toxic compounds. Member States with high recycling rates are overall found to have lower environmental life cycle costs than those with high disposal rates. In isolation, PO2 carries a risk of waste, in particular fossil waste streams, being diverted from incineration to landfills where no effective regulatory or fiscal policies (reduction targets, taxation, bans on organic and combustible waste streams sent to landfilling) to discourage landfilling are in place. In those cases, higher compliance and operational costs for municipal waste incineration may further increase the cost differential with landfilling, incentivising some operators or waste producers to look for cheaper treatment or disposal routes, which would run counter to the waste hierarchy. This was also consistently raised in the public consultation, with a majority of respondents stressing the need to address potential risks of diversion to landfills.

The EU has a comprehensive framework to reduce landfilling in place. However, implementation varies significantly across Member States and national regulatory and fiscal measures differ widely in scope, enforcement and impact. In addition to PO2, the harmonised

price signal on biodegradable organic fractions under PO3 can contribute to reduce landfilling and land and groundwater contamination from leachate. However, PO3 does not substantially address the risk that waste with high fossil waste fractions or fossil fractions separated from mixed municipal waste could be diverted to landfills to circumvent the carbon price on incineration. The simultaneous implementation and enforcement of effective complementary waste policies to discourage landfilling therefore remains crucial under all policy scenarios. In terms of incentivising waste treatment higher up the waste hierarchy, the additional impact of the application of the carbon price to hazardous waste incineration is expected to be more limited, especially for highly hazardous substances required to be disposed at high temperatures, as there is generally lower technical and regulatory flexibility in treatment options for materials that cannot be safely recycled, recovered, or treated by other means. The risk of waste diversion to exports to third countries under both PO2 and PO3 is considered to be limited as a result of legal restrictions under the Waste Shipment Regulation, with stricter rules and enforcement upcoming from 2027.

6.2. Economic impacts

This section assesses the economic impacts associated with the different policy measures that make up the three policy options. It is not an assessment of the economic impact of the climate ambition itself, which was analysed as part of the 2040 Climate Target Impact Assessment. The focus of this assessment is on whether the policy options will impose additional costs (i.e. ETS price or administrative) on business and, if so, how might this impact upon their competitiveness. These impacts will also be considered specifically for SMEs and the impact of the policy options more broadly on the functioning of the internal market and the impact on public authorities will also be carefully assessed.

6.2.1. Cost of compliance

The cost of compliance refers to the impact of the policy measures on the carbon price and the cost for installations to comply based on their exposure to the ETS price.

6.2.1.1. Carbon removals

The integration of removals is expected to help with cost containment, especially for hard to abate sectors by putting downward pressure on the allowance price over time. Compared to the baseline[62], all of the policy options will provide greater flexibility for the cost of compliance, but the impact is likely to vary depending upon how removals are integrated into the EU ETS. The net effect on compliance costs would depend among others on marginal abatement costs, on the removal supply curve and on complementary CDR support instruments.

Under PO1, a net cap with integration of removals through a public authority, it is expected that the allowance price goes down as compared to the baseline in line with the increased availability of allowances as removal-backed allowances via auctions. Indeed, it is associated

[62] The baseline is a net cap (adjusted to the relevant ambition level and all other changes in the policy options), as no additional emissions space would be provided through the integration. The ETS could eventually progress to absolute zero, unless removals would be generated elsewhere to compensate for the ETS having a positive cap, or it would be replaced by another system. For options on the future of the ETS in case of no integration of removals, see Stephanie La Hoz Theuer, Victor Ortiz Rivera, Katja Biedenkopf, *ETS, Reloaded? Designing Emissions Trading for Net-Zero and Net-Negative Societies,* Secretariat of the International Carbon Action Partnership, March 2025. Berlin, Germany, https://icapcarbonaction.com/system/files/document/ets-reloaded-paper_final.pdf.

with potentially lower ETS prices, as shown below, as it introduces two positive effects of regulatory intervention:

(i) a reduction in capital risk premiums for removal operators, due to the guaranteed purchase of removals, and
(ii) for industry emitters, a guarantee of removals availability that provides greater compliance certainty.

Overall, public intervention is expected to provide a mutual benefit to both emitters and removal operators through greater predictability and reduced market risk.

Under PO2, a net cap with direct integration of removals and a limit, it is expected that removal units increase compliance unit supply and affect allowance prices primarily if and when marginal abatement costs equal or exceed marginal removal costs, although expectations of future CDR cost declines and availability can lower EUA prices before parity is reached.

Under PO3, a gross cap with direct integration of removals, the regulator would increase the number of conventional allowances in circulation through an increase in allowance auction volumes distributed throughout the period. The increase in conventional allowances would not be conditional on removal units coming in. This would reduce scarcity in the EU ETS and exert downward pressure on the price – thereby reducing compliance costs compared to the baseline. Conversely, the use of removal units would trigger the cancellation of a conventional allowance from future auctions, potentially creating an upward price pressure[63].

The effects of the different integration options can be shown through either higher or lower discount rates, representing higher and lower risks for removals operators, which impact the removals price and therefore the ETS price in PO2 and PO3. In the modelling results, PO1 actually operates with a higher number of removals than those considered in the design of the policy option, due to removals becoming more attractive: more certainty leads to lower interest rates for investments, and thus to lower removals prices, and higher removals amounts. Thus, PO1 prices are affected indirectly through the increased of supply.

6.2.1.2. MSR

The MSR reform impacts compliance costs because MSR rules and parameters interact with all other elements in a given policy option (in particular as regards cap trajectory, removals integration and sectoral scope), to alter the allowance supply and demand, and therefore EUA prices. These will result in different compliance costs that will impact the standing of businesses across the economy. Three main indicators can be considered in the analysis of economic impacts of the MSR: future prices, price volatility and the TNAC-to-emissions ratio as a measure of market balance / liquidity. As explained above, the MSR1 design was chosen for PO1 and the MSR3 design for PO2 and PO3 and were tested for an EU ETS contribution to the 90-85% economy-wide emissions reduction target. The results for PO2 and PO3 are identical given certain MSR modelling limitations as regards the integration of removals and

[63] The year a removal unit is used instead of a normal allowance, the total emissions space in that year is higher. As an allowance is cancelled in a later year, the total volume doesn't change, but the distribution of those allowances. This creates temporal arbitrage opportunities. If arbitrage is perfect, frictionless, and without cost, this has no effect on prices in any years. If instead it is fully sticky, then the allowance price would be lower in the year the removal unit is used, and higher in the later year where fewer allowances are auctioned. Reality will lie between these two extremes, meaning a higher price volatility under PO3 than the other policy options.

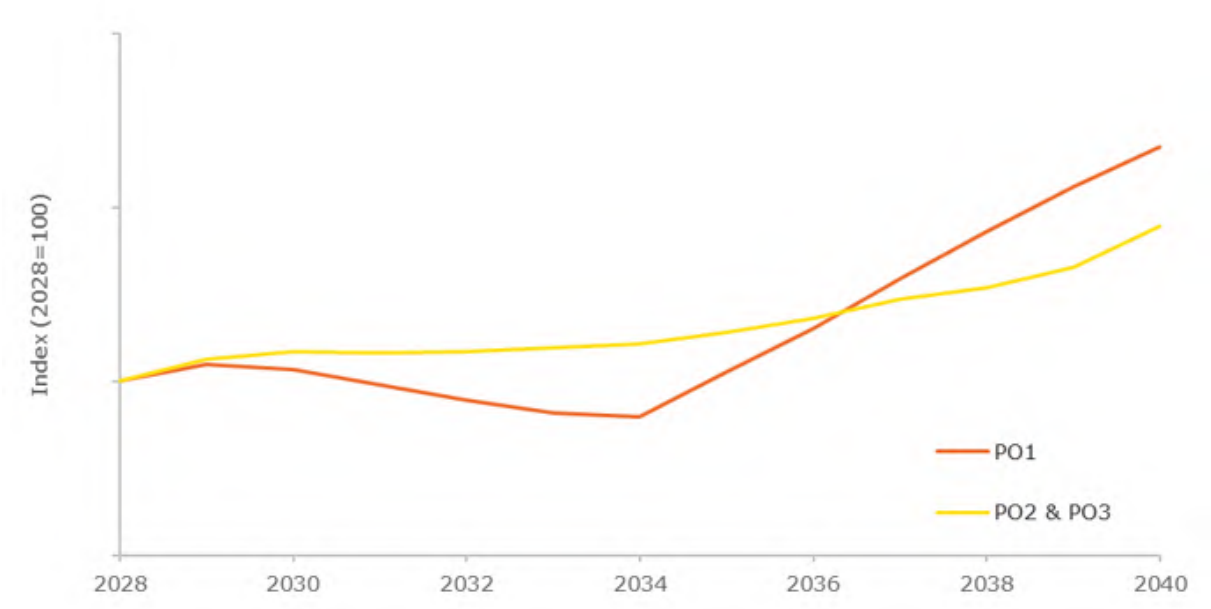
the different sector scope in the two policy options (see more detailed explanations in Annex 8).

The modelling provides estimates of the TNAC trajectory and corresponding MSR operations (intakes and releases) for each policy option, which impact the indexed carbon price trajectories. The EUA price evolution was simulated using the POLES-Enerdata model, based on a supply-demand equilibrium. In Annex 8, indexed price curves are presented to illustrate overall annual price trends compared to 2028. Such illustrations require careful interpretation as modelling relies on uncertain assumptions and may not capture actual short term price movements, which can be driven by other factors outside the scope of this assessment. The indexes are therefore used to illustrate trends - such as relative annual price increases and directional movements - and to serve as a comparison framework across policy options, rather than to deliver precise price forecasts. This approach applies to all measures modelled in Annex 8.

For PO1, the MSR1 design leads to an EUA indexed price that gradually increases until 2029, but then declines until 2034, which could potentially send mixed signals to actors investing in decarbonization. Then, the price increase after 2034 is steep and steady, as faster decarbonisation needs to be triggered to reach the 2040 target. However, this could prove challenging for regulated entities facing rapidly rising carbon costs and having limited time to adjust and decarbonize their activities. The indexed price curve in this policy option therefore depicts a lack of continuity in market tightness across the studied horizon.

For PO2 and PO3, the MSR3 design allows for a monotonic and steady increase in the price throughout the period, indicative of a healthy supply-demand balance on the market. More generally, the MSR3 design used for PO2 and PO3 brings a form of stability to the EU ETS price signal, with a progressively increasing price signal, providing a well-balanced environment for actors to invest in decarbonization activities while leaving them time to undertake the necessary transformations (i.e. not exposing them to rapid price increases).

Figure 5: MSR Policy options results – indexed EUA price evolution



Source: Own visualisation derived from POLES-Enerdata model

It is important to note that within-year price volatility cannot be assessed quantitatively with the modelling approach employed in this analysis. In addition, all the policy options assessed share the same Article 29a release mechanism, whose objective is to address high price movements, so cannot be distinguished in this regard. More generally, high price volatility, whether within-year or inter-annual, tends to occur in markets characterised by low liquidity.

Nonetheless, the inter-annual variability of the price paths shown reveals information about the comparative stability offered by the different policy options. As explained above, PO1 exhibits a notable price dip around 2030-2034, followed by a rapid and steep increase through to 2040, which would prove challenging for regulated entities facing such a price trajectory. In contrast, PO2 and PO3 demonstrates first a stabilisation of prices in the period of 2030-2034, followed by a progressive, monotonic price trajectory until 2040, offering a credible and steady price signal that facilitates long-term investment planning.

Market liquidity

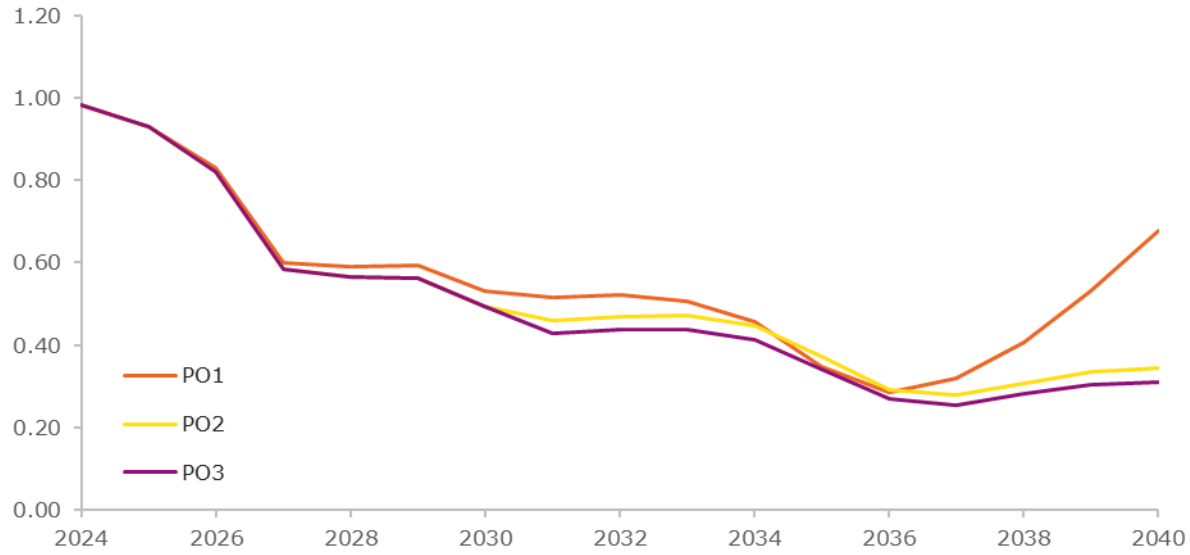
The TNAC-to-emissions ratio is used as an approximate measure of market liquidity. In all policy options, the ratio decreases from its high historical values to about 0.6 for the 2027 TNAC, given the downward TNAC technical adjustment for the historic net aviation demand in 2012-2023 of approximately 173 million EUAs. The ratio then slightly decreases by 2030, after which it diverges in the different policy options.

In PO1, the decrease continues slowly until 2036 to 0.29, a year after the first MSR release takes place. After that, due to the continued annual releases, the ratio rises again and reaches its maximum value of 0.68 in 2040, exhibiting a u-shaped pattern.

Starting in 2027, the PO2 & PO3 options include extra-EU aviation one-way emissions, not included in PO1, explaining the slight translation between their respective trajectories after 2027 (before other factors make them diverge further). Likewise, the inclusion of hazardous waste and landfills emissions from 2031 in PO3, not covered in PO2, creates the translation between their respective curves, otherwise comparable in evolution.

For PO2 & PO3, the ratio starts to increase again in 2038, due to the first MSR releases, and then oscillates in a narrow band, maintained by ongoing releases by the MSR, suggesting a steady state for this indicator. The spread of the ratio for the 2027-2040 period is slightly lower for PO2 (0.28-0.59) than for PO3 (0.25-0.59), although both are within an acceptable range. The PO1 spread is wider (0.29-0.68), and features values on the relatively high range in the last years of the period (above 0.6).

Figure 6: Policy options results - TNAC-to-Emissions ratio



Source: Own visualisation derived from POLES-Enerdata model

6.2.1.3. Instruments to support investments

The IDB by providing the support to investments will help the industry to stay on the net-zero trajectory. It thus helps to avoid higher compliance costs for industry stemming from further increases in the ETS carbon price that would have happened in case investments do not materialise or are delayed.

Considering the role of the IDB to contribute to ensuring that the investments foreseen in the 2040 climate target modelling materialises, there should be a limited/no impact on the ETS carbon price that was modelled. In the modelling exercise investments happen due to the carbon price trajectory and regulatory framework, fully implemented and perfectly integrated in the decision-making of all economic actors. In reality, however, there will still be shortcomings compared to model-based exercise and those shortcomings need to be addressed by the support mechanisms.

The IDB has no compliance costs for the ETS installation, instead it will turn the ETS resources into the investment support for the industry so that the industry can follow the net-zero trajectory. The magnitude of this support will vary across the IDB options primarily due to type of support (fixed or variable premium) and even more granular support features than those analysed in this Impact Assessment, e.g. the size of fixed premium.

6.2.1.4. Aviation

Compliance costs for aviation are made up by ETS compliance costs (minus benefits from ETS-financed SAF support) and CORSIA compliance costs, as applicable in the different policy options. Costs for compliance with ReFuelEU Aviation are out of the scope of this Impact Assessment. Administrative costs are limited and covered in Section 6.2.2.3. In the baseline, **ETS compliance costs** are highest, because the ETS scope is largest. When looking at 2035, ETS compliance costs are lowest in PO3, where ETS-financed SAF support is highest. ETS compliance costs are highest in the baseline, and second highest in PO2, where the ETS scope is the same as in PO3, but ETS-financed SAF support is modelled to have run out. ETS compliance costs are mostly channelled back towards climate action: either through revenues

for Member States, which they must use towards climate purposes (in the sector of their choosing), and/ or for allowances for the support of uplift of eligible SAF which are set aside before the revenues reach Member States. Most revenues are set aside for ETS-financed SAF support in PO3, and least (none) in PO1 and the baseline. The baseline and PO2 result in the highest revenues for Member States, as the ETS scope of application is larger (largest in the baseline) and SAF support is smaller (none in the baseline). See Annex 10, Section 3.1, tables 13 and 14.

CORSIA compliance costs depend on the level of participation of third countries (see Annex 10). CORSIA compliance costs are highest in PO1, since it assumes highest implementation of CORSIA by third countries. CORSIA is currently implemented in EU law until the end of 2026, therefore CORSIA costs are zero in the baseline. For all policy options, CORSIA costs are zero after 2035, as this is when CORSIA is set to end. In PO2/3, CORSIA costs are lower than in PO1, because it is assumed that fewer third countries implement the scheme. An important characteristic of this Impact Assessment and the Commission approach is that it **avoids double pricing emissions** – for each tonne of CO_2 emissions, airlines either pay the ETS carbon price, CORSIA offsetting, or no carbon price (if an exemption applies): airlines pay at most once per tonne of CO_2 emissions, never more than once, because PO2/3 allow for the deduction of CORSIA offsetting costs from ETS costs. This is taken into account in all modelling. CORSIA compliance costs are expected to nearly exclusively go towards the purchase of offset credits which are located in third countries outside Europe, for example Guyana (for detail, see Annex 10, Section 5.1).

6.2.1.5. Maritime

For maritime, the Baseline and PO1 have similar economic impacts in terms of compliance cost.

The increased **recycling of EU ETS revenues** to support the decarbonisation of the maritime sector would reduce costs across all vessel sizes. PO2 assumes that 50% of the ETS revenues generated by the maritime sector are going back to the sector, through national support programmes or the implementation of an EU ETS support mechanism for sustainable maritime propulsion, that would notably help bridging the price gap between renewable and low-carbon fuels and the use of fossil fuels. If designed in a way similar to the present SAF in aviation, the establishment of such a mechanism to support sustainable maritime propulsion would lead to 46 million EUAs being attributed to bridge the price gap between sustainable propulsion and fossil fuels over 2031-2040.

The extension of **existing derogations** in PO2 would reduce compliance costs for shipping companies compared to the baseline, corresponding to the none-surrendering of around 5 million EUAs.

The **application of the IMO deduction in PO2** would lead to lower compliance costs for vessels subject to both the EU ETS and the IMO mid-term measure (once adopted), compared to PO1 and the Baseline. It would prevent double regulation and double payment for the same emissions, while ensuring that emissions are always priced at a level at least equivalent to that of the ETS. The economic impact of the IMO deduction depends notably on the stringency of the IMO measure once adopted and the respective decisions of each ship regarding the use of fuels.

The **extension of the EU ETS scope to emissions from smaller vessels** contributes to a modest increase in total shipping costs in **PO2** compared to PO1 in 2030 and an increase of 1.6% in 2040 and 1.5% in 2050. In comparison to PO1 and Baseline, in PO2 it is expected that

companies responsible for smaller vessels will face a total shipping costs increase of EUR 1.2 billion in 2030, EUR 1.8 billion in 2040 and EUR 0.7 billion in 2050. These additional costs correspond to ETS payments but also to fuel costs and capital expenditure associated with decarbonisation measures within the segment. It should further be noted that smaller vessels are also eligible to benefit from existing maritime derogations under ETS (i.e. for outermost regions, public service contracts/obligations and ice-class ships), which would partially offset any compliance cost.

While the application of the cancellation mechanism accompanying the IMO deduction measure in PO2 would lead to reduced **ETS revenues**, the extension of the ETS scope to small vessels will increase ETS revenues. Depending on the stringency of the global measure, the fuel used by shipping companies and the scope of the priced emissions, the combined impact of these two factors will result in a net gain or net loss of the ETS revenues over the period 2030-2040 in PO2.

Similar to PO2, **the competitive and economic impacts of option PO3 for maritime**, are mostly driven by the extension of EU ETS to smaller vessels. Inclusion of all smaller vessel categories instead of only the most emitting ones (as in PO2) incurs only marginally higher compliance costs when considering the entire fleet.

Since **PO3** does not differ to PO2 as regards the application of the IMO deduction, derogations, the recycling of ETS revenues into decarbonisation measures within maritime sector as well as additional anti-evasion measures, the impacts in PO3 are only impacted by wider extension of ETS to all small ships. In comparison to PO1 and Baseline, in PO3 companies responsible for smaller vessels will face a total shipping costs increase of EUR 1.5 billion in 2030, EUR 1.9 billion in 2040 and EUR 0.5 billion in 2050. As for PO2, changes in ETS revenues depends on the amount of allowances to be cancelled under the IMO deduction measure, which would in turn largely depend on the level of ambition of the global measure.

In sum, the recycling of EU ETS revenues back to maritime sector is expected to incentivise the use of sustainable propulsion fuels and clean technologies and reduce costs of energy transition in shipping. The IMO deduction measure in PO2 and PO3 also ensures that emissions priced under IMO global measure (once adopted) are not priced for the second time under EU ETS, avoiding therefore double payment. The concrete economic impact on each shipping company will depend on the stringency of the global measure and the fuels used on board each ship. The prolongation of derogations contemplated in PO2 and PO3 leads to avoided costs for shipping companies, which could help support the connectivity of islands and outermost regions but delay at the same time investments for decarbonisation. The economic impacts linked to the inclusion of smaller vessels in PO2 and PO3 are relatively modest when considering the costs for the whole fleet. It also brings some positive effects in terms of level playing field with the larger vessels that are already subject to EU ETS.

6.2.1.6. Carbon leakage prevention

The different carbon leakage protection measures described in Annexes 7 and 12 will result in varying free allocation levels for non-CBAM sectors. This in turn will result in different levels of exposure to the carbon price in each of the policy scenario, impacting the carbon compliance costs faced by businesses.

The reforms to the provision of free allocation that are included within the policy options are compared to the baseline, which simply assumes a continuation of free allocation with updated benchmarks (same as CL1), but with a lower free allocation budget as the baseline is set in

accordance with the legal default that sets a more stringent EU ETS cap than assumed in the policy options.

In the baseline, the free allocation is expected to be 778 M EUAs. For the policy options, based on the available free allocation budget (see Table 4 in Annex 12) and the policy measure, the resulting free allocation will range between 487 and 990 million EUAs over the period 2031-2040. The equivalent financial volume of this free allocation amounts to over 110 billion EUR for the baseline and between aproximately 70 – 170 billion EUR for the policy scenarios (see Table 12 in Annex 12 for additional details).

In terms of the adjustment cost of each policy option compared to the baseline, it would have a positive impact in PO1 and PO2 on the conduct of business as the provision of free allocation would increase compared to the baseline. This primarily reflects the less stringent ETS cap set for the policy options than the baseline, but the extended scope of the EU ETS into waste activities also has an upward effect on the number of free allowances available under PO2 and PO3. However, in the case of PO3 the increase in allowances due to the extension of the scope is offset completely by the rapid phase out of free allocation envisaged under CL3 for non-CBAM sectors and the total number of allowances available is lower than the baseline.

In addition, under PO2, part of the free allocation is made conditional to making investment of equivalent value to that of the free allocation given. This results in an expected level of investment due to conditionalities between approximately 50 and 90 billion EUR, depending on the assumed level of compliance. **ICC** compensation can prevent carbon leakage and encourage industrial electrification by compensating for some of the ICC cost that electro-intensive industries incur.

Analysis in Annex 12 suggests that the cost of such compensation could be equivalent to 11% of ETS revenues in 2031-40 on average, if all Member States were to provide State aid post-2030 using schemes similar to those currently in place[64]. Among other drivers, this estimate assumes that indirect carbon costs are dampened by the increasing role of non-fossil generation in setting electricity prices post-2030 (meaning that indirect carbon cost accounts for a smaller share of electricity bills). Without the estimated price-setting effect of non-fossil generation, demand for ICC compensation could reach even higher levels (up to 22% of revenues).

Under both ICC1 and ICC2, actual expenditure could be lower than the range given above due to budget constraints and priorities of Member States. However, under ICC2 a minimum compensation level of 5% of the total revenue generated from 2031-2040 would be guaranteed, provided this level of eligible indirect carbon cost can be demonstrated.

6.2.1.7. Waste

Under PO1 (no inclusion of additional waste management processes), no additional cost of compliance is expected compared to the baseline.

Under PO2 (inclusion of municipal waste incineration installations) and PO3 (inclusion of all waste incineration installations and landfills of non-hazardous waste), the effective carbon cost for operators depends on the volumes of waste treated, the share of fossil versus biogenic emissions, the carbon price, the ability of operators to pass on carbon costs to other actors and

[64] Note that this figure does not take into account i) the forthcoming possibility for some indirect costs to be compensated by free allocation rather than State aid (which would reduce the figure); and ii) the expanded number of sectors eligible for ICC compensation since the December 2025 amendment to the State aid rules (which would increase the figure). See Annex 12 for further details.

the availability and cost-effectiveness of abatement solutions across the waste value chain. Complementary policies and targeted support mechanisms can be essential enabling conditions to provide investment and planning predictability for local authorities and operators, investment support to help manage the impact and implement key decarbonisation pathways, and synergies with circular economy policies to strengthen the market for recycled materials, address upstream producer responsibility and discourage landfilling (see Annex 13, Sections 1.3.1. and 1.3.2.). The extension of the carbon price to waste management operations will generate significant revenues which can be used for targeted investments for these purposes.

Under PO2, the effective carbon cost is substantially reduced due to the zero-rated biogenic share of emissions (roughly half). Compared to the baseline, ETS inclusion can financially incentivise and support investments in carbon capture technology, which is a key decarbonisation pathway for the waste incineration sector to reduce hard-to-abate emissions and contribute towards the economy-wide 2050 climate neutrality target. The integration of permanent carbon removals into the EU ETS can further provide opportunities to mitigate or offset the cost of carbon capture implementation mitigated or compensated through the generation of biogenic carbon removals. The carbon price cost passthrough can also incentivise circular economy policies, such as improved waste prevention, reduction, collection, sorting and recycling, to be more successful, if channelled to targeted and proven waste measures and policies with a positive steering effect, such as Pay-As-You-Throw or weight-based disposal fees (see Annex 13, Section 1.3.1.), reducing emissions and costs at source. While operating costs are expected to vary depending on installation type, size and location, evidence from the national application of the EU ETS to municipal waste incinerators in Sweden and Denmark indicates the carbon cost (2025) represented ≥10% of total operating costs prior to the implementation of abatement solutions or cost passthrough.

Under PO3 the cost of compliance differs per type of waste treatment. Costs are expected to be comparatively higher for hazardous waste incineration compared to municipal waste incineration due to a higher fossil content of the waste treated, also leading to a more limited potential for biogenic carbon removal generation. For non-hazardous landfilling, the average effective carbon cost per tonne of waste is projected to be higher than for municipal waste incineration in both absolute and relative terms. At the same time, the assessment indicates a higher cost-effective abatement potential for emissions under PO3 (coming from landfills), with biogas production from landfill gas capture providing a substantial economic benefit potential for operators. The specific associated costs of compliance for the sector would further depend on the scope of PO3 covering only emissions from future landfilling or also emissions from historical deposits before the application of the carbon price. While positive in terms of environmental integrity, the latter scope would pose additional monitoring, economic and operational constraints while not being influenced by pre-treatment or alternative waste management higher up the waste hierarchy.

6.2.1.8. CCU

Compared to the baseline, PO1 represents no change to the current upstream accounting, which continues to reward only the capture of emissions for permanent storage (CCU0). As CCS is not an economically feasible option for all installations that could benefit from carbon capture, upstream accounting effectively restricts the development of alternative technologies that make use of the capture carbon instead of storing it. Therefore, under PO1, the upstream accounting negatively affects the efficiency and effectiveness of the EU ETS in achieving its objectives.

The measure CCU3, hybrid downstream and midstream accounting, included in PO2 and PO3 effectively addresses the issues outlined in the previous paragraph and it enables investments

in carbon capture and non-permanent CCU. This in turn contributes to reduction in costs of CO_2 feedstock and it improves the business case for CCU products. The midstream accounting encompassed in measure CCU3 also best addresses the specificities of e-fuels, for which there is a well-developed regulatory framework is already in place.

The hybrid accounting under PO2 and PO3 would incentivise the capture of CO_2 and provide flexibility for operators to decide whether the CO_2 should be stored or utilised in different types of products or applications depending on their particular circumstances (location, access to CO_2 infrastructure and storage, access to green H_2, etc.) and the comparative costs and benefits between storing emissions, or producing different synthetic chemicals, plastics or e-fuels. However, it would also increase ETS compliance costs for e-fuel for e-fuel producers or distributors, responsible for surrendering ETS allowances for the fossil CO_2 used in e-fuels.

6.2.2. Administrative effort for the private sector

The ETS Evaluation Report (see Annex 15, in particular Section 10.4.4.2), based on a survey of ETS installations and the feedback from a reality check workshop, identifies a number of simplification options for the Monitoring, Reporting, Verification and Accreditation (MRVA) system. This includes for example increased use of existing common reporting tool, increased use of default values, and streamlining and harmonising of procedure for competent authorities, which will benefit all ETS compliance entities.

6.2.2.1. Carbon removals

The administrative cost associated with integration of removals is expected to be influenced by the channel through which operators procure compliance units, contract standardisation and market infrastructure, and risk management needs.

Under PO1, a net cap with integration or removals through a public authority, the transaction costs related to CDR purchases for operators under this measure would be lower than under measures where operators would acquire all allowances (including removal-backed ones) through regular ETS auctions or the secondary market. There would be no need to engage in separate procurement of CDR units – from this perspective, the option is the same as the baseline.

Meanwhile, PO2, a net cap with direct integration of removals and a limit, the inclusion of another compliance unit would mean that operators could face higher portfolio management complexity – optimising between allowances, CDR types, and timing, including risk management costs. Nevertheless, for PO2 direct market access through e.g. standardised contracts could minimise intermediary fees.

Under PO3, a gross cap with direct integration of removals, the administrative cost would be similar to PO1 but with additional cost for operators to understand how best to respond to the extra operational complexity from tracking the one-in-one-out mechanics.

6.2.2.2. Instruments to support investments

For the IDB, the measures assessed have different levels of complexity. In terms of allocation mechanism, the 'regular' multicriteria calls for proposals as well as the types of support employing 'regular' grants and CCfDs, particularly when aligned with dynamic energy vectors prices) require more complex multi-stage evaluations. These processes involve, sophisticated financial modelling, extensive documentation, regular calibration of parameters such as energy price indices, due diligence, grant negotiations and thorough monitoring of emissions reductions and performance milestones. Therefore, these approaches result in higher administrative costs for both the programme and applicants, particularly impacting small and

medium sized enterprises that may lack the necessary resources. In addition, Member State-driven processes can lead to additional administrative burden due to divergences in priorities, sequential consecutive stages of project selection, State aid compliance issues, and fragmented project pipeline.

On the other hand, auctions and administrative schemes as allocation mechanisms and fixed premium grants offer lower transaction costs through standardised terms, price/output-based selection, and simpler compliance (though monitoring remains necessary),

Such simplified mechanisms with performance requirements distilled to key aspects (i.e. GHG abatement) ensure good coverage of all industrial sectors and countries while containing administrative costs across the support lifecycle.

6.2.2.3. Aviation

Administrative effort relating to the EU ETS and CORSIA is shared between the aircraft operators, national competent authorities, and the European Commission[65]. Aviation has been included in the EU ETS since 2012, and aircraft operators have established processes to comply. Therefore, compared to the baseline, none of the policy options increase the administrative effort: the amount of climate action varies, but the tools remain unchanged. In principle the same pool of aircraft operators must comply with the EU ETS and CORSIA as the threshold for inclusion in the EU ETS is always based on the geographic scope of the baseline. Moreover, individual flights are reported either under the EU ETS or CORSIA in any case, resulting in no to very low differences in administrative effort required. For the inclusion of private and business jets in the EU ETS, the Commission proposes considerable administrative simplification for any newly covered aircraft operators as well as further simplification for low activity operators already covered. This includes simplified monitoring and reporting, a waiver of verification as well as exclusion for aircraft operators with very low EU ETS surrender obligation (see Annex 10, Section 7). This assessment applies equally to all policy options.

Administrative efforts for the deduction of CORSIA costs do not apply in the baseline or in PO1. Some administrative costs apply in PO2 and PO3: Operators are already required to report the most important information. National competent authorities handle this information already, whereas the additional effort would concern the deduction of costs and relate to aircraft operators, national competent authorities and the Commission. This would apply until 2035, when CORSIA is set to end (unless a decision is taken to prolong it).

ETS-financed SAF support is prolonged under PO2 and PO3, with conditionalities to further support decarbonisation. All key characteristics of the existing support would be maintained, meaning it would continue to work with minimal administrative effort. This was welcomed by stakeholders in the open public consultation. Additional conditionalities are examined in the context of incentivising decarbonisation and limiting administrative effort (see Annex 10, Section 8).

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[65] Operators need to monitor, report and verify emissions, and comply (i.e. buy and surrender/ cancel EU ETS allowances and CORSIA eligible credits). National authorities manage the system for reporting emissions, control free allocation, administer Union Registry accounts, follow up and enforce compliance and are in direct contact with aircraft operators. The Commission provides the Union Registry, approves free allocation, publishes the list of aircraft operators and administering Member States, publishes annual prices of SAF, publishes all data under transparency provisions, proposes/adopts legislation and guidance documents for harmonised implementation of the system.

6.2.2.4. Maritime

The **simplification measures** in **PO1, PO2 and PO3** aimed at aligning requirements across different regulatory frameworks. They would directly benefit shipping companies and translate, according to conservative estimates, into potential annual savings between 10% and 20% of current annual MRV compliance costs, i.e. up to EUR 9.4 million per year for the entire MRV fleet. These savings would originate from streamlined compliance processes and reduction of existing duplications reducing man-hours and staff costs for companies through the different steps of the compliance process.

The **administrative costs** for smaller ships will increase in **PO2** due to their partial inclusion in the EU ETS and MRV scope. However, the annual additional administrative costs need to be compared to the revenues that ships would be eligible to receive from the support to decarbonise shipping (see economic impacts). Recurrent MRV compliance costs for smaller vessels are estimated on average at EUR 3 690 per year and per vessel (plus one-off costs estimated at EUR 3 193 per vessel). Staff limitations and increased frequency of voyages of smaller vessels have been quoted by some shipping companies as the main reasons for slightly higher monitoring costs in comparison to similar costs for larger vessels. In addition, those shipping companies not previously active under ETS scope, would incur additional administrative costs to familiarise themselves with the ETS rules and set up and manage their Union Registry account. When considering together the MRV and ETS total administrative costs, PO2 would result in additional recurrent administrative costs for smaller ships estimated at EUR 15 million EUR per year. For **PO3**, which covers more smaller vessels, the total additional administrative costs would amount to EUR 30 million EUR per year.

6.2.2.5. Carbon leakage prevention

All the carbon leakage prevention measures include design options that will reduce administrative burden. The main simplification measures introduced in PO1 and PO2 are linked to simplifying or eliminating the need to update the carbon leakage and streamlining the process for applying for free allocation. This simplification will eliminate administrative obligations for EU ETS operators in all the policy measures, with considerable time spent on administration expected to be saved.

However, the extension of conditionalities for free allocation under PO2 would introduce new administrative requirements. The additional administrative cost has been estimated based on the information provided by industrial stakeholders on the person/time spent for different administrative tasks and estimated as one-off administrative tasks for complying with the conditionalities. Considering an average cost of labour across Member States of EUR 40, the average administrative cost for free allocation related tasks amounts to EUR 0.02 per tonne of CO_2. This represents a very small share (approximately 0.026%) of the carbon price (assumed to be EUR 64.74, which was the average price of a EUA in 2024) and it is insignificant in relation to the estimated value of free allocation. Nevertheless, to avoid a disproportionate burden on small installations of the new measures, simplified requirements or even exclusion of small installations can be applied.

The stakeholder consultation involved a series of interviews with industrial associations[66] and strong views were expressed opposing the expansion of conditionality requirements for free allocation and that any expansion of conditionality would add significant administrative

[66] Stakeholder interviews were conducted with eleven industrial associations from CBAM and non-CBAM sectors.

burdens to EU ETS operators. However, results from the OPC also showed support for conditionality, mainly among companies and business associations from the energy sector and NGOs.

PO3 will result in the most significant reduction of administrative burden, given that free allocation would be replaced by a partial surrender obligation. Therefore, there would be no administrative costs associated with the application of free allocation (i.e. provision of a baseline data report, monitoring methodology plan and verification plan, etc.). It is important to note that whilst indeed the administrative costs would be lower if PO3 was adopted, this would lead to higher compliance costs.

For additional details on the impact on administrative costs of the carbon leakage protection, see Section 1.4.2.2 of Annex 12.

6.2.2.6. Waste

Extending the scope of the EU ETS to the waste disposal sector under PO2 and PO3 overall relies on the existing system under the EU ETS. For both options PO2 and PO3, one-time administrative costs, regularly occurring administrative costs and costs for disclosure and sanctioning can be identified for competent authorities and for the operators. For PO2, the existing system, processes and infrastructure (such as the Registry) can be used, limiting costs. For PO3, the existing system and processes need to be modulated to a new sector and GHG emissions (diffuse methane emissions from a large number of landfill sites) different to the current system.

PO2 builds on the already implemented MRV requirements for MWI, including the developed monitoring plans, data collection and reporting and verification infrastructure. Additional monitoring and reporting costs under PO2 may result from changes when further detailing tailored harmonised monitoring and reporting standards and protocols for the sector. The administrative burden for a specific operator will vary according to plant size, complexity and the MRV methodology adopted. There are a range of methods available for monitoring emissions from waste incinerators, which have different associated costs. The sector-wide annual MRV costs (assuming 395 installations as reported under the 2024 MRV data) has been estimated in Annex 13, Section 1.4. to range from EUR 7.8 million to EUR 78 million per year, depending on plant size, methodology and specific monitoring requirements (e.g. frequency). Overall, the technical implementation and cost related to MRV have been manageable in light of other reporting obligations and experience already in place, for example under the Industrial Emissions Directive (IED), and the tiered system that incorporates both measurement-based and calculation-based methodologies, along with simplified provisions for smaller emitters, to provide a scalable and proportionate MRV system minimising administrative costs.

Under PO3, the monitoring and reporting framework for hazardous waste incineration would largely build on the framework under PO2, while additional costs may be associated to the development and implementation of tailored approaches due to regulatory and operational restrictions. For landfilling, additional administrative costs for competent authorities and operators are expected to be associated to the development and implementation of dedicated monitoring, reporting and verification rules, standards and protocols under the ETS framework in view of the current lack of established, harmonised MRV approaches to monitor and report methane emissions from landfills. The administrative and operational cost of MRV would be dependent on the methodological approach followed (calculation- vs measurement-based), as well as on the choice of the scope of emissions covered (emissions from future disposal only

or also emissions from historical disposal) (see Sections 1.4.3. and 1.5.1.2.3. of Annex 13 for a detailed analysis).

6.2.2.7. CCU

In terms of administrative costs, the hybrid downstream and midstream accounting (PO2 and PO3) will result in a simplification in the rules applicable for the reporting of emissions in case of the capture of CO_2, compared to the upstream accounting (baseline and CCU0/PO1). Emitters that capture CO_2 will be able to report it as captured (and deduct it from their overall emissions) the amount of CO_2 that has been captured and transferred to another ETS installation, regardless of the purpose, be it for CCS, permanent CCU or non-permanent CCU. This contrasts with the current situation where CO_2 captured for different purposes has different regulatory treatments.

The downstream accounting for non-permanent CCU products other than e-fuels relies on the integration of waste incineration in the EU ETS. However, once included in the EU ETS, there is no difference between the administrative costs for waste incinerators in the upstream accounting (CCU1) or the hybrid downstream and midstream accounting scenario (CCU3/PO2 and PO3). Waste incinerators would continue to monitor and report emissions in the same manner in both accounting approaches.

6.2.3. Sectoral competitiveness, trade and investment flows

6.2.3.1. Cap

The different POs examined in the impact assessment regarding the cap do not change in substantial terms the efforts required by the regulated sectors to decarbonise, and with it their competitiveness, as they have all been chosen to lead to the same emissions reduction objective compatible with the European Climate Law and follow the same cost-efficient 85% trajectory (all POs include measure 'CAP2'). An analysis of the impact of the ambition level itself was carried out in the 2040 Climate Target Impact Assessment[67]. Of the scenarios assessed at the time, scenario S2 resulted in a -88% net reduction of domestic economy-wide greenhouse gas emissions by 2040 compared to 1990, i.e. equivalent to a use of 2% international credits compared to a 90% target.

In particular, in the 2040 Climate Target Impact Assessment, Tables 17 in Section 6.4.2 of Part 1 and 18 in 6.4.3. show the increase in investment needs in the decade 2031-2040 compared to the previous decade 2011-2020, per major sector of the economy. In the same Impact Assessment, Tables 14 and 15 in section 6.4.1. show the macro-economic impacts on sectoral output and the EU share in global exports respectively, with Table 15 illustrating the difference between a world with globally coordinated climate action and more fragmented action. More details are provided in Part 3 of the 2040 Climate Target Impact Assessment, in particular in Section 2.3.2. on energy system costs and prices for industry, as well as 2.3.6 on sectoral output and international trade. In terms of the measures taken, Section 1.4 of Part 3 shows energy efficiency, fuel switches and carbon capture as applied across different industrial sectors. Below some examples of the modelling of technological change in different industrial sectors towards the 2040 target. For *steel* modelling shows a large reduction in pre-capture emissions

[67] Commission Staff Working Document: Impact Assessment Report: Part 1: Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society, SWD(2024) 63 final, 6.2.2024, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52024SC0063.

by more than half due to a strong decrease in blast furnace use, substituted by hydrogen direct reduction technologies. Between 20-40% of the remaining emissions would be covered by carbon capture; residual emissions would be around 35 Mt.

For *non-metallic minerals* cement is the most important source of emissions. Here there is a strong need for carbon capture (70-100 Mt) with residual emissions of around 35-40 Mt. The modelling shows some deployment of low-carbon cement, where limestone is substituted by other, less emitting minerals.

The *chemicals* sector is highly complex, and a combination of electrification, biomass and hydrogen shows around 50% reduction of pre-capture emissions. Around a third of remaining emissions would be captured.

In *other industry sectors* modelling shows large emissions reduction (60-70%), mostly through electrification; there is some limited ability to also apply CCUS.

All policy options support the demand for permanent removals, although at different scales. Those measures that support removals in a more guaranteed manner (PO1) will support the competitiveness of EU both in carbon removals and broadly industrial competitiveness by allowing more space for emissions in the EU. The ultimate impact on the removals industry, however, will depend on support measures that may complement each policy option. E.g. PO2 with carbon contracts for difference (CCfDs) can have a greater incentivisation of carbon removals as it leads to an initial scarcity and higher ETS price. PO3 complemented with CCfD at the level required to incentivise the same level of removals as included by the public authority in PO1, could lead to similar results. Conversely, the options with highest guaranteed of removals can also lead to most abatement deterrence, having a detrimental effect on the competitiveness of decarbonised technologies in the EU ETS sectors (see Section 6.1.1.2 on abatement deterrence and CDR support).

The following table gives an illustration of investment needs and energy system costs in CAP 3 "9085" scenario. The numbers shown are a range of results from PRIMES and POTEnCIA models, illustrating the intrinsic uncertainties involved.

Table 8: Annual investment expenditure, energy related excluding transport in CAP 3 "9085" scenario

Annual Investment expenditure (energy related excl. transport)	**EUR bn'25**		**%GDP**	
	2021-2030	**2031-2040**	**2021-2030**	**2031-2040**
Industry	40;45	30;40	0.2%	0.2%
Supply side*	110;120	140;175	0.6%;0.7%	0.7%;0.8%

**includes power generation and production of new fuels.*

Note: rounded to closest 5. Source: range over PRIMES and POTEnCIA models.

While the 2040 Climate Target Impact Assessment is the primary source for the impacts of the overarching ambition level, the impacts of CAP2 "85" cap trajectory are shown below relative to the CAP3 "9085%" cap trajectory. As shown in 6.1.1.1, there is more decarbonisation by 2035 and over the decade 2031-2040 in CAP3 compared to CAP2.

The steeper cap reduction under CAP3 up to 2035 incentivises a higher level of investment in decarbonisation technologies in the first half of the decade (2031-2035) than under CAP2 (see table 8). This is the case on the supply side (power generation and new fuels) as well as for industrial sectors on the demand side: the modelling analysis projects the anticipation of investment plans, with somewhat different degrees depending on the model, particularly on the supply side. Within industry, the anticipation of decarbonisation investment is stronger for energy-intensive industries than for non-energy intensive industries.

Given that both cap trajectories converge by 2040, the anticipation of investment needs under CAP3 translates into a flipside effect in the second part of the decade (2036-2040), where investment needs in the energy system are generally higher under the CAP2 than under CAP3, both on the supply side and for industry.

On average over the whole decade, both models find that average annual investment needs in ETS1 sectors are not significantly affected by the cap trajectory, with relative changes within a narrow -2%/+2% range for supply side and very small for investment in industry.

For the CAP4 "accelerated 9085" scenario, investments are estimated to be significantly higher in the first half of the decade than under the CAP 3 "9085" scenario, but lower in the second half of the decade. Over the whole decade (2031-2040), average annual investment needs on the supply side and in industry are slightly higher in the CAP4 "accelerated 9085" scenario.

Table 9: Investment needs in ETS sectors, deviation of the CAP4 "accelerated 9085" scenario and CAP2 "85%" scenario relative to CAP 3 "9085" scenario

		2031-2035	**2036-2040**	**2031-2040**
CAP4 "accelerated 9085" scenario relative to CAP 3 "9085" scenario	**Supply***	+17%	-8%	+4%
	Industry	+12%	-7%	+2%
	Energy-intensive	+16%	-10%	+2%
	Non energy-intensive	+4%	-1%	+2%
CAP 2 "85%" scenario relative to CAP3 "9085" scenario	**Supply***	-9%	+5%	-2%
	Industry	-6%	+5%	-0%
	Energy-intensive	-8%	+8%	+1%
	Non energy-intensive	-4%	+0%	-2%

**includes power generation and production of new fuels. Source: POTEnCIA model.*

A similar pattern is observed in terms of energy system costs for industry.

The following table shows energy system costs (system costs are annual costs incurred for energy services of end-users including annualised capital costs, variable costs, and fuel costs) as a percentage of GDP for the CAP 3 "9085" scenario. Energy system costs take into account both the capital costs of investments and potential economic savings in (fossil) energy expenditures, as experienced by the economic actors in a given year, over their foresight period. The numbers shown are a range of results of PRIMES and POTEnCIA models, illustrating the intrinsic uncertainties involved.

Table 10: Energy system costs as % of GDP in the CAP 3 "9085" scenario

Energy system costs as % GDP (including auction payments)	2030	2035	2040
Industry	2.0%; 2.3%	2.1%; 2.4%	2.2%; 2.3%

Source: PRIMES and POTEnCIA models.

The overall energy-related costs in the first half of the decade in the CAP4 "accelerated 9085" scenario are around 5.7% higher than under the CAP 3 "9085" scenario for energy intensive industries and 2.6% higher for non-energy intensive industries. This is driven essentially by fuel costs, but also capital costs to some extent, due to the anticipation of some level of investment in the first half of the decade. Fuel costs over that period are higher in the CAP4 "accelerated 9085" scenario than in the CAP 3 "9085" scenario due to a more rapid uptake of new fuels and to higher ETS carbon values. However, the redistribution of ETS revenues to decarbonisation of the sector could be used to mitigate this effect (ETS allowances purchasing represents around 60% of the total increase in fuel costs between scenarios over 2031-2035 and around 25% over the entire decade).

The relative difference in energy system costs in the period 2036-2040 between both scenarios is limited to less than 2% for industry as a whole. This translates into an energy-related cost for the sector over the entire decade (2031-2040) being 3.4% higher in the CAP4 "accelerated 9085" scenario compared to the CAP 3 "9085" scenario. This includes about 0.8 pp related to ETS allowance expenditure by the sector itself, which could be recycled, as could, potentially, other ETS revenues.

Table 11: Energy system costs in ETS sectors, deviation of the CAP2 '85' and CAP4 "accelerated 9085" scenario relative to CAP 3 "9085" scenario

		2031-2035	**2036-2040**	**2031-2040**
CAP4 "accelerated 9085" scenario relative to CAP 3 "9085" scenario	**Industry**	+5.1%	+1.8%	+3.4%
	Energy intensive	+5.7%	+2.4%	+3.9%
	Non-energy intensive	+2.6%	+0.1%	+1.4%
CAP 2 "85% trajectory"	**Industry**	-2.6%	-0.9%	-1.7%
	Energy intensive	-3.0%	-1.2%	-2.0%

scenario relative to CAP3 “9085”	Non-energy intensive	-1.2%	-0.3%	-0.8%

Source: POTEnCIA model.

Energy system costs are lower in the CAP2 “85 trajectory” compared to CAP 3 “9085 scenario, -2% for energy-intensive industries and -1.7% for industry as a whole.

However, it should be noted the modelled impacts do not represent all the impacts, nor their potential mitigation through complementary policies.

System cost impacts could be mitigated through distribution of ETS auctioning revenues and supporting policies. Investments, when frontloaded in the decade, are lower in the last five years. The frontloading of investments would increase the probability of faster technological developments through scaling up and learning by doing. It would allow a fast electrification of the energy system and increase Europe’s energy independence. As pointed out in the 2040 Climate Target IA, this will also depend on Europe’s ability to secure supply chains for new technologies.

6.2.3.2.Instruments to support investments

All IDB options effectively create the business case for private investment in industrial decarbonisation technologies by covering sufficient share of the funding gap, though the outcomes will depend on further, more granular features of funding mechanisms like eligible technologies, eligible project stages or compensation structures (not analysed in this Impact Assessment).

Administrative schemes and fixed premia offer clear, simple mechanisms that integrate easily into corporate planning, while auctions with variable premia are more cost-efficient driving the high level of competition but eliciting also projects willing to take on more risks. There are risks of non-delivery (i.e. projects not materialising) inherent to all options and they would need to be analysed on more granular level (e.g. setting penalties on non-delivery or overly strict criteria triggering underbidding). Those risks are more prominent in IDB option packages that put projects under higher level of competition (PO1 and PO3), while on the other hand the approach of administrative schemes (in PO2) mitigates those risks, especially if favouring projects that are first to deliver on the market.

In general, the mechanism that bring high level of competition (PO1 and PO3) are better suited to more mature technologies that operate on deep and liquid markets, which should progressively become the case for many decarbonisation technologies. Administrative schemes (PO2) should be needed in the early years of the IDB operation when uncertainties are the highest and the business case the most difficult.

Through the IDB, industrial sectors in particular stand to benefit from accelerated deployment of decarbonisation solutions, which can mitigate the competitiveness pressures associated with rising carbon prices and reduce the transition risks (i.e. investments delayed or not materialising).

In addition to the direct investments provided by the IDB, the EC analysis indicates that a direct investment leverage effect of IDB support could be expected between 5% and 75%, depending on the sector and technology, with a weighted average of 45% across all modelled projects.

It must be emphasised that the industrial decarbonisation requires substantial upfront capital investments (CAPEX) in plants with long lifetimes (typically 15-25 years), but it is operating costs, particularly energy-related that dominate total production costs, a trend amplified for

low-emission technologies. The energy-related OPEX (notably electricity, hydrogen) were included in the assessment of the environmental impacts of the IDB but fall outside the direct leverage calculation presented above for simplicity of analysis. It is clear that IDB support is bound to generate stable demand signals that would drive additional indirect investment at the energy supply side and macro-economic levels (quantification of this effect was, however, beyond the scope of the analysis performed).

In the baseline the ETS revenues are set aside for the IF, which would imply broader eligibility (beyond the EIIs) and focus on innovation with continuation of the allocation mechanism and support formats of the IF. The needs of the decarbonisation technologies roll-out would not be then fulfilled, there could be also a diminishing attractiveness of the IF calls for proposals considering that decarbonisation technologies in their majority would be entering the roll-out phase post-2030.The Modernisation Fund, through continuing the support for investments in modernising energy systems and energy efficiency, indirectly supports the beneficiary Member States' competitiveness across many industrial sectors. Against the backdrop of high investment needs in lower-income EU Member States to reach the 2030 climate and energy targets as well as higher carbon prices, the MF financial support has been essential for these countries to close the investment gap for the decarbonisation. Furthermore, by expanding the support to CCS and electrification in industry, these economies will become more competitive and maintain their industrial base while ensuring alignment with climate objectives.

In the context of the 2040 climate and energy targets, the current MF beneficiary Member States are estimated to have an annual average investment need of around EUR 90 billion[68] in sectors relevant for the Modernisation Fund (power generation and distribution, industry, residential etc.) in the 2030-2040 decade.

6.2.3.3. Aviation

When looking at economic impacts, it is important to assess the policy options' implications on operating costs, ticket prices and demand, as well as aviation auction revenues. These are then used to assess whether there is potential for options to distort competition, between airlines, airports, and tourist destinations.

The options vary in their coverage of CO_2 emissions from aviation and in the policy tools used to cover different segments of emissions. The two policy tools, the EU ETS and CORSIA, lead to different prices for each tonne of CO_2 emissions covered. The scale of SAF support influences the effective price airlines pay for SAF which may in turn influence the amount of SAF they use (and therefore CO_2 and non-CO_2 emissions). As a result, the different measures have different impacts on the **operating costs** of airlines. Fuel costs currently account for about 30% of airlines' operating costs[69], and carbon costs depend on the amount and sustainability of fuel used. Regarding economic impacts and passenger demand, it is most interesting to compare over time two market segments: economy class demand and low-cost carrier demand. The most noticeable differences can be found in departing flights, as this is where policy changes on scope would apply, and where most fuel is consumed and therefore also the impact

[68] Model-based estimates with risk of changing due to finetuning of PRIMES model (4); Figures in EUR are rounded to the nearest EUR 5 billion.

[69] IATA, *Airfare, jet fuel price, and inflation*, 2024, https://www.iata.org/en/iata-repository/publications/economic-reports/airfare-jet-fuel-price-and-inflation/.

of the SAF support is biggest. Under all policy options, the aviation support study[70] finds an increase in demand and a decrease in prices compared to the baseline for **extra-EEA departing flights**. Low-cost demand is modelled to grow less than the other travel classes, whereas first/ business demand is expected to grow most. Passenger demand is relatively price inelastic for first/ business class travel. Ticket prices behave similarly for business and economy, but the latter is more affected by prices: first/ business demand is almost the same: +1.6pp in PO1 versus the baseline, whereas for economy it is +5.1pp higher in PO1 than in the baseline - see Table 7 in Annex 10.

Fuel use for departing flights increases under the baseline and all policy options: By 2040, fuel use for departing flights increases least under the baseline (11% compared to 2023), and most under PO1 (20% compared to 2023). Fuel use increases by 15% under both PO2/3.

SAF costs for airlines mainly depend on demand: higher traffic leads to higher SAF use, in line with ReFuelEU mandates, and results in higher costs. For departing flights in 2035, SAF cost would be lowest in the baseline, which has lower traffic than the policy options. Among the policy options, SAF costs would be lowest in PO2 (because traffic in PO2 lower than in PO3), and highest in PO1 (because there is no SAF support and traffic is higher than in PO2/3) -ee Table 9 in Annex 10.

Table 12 below summarises **carbon costs as a percentage of total operating costs**. In PO1, the share of the carbon costs generally peaks in 2035, because after 2035 CORSIA would not apply anymore for extra-EEA flights (and in PO1 the EU ETS would not apply either on those flights). In PO2 and PO3, the carbon cost share increases over time because CORSIA's application until 2035 is accompanied by the EU ETS scope extension to departing flights (until but also beyond 2035). For those options, the SAF support is also reflected in the figures: in 2030 for PO2 as it is modelled to run out before 2035, and in PO3 in 2030 and 2035. **In all cases, carbon cost shares are lower in all policy options than in the baseline**. This is due to lower SAF and ETS costs, for example in 2035 PO3 carbon costs as percentage of fuel costs are about half of those in PO2. This is because SAF support is still available in PO3 but projected to have been fully used in PO2. See Table 11 in Annex 10 for further analysis.

Extra-EEA flights generally show lower carbon cost as a share of operating costs, compared to all (total) EEA flights. This is because in the policy options, extra-EEA flights are on average subject to a lower share of carbon pricing.

Table 12: Carbon costs as percentage of total operating costs

Extra-EEA flights (departing + incoming)				
Policy option	**Carbon costs as % of total operating costs**			
	2024	**2030**	**2035**	**2040 (87%)**
Baseline (full scope)	0%	7.7%	8.0%	10.8%
PO1 (clean cut)		0.4%	1.6%	0.0%

[70] Ricardo/WSP (forthcoming), *Support for the review by the Commission concerning the implementation of ICAO's CORSIA, and for Commission reports on certain types of flights, social impacts, and air connectivity of islands, remote territories and Iceland*, Referred to as "aviation support study".

PO2 (departing flights, medium SAF support)		3.4%	4.7%	5.4%
PO3 (departing flights, larger SAF support)		3.4%	2.2%	5.4%

In the freight sector, we also focus on the segment where the impact of policy options is greatest, extra-EEA departing flights. Demand is projected to increase by 2040 compared to 2024 in all cases: 37pp in the baseline (lowest increase) and 45pp in PO1 (highest increase). Again demand growth is greatest where prices are lowest: demand grows most where the ETS scope is smallest, and SAF support also has a positive effect on demand (see Table 7 in Annex 10).

For outermost regions, compared to the baseline, all options are expected to have a very limited impact on ticket prices for flights between outermost regions and their domestic mainland. In PO1, ticket prices remain unchanged compared to the baseline. PO2 shows that a potential slight (<1%) decrease in fares could be experienced in 2030 by most ticket types thanks to the prolonged ETS support for SAF uptake, with varying magnitude of impacts depending on the flight distance. Up to 0.8% reduction in the ticket price could be experienced by a passenger flying on a low-cost carrier between Paris and Guadeloupe. Through a further extension of the ETS-financed SAF support, PO3 shows that cheaper tickets could potentially be bought by passengers flying business, economy, and low-cost carriers beyond 2030, although differences remain small (less than 3% price difference compared to the baseline through to 2040). The maximum reduction in ticket prices (2.5%) is experienced by low-cost carrier passengers on a flight between Paris and Guadeloupe in 2035. Overall, while all options maintain or slightly enhance affordability, PO3 has the most favourable outcome, followed by PO2. Outermost regions and small islands benefit from 100% support for uptake of eligible SAF.

Competitive distortions for **airlines** may arise when policies do not apply equally on routes and where they are not enforced equally, for any policy option. Enforcement has been crucial for the success of the EU ETS to date[71]. Previous assessments[72] found no evidence of carbon leakage for airlines, because they are equally treated on routes covered by the ETS. All options apply uniformly per route to all airlines so do not create distortions. For airlines with a higher proportion of flights on routes covered by the ETS, there is a risk that they are less able to cross-subsidise them from other routes. Several studies nevertheless argue that such cross-subsidisation is minimal[73]. Also, the fact that SAF support is available for routes covered by the ETS channels more revenues back to the relevant airlines. This is consistent with the 2021 Aviation ETS Impact Assessment. For PO2 and PO3 where the EU ETS applies to departing flights, airlines are able to deduct any CORSIA offsetting costs.

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71 Following some airlines paying fines for non-compliance for their flights within the EU, all major airlines have maintained compliance with the system.

72 European Commission, Commission Staff Working Document: Impact Assessment Report: Accompanying the document: Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC as regards aviation's contribution to the Union's economy-wide emission reduction target and appropriately implementing a global market-based measure, SWD(2021) 603 final, 14.7.2021, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021SC0603.

73 CE Delft, *Giving wings to emissions trading: inclusion of aviation under the European emissions trading scheme (ETS): design and impacts*, 2005, https://cedelft.eu/publications/giving-wings-to-emission-trading/; CE Delft and MVA, *Implications of EU emissions trading scheme for competition between EU and non-EU airlines*, 2007, https://ce.nl/publicaties/implications-of-eu-emission-trading-scheme-for-competition-between-eu-and-non-eu-airlines/.

Passenger behaviour and airport hubs: Modelling shows that across the policy options and the baseline, in most case studies there are some passenger shifts from EEA to non-EEA hubs. All policy options reduce these shifts compared to the baseline, with PO1 having the most significant effect, followed by PO3 and then PO2, see Annex 10, Table 18. EEA **airport** hubs with large shares of transfer passengers may face an unlevel playing field compared to other hubs subject to laxer rules, causing differences in operating costs, ticket prices, itinerary choice, etc. For EEA hubs, relatively higher costs induced by local policies[74] could risk shifting air transport activity to non-EEA hubs. If **passenger shift** occurs, it may lead to **hub carbon leakage**[75] – or it may reduce emissions, if the overall route is shorter for example. To address problem drivers D2 (Lack of internalisation of the climate impact) and D3 (International carbon pricing measures in transport), it is important to limit the risk of carbon leakage. Five case studies were carried out to assess the risk of hub carbon leakage (see Section 4 in Annex 10). As shown in Table 13 below, minor hub carbon leakage is observed in one case study in PO1 in 2040 (and two in the baseline). Overall, hub carbon leakage is minimal and emissions slightly decrease across all options and the baseline[76]. **In PO1,** there is a risk of passenger shift of 3.5% in passenger-kilometres from the original route to the alternative route in 2040 on average across all case studies for economy and first classes. **In PO2 and PO3**, average risk of passenger shift is 1pp higher than in PO1 (4.5% on average in 2040).

Table 13: Case study averages for risk of passenger shift and emissions change compared to the original EEA-route

	Average passenger shift risk		**Average emissions change**		**Specific risk of hub carbon leakage**
	2035	*2040*	*2035*	*2040*	
PO1	3%	3.5%	-0.5%	-0.2%	CS 4 (0.25% in 2040)
PO2	3.7%	4.5%	-0.9%	-0.7%	n/a
PO3	3.4%	4.5%	-0.8%	-0.7%	n/a
Baseline	4.6%	6%	-1%	-0.5%	CS1 (0.72% in 2040) and CS5 (0.25% in 2040)

The impact assessment for the revision of the EU ETS for aviation[77] found that carbon leakage risks for **tourist destination** switching were low, due to the nature of air travel (passengers

[74] These could be related to climate policy, but equally to other policies such as labour laws, passenger rights and subsidies. The latter are out of the scope of this Impact Assessment. It should also be noted that itinerary choice is a function of journey time, cost, number of flight segments, available flight frequency and characteristics of the origin and destination airports.

[75] In the European Commission's 2025 Carbon Market Report, carbon leakage is defined as a situation that could occur if ETS-regulated activities were moved to non-EU countries with less ambitious climate policies, leading to an increase in overall greenhouse gas emissions. Hub carbon leakage therefore occurs when such emissions displacement and increase take place due to hub switching, i.e. passengers switch from a direct flight or a connecting flight via an EEA hub to a connecting flight via a non-EEA hub.

[76] Emissions may still be displaced from within Europe to outside Europe.

[77] SWD(2021) 603 final.

usually know where they want to go and choose the best flight options to get there[78]. This was confirmed by external studies[79], also showing that tourists prefer direct flights[80] and that demand has historically been relatively inelastic to cost changes[81]. A study of Green Deal policies for aviation (ETS, ReFuelEU) found that they achieve emissions reductions without carbon leakage (scope of the study: global aviation). It mostly identified carbon leakage to other sectors in case aviation fuel demand reduction leads to overall fuel price reductions[82]. Qualitative analysis therefore suggests that ticket prices are one among several decision-making factors for tourists, not necessarily the decisive factor. Ticket prices for tourist flights are impacted in the same way as any other flight, so analysis above on ticket prices etc. applies.

On **SAF support and ETS revenues,** PO2 sets aside 140 million allowances for SAF support, whereas PO3 sets aside 280 million. The allowances set aside lower the volume of allowances auctioned and thus decrease the ETS revenues available to Member States for other climate mitigation purposes and the Innovation Fund. In 2035, the medium amount of SAF support in PO2 is projected to be used up, while there is still support in PO3. See Section 8 in Annex 10 for analysis on the SAF support mechanism.

As a complement to the ETS price signal, ETS auctioning revenues are used to support the transition towards climate neutrality. **The highest revenues come from PO2, where ETS coverage is widest and a medium amount of allowances is set aside for direct SAF uptake support**. See Annex 10, Table 10 for more detail.

6.2.3.4. Maritime

In the policy scenario PO1, the **uptake of renewable fuels** would still be limited in 2030, but increase significantly in the period 2040 and 2050, reaching 87% of total energy demand in 2050. The fuel mix in 2050 is dominated by biofuels (58%), renewable fuels of non-biological origin (RFNBOs) (27%), electricity (2%) and a residual use of fossil fuels (13%). In policy options PO2 and PO3, the uptake of renewable fuels slightly increases by around 2-3 percentage points in 2040 and 5-6 percentage points in 2050. This is mainly due to the expansion of EU ETS to smaller vessels and the further uptake of renewable fuels in this segment. The allowances set aside for the SMAP mechanism would also contribute to such an uptake, although they also decrease the ETS revenues available to Member States for other sectoral uses.

In relation to **competitiveness impacts**, the lowering of the container transhipment incidence threshold from 65 % to 50% should lead to the identification of additional "neighbouring container transhipment ports" under the ETS Directive. In the short-term, it would concern, based on current data at the time of preparing this impact assessment, the ports

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78 Top determinants for overseas travellers to Europe are safety, famous landmarks, quality of infrastructures, weather conditions and direct routes. Source: European Travel Commission, *Long-Haul Travel Barometer 2026*, 2026, https://etc-corporate.org/news/long-haul-travellers-grow-more-cautious-in-2026-while-safety-and-flexibility-shape-demand-for-europe/.

79 For example: SEO & NLR, *Aviation Fit For 55 – Ticket Prices, Demand and Carbon Leakage*, 2022, https://www.seo.nl/wp-content/uploads/2022/03/2022-16-Aviation-fit-for-55.pdf.

80 Verma, Rebelo, and Araújo, *Impact of Inter-Country Distances on International Tourism*, 2019, https://arxiv.org/abs/1902.04944?.

81 ICF et al., Assessment of ICAO's global market-based measure (CORSIA) pursuant to Article 28b and for studying cost pass through pursuant to Article 3d of the ETS Directive, 2020, p. 236, https://data.europa.eu/doi/10.2834/714858.

82 Wei & Kallbekken, *Carbon leakage from aviation under the European Union Fit for 55 policies*, 2024, https://www.sciencedirect.com/science/article/pii/S1361920924002268.

of Abu Qir and Damietta in Egypt and the port of Tekirdağ in Türkiye, which represent a yearly transhipment volume of more than 2 million TEU. If these three additional ports were included, the anti-evasion measure would apply to more than 80% of the transhipment activities taking place in non-EU Mediterranean countries.

This measure could also help better address the risk of evasion linked to future transhipment hubs, such as the port of Cherchell in Algeria, the Port of Dakhla or Nador West Med in Morocco. In general, this measure should contribute to protect the competitiveness of EU ports and help avoid the negative impacts that may occur if relocation of container transhipment activities is taking place.

Amendments to relevant EU MRV and ETS elements to address the specific nature of offshore activities would ensure that all ships involved in offshore activities within EU Member States' territorial waters or Exclusive Economic Zones are subject to emissions regulation, regardless of their flag or port of origin. Consequently, it would promote a fairer and more level playing field for EU offshore shipping companies. However, it could slightly increase the administrative burden for both shipowners and regulators, due to the need for more detailed reporting and verification.

Additional compliance costs for smaller vessels are expected to be passed on to shippers and voyagers, which may have indirect impacts on **trade patterns and macroeconomic indicators**. Modelling of impacts of maritime policy options in GEM-E3 found that, for EU27 countries, GDP would drop by 0.001% in 2040 under both PO2 and PO3, which means that macroeconomic impacts are expected to be marginal on average. These effects are expected to be slightly more significant in FI, EL, SE, DK, due to higher dependency on transport provided by smaller vessels. Impacts on third countries are expected to be negligible, on average, with a drop in GDP estimated at 0.0003% in 2040.

6.2.3.5. Carbon leakage prevention

GEM-E3 model results provide insights into how alternative ETS design choices translate into heterogenous sectoral and macroeconomic impacts, relative to the baseline scenario by taking into consideration key drivers within scenario assumptions such as the different free allocation distributions across industry, as well as the different ETS coverage and cap stringency and alternative revenue recycling. The policy scenarios assessed by the GEM-E3 model are described in Section 6.1.1.7 and in Annex 12, Section 1.4.1.

Changes in the unit cost of production are driven by specific scenario assumptions namely: (i) different shares of free allocation, with highest shares in PO2_90, (ii) changes in carbon prices, notably in PO2 and PO3 where carbon prices are lower than the reference case due to the expansion of EU ETS coverage to waste emissions, (iii) other scenario implications of waste inclusion in EU ETS, such as the increase in the price of electricity and (iv) the impact arising from revenue recycling. The dominant driver of the sectoral effects varies between these four mechanisms across sectors.

Among the policy measures, PO3 shows the highest reduction in production costs relative to the baseline, despite the full phase-out of free allowances after 2034. This improvement in competitiveness is driven by the inclusion of waste emissions in EU ETS, which leads on to a decline in the carbon price. By contrast, policy options with alternative revenue recycling (PO3R and PO1R) exhibit lower competitiveness, as redirecting revenues away from power-sector investment towards households increases domestic demand, which in turn raises both capital and labour costs.

Production and exports respond heterogeneously across policy options relative to the baseline scenario, reflecting differences in free allocation, sectoral coverage, and revenue recycling. By contrast, policy options with alternative recycling (PO3R and PO1R) show lower production and export level due to reduced competitiveness.

In all policy options, GDP in 2040 increases relative to the reference scenario, reflecting positive macroeconomic effects driven by higher exports and/or increased private consumption, depending on the scenario. The GDP increase ranges from 0.00% under PO2_50 to 0.08% under PO3R, with the latter achieving the highest GDP level due to the combined effect of a lower carbon price and stronger household demand stimulated by lump-sum recycling of EU ETS revenues.

In all scenarios except those with alternative recycling schemes, an improvement in EU27 competitiveness is observed, reflected in higher exports. This outcome is driven by a higher allocation of free allowances to EU ETS sectors (e.g. PO1), and/or lower carbon prices required to meet the EU ETS cap because of including waste emissions in EU ETS (e.g. PO3). In the recycling scenarios, private consumption is the main driver of GDP growth, reflecting the lump-sum transfer of EU ETS revenues to households. In these cases, exports decline due to higher labour and capital costs, which arise from increased household demand and upward pressure on factor prices. In PO2 scenarios, private consumption drops marginally as increasing electricity prices stemming from higher waste incineration, put a pressure to the remaining disposable income.

Additional details on the competitiveness impacts of carbon leakage measures, including figures and insight for selected sectors can be found in Annex 12, Section 1.4.2.

It was outside the scope of the impact assessment to consider the impact of the CBAM in preventing carbon leakage up until 2040, but it is important to note that the policy instrument will be progressively phased in as free allocation is phased out and it is expected that by equalising the carbon price paid at the border that the risk of carbon leakage in the sectors currently covered should be significantly, if not entirely, reduced.

Free allocation was always intended to be transitory in nature so its continuation into Phase V (2031-2040) in all of the policy measures under consideration shows an acknowledgement by the Commission that the non-CBAM sectors will require further support to decarbonise in what is a very challenging operating environment. However, the trajectory of the ETS cap means that the extent to which free allocation continues to be distributed based on the existing free allocation rules, will increasingly become less relevant if the annual amount of preliminary free allocation calculated exceeds the annual free allocation budget and the cross sectoral correction factor is applied in most years – ranging between 0.92 to 0.36 depending on the policy scenario[83].

An important topic in this regard is the use of allowance revenue to solely be used to support industry, which was a frequent position advocated by industrial associations during the stakeholder interviews. Ultimately it will require the state and private sector to work together to ensure the enabling conditions (i.e. availability of green hydrogen, infrastructure for CCUS,

[83] The cross-sectorial correction factor (CSCF) functions as an adjustment factor in case the preliminary free allocation (calculated based on benchmark, activity levels, etc.) is above the total free allocation budget. A CSCF of 1 means that final free allocation equals the preliminary free allocation. A CSCF of 0.7 means that the final free allocation is 30% lower than the calculated preliminary free allocation. N.B. the CSCF is applied before the CBAM phase-out factor.

availability of low cost and low carbon electricity, market demand for low carbon products) are available so that the ambitious trajectories already outlined by industrial sectors for their decarbonisation are achieved. The instruments to support decarbonisation via the IDB and the IF are assessed separately. In addition, other measures and initiatives announced by the European Commission, such as the Industrial Accelerator Act, the European Grids Package, or the CO_2 Infrastructure Package, as well as the revision of the Renewable Energy Directive will further complement EU ETS and drive the process of industrial decarbonisation

For **ICC** compensation, estimates indicate that indirect carbon cost accounts for between 8%-11% of the retail electricity price paid by large industrial consumers in the EU on average in 2025, smaller than the share of taxes, network charges, or fuel costs.

The upper end of this range is based on the *marginal emissions factor,* which takes account of the fact that ICC can be passed on through electricity prices even when the grid is largely decarbonised. This means that: i) carbon cost is passed through to consumers whenever fossil fuels are the price-setting marginal generator; but ii) carbon cost is not passed through whenever the price is set by non-fossil generation. The lower end of this range is based on the *average emissions factor* of the EU power mix and represents the share of carbon cost in total electricity system costs.

The main effect of continuing to provide compensation would be to alleviate the risk of carbon leakage and incentivise electrification by compensating for some of this cost. ICC compensation is therefore also an important contributor to the competitiveness of electro-intensive processes within sectors. This is particularly important for as long as direct emitting processes continue to receive free allocation, and as long as fossil fuels continue to act as the marginal generator, thereby exerting a greater influence on electricity prices than their generation share would suggest.

The provision of some ICC through an EU-level instrument would provide greater certainty over the availability of compensation compared to a purely State-aid-based approach, as well as diminish distortion of competition. Therefore, option ICC2 would have additional competitiveness benefits to some installations (those who would not have received aid under ICC1). On the other hand, it would bring additional administrative burden as noted in Section 6.2.2.5.

As explained in Section 6.2.1.6 above (and in Annex 12), the extent of this compensation is estimated as being equivalent to 11% - 22% of overall ETS revenues in the 2031-40 period if all Member States were to provide State aid post-2030 using schemes similar to those currently in place[84]. The higher end of the range assumes that post-2030 compensation continues to be based on the carbon intensity of fossil-based electricity generation.

6.2.3.6. Waste

Extending carbon pricing to greenhouse gas emissions from municipal waste incineration (PO2) and hazardous waste incineration and landfilling of non-hazardous waste (PO3) can provide an important complementary financial incentive to foster sectoral innovation, support the economy-wide uptake of carbon removals and CCU, and contribute to the circular economy, reinforcing recycling, more efficient material flows, and EU competitiveness. These were also the most frequently cited reasons by stakeholders in the public consultation in support of MWI inclusion.

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[84] See Section 6.2.1.6.

First, as explained in the preceding and following sections, the inclusion of municipal waste incineration in the scope of the EU ETS under PO2 and PO3 offers considerable opportunities for biogenic carbon removal generation and enables the consideration of alternatives for how to account the emissions that are captured and used in non-permanent products, such as e-fuels and synthetic chemicals.

Second, by internalising the carbon footprint of waste disposal and financially incentivising the business case for separate waste collection, sorting, material and carbon recovery and recycling, PO2 and PO3 contribute to the ambition set out in the Competitiveness Compass and the Clean Industrial Deal to make the EU the world leader on the circular economy by 2030, to double the amount of circular materials by 2030, and to establish a clear link between incentives for decarbonisation and circularity efforts by industry. Circular economy activities already represent around 1-2% of EU GDP[85] and generated almost EUR 300 billion in gross value added, alongside EUR 122 billion in private investment, in 2021[86]. The European remanufacturing market's circular potential is projected to grow from its current value of EUR 31 billion to EUR 100 billion by 2030, creating 500,000 new jobs[87], with PO2 and PO3 projected to foster the growth of the EU circular economy and recycling sector. The impact is expected to be significant for PO2, and comparatively highest for PO3, while no change compared to the baseline is expected under PO1. Accelerating the joint transition to more circularity and decarbonisation of waste increases the EU's economic security, resilience and competitiveness by reducing global dependencies on imported virgin materials and price volatility, improving resource productivity, job creation and strengthening innovation.

Finally, while the situation substantially differs between Member States, in view of the EUs increasing recycling and circular economy targets, the carbon price can also provide a complementary incentive over time to aggregate infrastructure and make waste disposal more efficient from an environmental and recycling point of view.

6.2.3.7.CCU

Under the baseline scenario, upstream accounting would make non-permanent CCU products uncompetitive as it would require the surrender of allowances for the carbon embedded in CCU chemicals, plastics, which does not apply to traditional virgin fossil equivalent products (for which only direct, scope 1 emissions are covered by the ETS). Furthermore, in the baseline, the limited incentive to invest in carbon capture results in CO_2 feedstock being scarce and expensive, which negatively affects the business case for non-permanent CCU products.

The hybrid downstream and midstream accounting approach (PO2 and PO3), enabled by the integration of waste incineration in the ETS, ensures that there is a level playing field in terms of emissions accounting for non-permanent CCU products and their fossil fuel equivalent. Only the combustion and process emissions from their production are reported and priced in the ETS for both type of products, while the emissions embedded in the product will be reported and paid for downstream when those emissions are realised, i.e. at the point of incineration. This

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85 OECD, *The Circular Economy in Cities and Regions of the European Union*, 2025, https://www.oecd.org/en/publications/the-circular-economy-in-cities-and-regions-of-the-european-union_e09c21e2-en.html.

86 Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on a revised monitoring framework for the circular economy, SWD(2023) 306 final, 15.5.2023, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52023DC0306.

87 World Bank, 2022

accounting approach also provides flexibility for operators to decide whether the CO_2 should be stored or utilised in different types of products or applications depending on their circumstances (location, access to CO_2 infrastructure and storage, access to green H_2, etc.) and the comparative costs and benefits between storing emissions, or producing different synthetic chemicals, plastics or e-fuels. For e-fuel producers this option gives more clarity on the costs and trade-offs available for sourcing different CO_2 feedstock for their production process. Fossil CO_2 may be more available and cheaper to capture, but it requires the surrendering of emissions of allowances, while biogenic or atmospheric CO_2 may be more expensive to source, but do not require an ETS payment.

6.2.4. SMEs

6.2.4.1. Aviation

There are more than 370 active aircraft operators in the EU ETS, and 187 of these are registered in EU countries and therefore included in this report's analysis.

In most EU member states, large enterprises own a majority of aircraft operators. In 15 member states, large enterprises own all aircraft operators. In seven member states, 60 to 95% of aircraft operators are owned by large enterprises: Bulgaria (60%), Poland (67%), Greece (75%), France (86%), Belgium (86%), Italy (88%), and Germany (93%). In Romania, two thirds of aircraft operators are owned by medium-sized enterprises. Hungary and Slovenia each have a single aircraft operator, owned respectively by a medium-sized and a small enterprise. For more detail, see Annex 6.

6.2.4.2. Maritime

The extension of the ETS to smaller vessels under PO2 is expected to **primarily affect SMEs**, since companies managing smaller vessels tend to be on average smaller (i.e. 1.6 vessels per company) than those already reporting under the EU maritime MRV (2.6 vessels per company). In addition, most companies managing smaller vessels would be new to the MRV and ETS system and would need to set up and familiarise themselves with MRV and ETS processes. A key disadvantage for SMEs is their more limited capacity to absorb additional administrative costs. While some administrative costs borne by shipping companies are dependent on fleet size, other costs are fixed. As such, the proportionate administrative burden is likely to be higher for smaller businesses who do not benefit from significant economies of scale. SMEs in the maritime sector are expected to sell or buy allowances via intermediary traders mainly from the financial sector instead of participating directly in the primary or secondary markets. Another key disadvantage for SMEs is their limited ability to access financing for capital investments in low-carbon technologies (e.g., alternative propulsion systems or onboard carbon capture). This constraint may reduce the range of greenhouse gas abatement options available to them, potentially increasing their exposure to ETS-related costs in the short term.

6.2.4.3. Carbon leakage prevention

Businesses most likely to be affected by the policy measures were identified by using the preliminary NIMs dataset to categorise sub-installation information for selected non-CBAM sectors into different tCO_2 emission ranges. However, SMEs cannot be directly identified from the ETS data available and therefore proxy measures based on low direct emissions or low electricity consumption (for indirect emissions) are adopted for the SME test. Annex 6 contains further analysis, using non-ETS data, of the potential presence of SMEs among ETS-regulated installations.

For the non-CBAM sectors, the lime and refined oil sectors have the lowest shares of their total sub-installations that emit under 5,000 tCO_2 (under 20% and around 20% respectively), while the ceramics and paper and paperboard sectors have the highest shares accounting for over 60% and 50% of their total sub-installations respectively. The chemical sectors both organic and inorganic are within this range with a 34% and 36% share of their total sub-installations that emit under 5,000 tCO_2 respectively.

SME stakeholders were represented by their sector associations in the stakeholder interviews as well as having the opportunity to submit their views within the OPC itself. In terms of the impact of the policy measures on SMEs within the non-CBAM sectors, the consultation exercise collected evidence that the concerns raised (i.e. increased direct carbon costs and a loss of international competitiveness) are very similar in nature to larger emitters but that the magnitude of the impact may be greater. It is to be expected that CL1 (PO1) will have a smaller impact on SMEs than CL2 (PO2) or CL3 (PO3) given that the non-CBAM sectors receive more free allowances under the current approach without imposing additional requirements under CL2 (PO2) to comply with conditionalities or receiving less allowances under the more rapid phase out of free allocation envisaged under CL3 (PO3) to align with CBAM sectors. Indeed, interviews with industrial stakeholders advanced the position that the introduction of further conditionalities as envisaged in CL2 (PO2) would impose additional administrative costs on operators and that these would have a higher impact SMEs. Given the strong insistence by industrial associations regarding the importance of continued free allocation, CL3(PO3) would increase the risk of carbon leakage, and this risk would be even greater for SMEs.

Small installations in the NIMs dataset were also identified in sectors eligible for ICC compensation and categorised according to their annual electricity consumption. The smallest installations (under 5,000 MWh) accounted for 20%-35% of the total number in manufacture of other inorganic basic chemicals, aluminium production, the manufacture of basic iron and steel, and ferro-alloys and copper production (see Annex 12 for details). This suggests that changes to ICC compensation would have the greatest effect in these sectors, and that they would be most affected by the potentially larger administration effort of Option ICC2 (see Section 6.2.2.5).

6.2.4.4. Waste

PO1 is not expected to have an additional impact on SMEs as the scope of the EU ETS is not further expanded to waste activities. Under PO2 and PO3, the waste disposal sector integrated in the EU ETS is characterised by a relatively higher share of medium-sized enterprises compared to most other sectors currently under the EU ETS. Both the scope of PO2 and PO3 would be modulated by the applied activity threshold. Under the ETS Directive, combustion installations are normally included in the scope of the system if they are above the threshold of 20 MW rated thermal input. As assessed in Annex 13, an inclusion of the waste disposal sector under PO2 or PO3 must consider the appropriateness of this thermal capacity threshold in view of the specific nature of waste as a feedstock, regulatory consistency with the Industrial Emissions Directive, avoiding threshold effects and risks of circumvention, and avoidance of disproportionate impacts on small operators. Regardless of the threshold level, the impact on SMEs can be addressed through several provisions. First, administrative and financial burdens resulting from MRV compliance requirements are addressed through simplified MRV provisions for smaller installations, providing a scalable and proportionate approach, avoiding excessive burdens on low-emitting sites while still ensuring a basic level of emissions accountability. Second, regardless of the threshold level, smaller installations would be eligible

for the opt-out clauses under the existing small- and ultra-small emitter provisions in the ETS Directive.

6.2.4.5. CCU

While carbon capture requires expensive investments that make sense only for large installations, many technology providers in the field of CCU that look to commercialize recently developed technology are small, start-up businesses. Therefore, measures CCU2 and CCU3 seek to level the playing field for these new entrants to allow new CCU products to compete with CCS.

Furthermore, these measures have been designed to be implementable based on the established MRVA system that can ensure the accounting integrity of the EU ETS, while not imposing excessive administrative burdens on operators. For this reason, the measure based on LCA accounting has been discarded as overly complex and costly to implement.

Stakeholders consulted as a part of the OPC questionnaire emphasize the importance of 'administrative proportionality' for non-permanent CCU policy measures. Especially amongst business associations, emphasis was placed on implementing an accounting approach that prioritizes simplicity and continuity for SMEs to effectively implement non-permanent CCU measures.

6.2.5. Public authorities

A major benefit to public authorities is represented by the auction revenue derived from the auctioning of the EU ETS allowances. The auctioning volumes are derived from the estimates for the allowances distributed for free to industry, and it does not take into account any split between auction revenue that is accrued to EU level funds or to national treasures. This represents the total maximum auction revenue, excluding only what is allocated for free to industry from the annual cap of allowances. By deducting the estimated volumes of free allocation from the ETS cap for each year, the cumulative the value of auction revenue will range between aproximately EUR 600 to over 800-= billion, depending on the policy options – see Table 22 in Annex 12 for additional details.

In terms of the use of auction revenues, the quantitative assessment of macro-economic impacts done based on GEM-E3 assume that the revenue generated by EU ETS is recycled with 50% financing power dedicated to sector investments and 50% dedicated to improving energy efficiency in EU ETS industries. A variant to this assumption (marked R in the respective scenarios) considers a revised recycling structure where the 50% allocation to the power sector is instead transferred as a lump sum payment to households.

The spending of Member States revenues is analysed yearly in the Climate Action Progress Report and the Carbon Market Report[88]. The Member States reported only 5% of the ETS revenues is used to support decarbonisation of energy intensive industries in 2024, while the most support received by industry is for indirect cost compensation. While the Member States could allocate a higher share of this revenue for the decarbonisation of industry, national approaches will remain inherently fragmented, lacking the ability to exploit the economies of scale and efficient allocation of resources the single EU market can provide.

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[87] Report from the Commission to the European Parliament and the Council on the functioning of the European carbon market in 2024, COM(2025) 735 final, 3.12.2025, https://climate.ec.europa.eu/document/download/ddc1b1de-652b-49ed-8f15-d9fa8badd39f_en?filename=com_2025_735_en.pdf.

Therefore, EU level instruments, such as the IDB and the IF, will play a key role in the funding of decarbonisation investments in the next period (see Annex 9 for more details).

Impacts on public authorities also relate to the operation Union Registry, which resulted from the centralisation of 30 separate national registries under a single system. As indicated in the ETS Evaluation (see Annex 15, Section 10.6.4), the Union Registry plays a crucial role in ensuring the transparency, integrity, and security of the EU ETS. The changes analysed in this impact assessment, in particular as regards PO2 and PO3, increase the scope and complexity of the EU ETS, which in turn increase the risks for and demands on the Union Registry and the underlying IT infrastructure. In addition, the growth of the European carbon market and the value of the ETS allowances over the last decade[89], expected to continue with the measures analysed in this impact assessment, and the evolution of the regulatory environment[90] require a new setup for the financing of the Union registry, leaning of financial market standards and proportionate to the growing value of the assets.

Nevertheless, measures exist to address these growing risks to ensure a reliable service to its users, through adequate financing for the operation for the operation of the Union Registry. The central administrator of the Union Registry could be given the legal prerogative to raise fees from the users of the system (compliance accounts and traders) or use part of the auction revenue to finance the services it renders to these entities. These costs would cover the development, maintenance, and operation of the Registry, IT infrastructure, users' support, as well as IT security, audit capacity, oversight, and other functions required to achieve better compliance with financial market frameworks. These costs could also cover further tasks of the Central Administrator and related non-regulatory implementation tasks in the area of ETS.

6.2.5.1. Carbon removals

The fundamental, overall cost of achieving EU climate targets in terms of gross and net emissions objectives is not expected to change materially across the five CDR measures considered here. Similarly, the investment needed to support the development and deployment of CDR technologies does not a priori change materially across the measures assessed. Public disbursement can occur through the EU ETS as in PO1 and/or through other support policies (e.g. CCfDs or a public purchasing programme) that would complement PO2 or PO3.

In either case, total expenditure should be similar if the regulator has a clear commitment towards procuring enough CDR that guarantees the extra gross emissions headroom for operators (CR1) or to deliver the net emissions outcome (CR3), as the public purchasing programme guarantees in PO1. In PO1, the public authority would pay the full price of each CDR credit upfront but then recover the price difference with EUAs when the removal-backed EUAs are auctioned, covering only the price difference in the end, comparable to CCfD support in PO2 and PO3 ([91]). That said, the measures do vary considerably in terms of risk distribution and upfront finance for CDR development and deployment.

PO1 would see the regulator purchase removal units even if they are not cost competitive vis à vis the allowance price. Thus, CR4 would likely entail significant administrative costs for the regulator in e.g. the procurement of removal units, although it seems possible that procurement

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89 The last decade has brought a steep increase in the asset value, moving from an allowance price of EUR 5-10 to the current level of EUR 60-80.

90 Since the entry into force of the review of the Directive on Markets in Financial Instruments in 2018, the emission allowances are categorised as financial instruments.

91 The exact amounts will depend on the timing of the purchase of the removals and the sale of allowances.

methods such as reverse auctions could yield lower overall transaction costs than if purchases were done by individual regulated entities in the primary CDR market, and would need to be compared with the administrative cost of complementary support measures needed under the other policy options (e.g. CCfDs). Annex 8 provides an illustrative assessment of the investment needs in CR4, the measure included in PO1. It estimates the total investment requirements for achieving net emissions reduction target of 85% with the ETS integration of 173 Mt of BioCCS and DACCS (PRIMES modelling result) by 2040 at EUR 35.7 billion based on the mid-point technology costs[92]. Considering different technological costs, between EUR 29 billion and EUR 43 billion (lower to upper bounds) are required as upfront investment. However, the purchasing programme would have a final fiscal cost of EUR 3 billion (based on the mid-point technology costs), when the revenues generated from the removal-backed allowances is deducted from the upfront costs[93][94]. These are illustrative results, as investment requirements and final fiscal cost for a potential removal integration as per CR4, strongly depend on the final ambition level set out, the corresponding ETS prices, total volume of removals to be purchased, the ratio of BioCCS to DACCS in the portfolio, and timing of the purchase of the removals compared to the sale of the allowances. They nevertheless suggest that the sale of removals into the EU ETS could potentially be close to covering the full cost of the purchasing programme, if the timing of the purchase of the removals compared to the sale of the allowances could be fully optimised (e.g. delay in the sale of allowances to a time when ETS prices are highest and purchase of removals when the removal prices have decreased). However, as this is unlikely due to the need to kick start the market, budgetary rules requiring the availability of revenues at the start of a procurement process and the uncertainty in ETS and removal prices, a conservative approach to the calculation of the fiscal cost would be advisable, potentially considering average ETS prices during the phase.

PO2, in theory, would entail lower direct EU ETS costs for the regulator as compared to PO1. There would not be an upfront increase in the cap that would lower ETS prices and with it, it would also lower auction revenues for Member States, and no public purchasing would be needed. However, in the absence of public investments in CDR through other policies, PO2 risks that the CDR development and deployment does not take place in time for the CDR scale-up required and that the extra 'space' for residual emissions inside the ETS therefore not materialize, leading to higher costs for the regulator later on.

PO3, which applies a gross cap, would see a similar effect in apparent cost savings due to lower direct EU ETS costs for the regulator, again with the need for further support policies to ensure that CDR development and deployment take place in time for the CDR scaleup required. This is aggravated by the initial reduction in scarcity, which could reduce incentives for abatement and investment in removal by regulated entities – thus potentially requiring further investments in abatement and removal by the regulator outside the ETS. Effects are also expected on auction revenues. Under CR3, Member States would see an increase in the number of allowances for auction, but it is unclear whether this would entail higher revenues as the increase in the allowance volume may be offset by a price drop due to the reduced scarcity. Moreover, the

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92 European Commission: Directorate-General for Climate Action, Ramboll Management Consulting, Witteveen, E., Marton, C., Bert, N. et al., *Carbon removals in the EU – Review of current carbon removal projects and early-stage financing*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2834/0004994.

93 The public authority would pay the full price of each CDR credit upfront but then recover the price difference with EUAs when the removal-backed EUAs are auctioned, covering only the price difference in the end.

94 See caveats to these results at the end of Section 2.3.1.2 in Annex 8, notably the high uncertainty on the development of technology costs and deployment capacity can greatly influence final costs.

one-in-one out mechanics would entail a reduction in auction volumes later in the phase, when prices are expected to be higher.

Beyond direct costs, it should be noted that funding from ETS revenues provided to support the integration of removals - in particular in PO1 which is designed with the funding as essential element - necessarily reallocates scarce fiscal resources away from other uses, which could potentially lead to crowding out cheaper emission reductions today and potentially increasing the overall cost of achieving EU targets.

Finally, any the integration of CDR into the EU ETS would require regulation and oversight on CDR eligibility and market surveillance, thus resulting in administrative costs.

6.2.5.2. Instruments to support investments

The IDB will be centrally managed on the EU-level except the option of the Member States proposing the short-list of projects (in terms of allocation mechanism), not included in the main policy options 1-3. Member States proposing shortlist would be a single case that would generate administrative costs for Member States. The size of the cost was not estimated but would likely be similar to estimation done for the Modernisation Fund, see below. Otherwise, all IDB policy options are centrally managed clearly offering to MS the management of complete project cycle from the allocation mechanism to monitoring.

For the Modernisation Fund, as shown in the evaluation, Member States are primarily responsible for implementation. Consequently, there are some administrative costs attached to it which have been estimated at 0.13% of the total MF envelope under the current version of the ETS Directive.

PO3 has the largest impact on administrative costs for public authorities, most notably through introducing a vetting of all priority investments by the Investment Committee. This would imply that all beneficiary Member States and the three non-beneficiary Member States sitting at the Committee review all investments submitted under the Fund and decide on their approval. At the same time, with the exclusion of gas and waste-to-energy from the scope of the MF as well as the exclusion of non-priority investments also entailed by this Policy Option, investments to be discussed at the Committee would be likely to be consensual. All investments submitted would indeed have to fall under the pre-defined list of activities supported as priority investments, with the European Investment Bank conducting a first screening. The reduction of the share of non-priority investments to 0 would also decrease administrative efforts related to applying to the Fund, as applications for these investments are more time-consuming.

PO1 and PO2 would reduce the administrative costs related to applying to the Fund, as they both reduce the share of MF envelope that beneficiary Member States can dedicate to non-priority investments, which bring a notable higher burden.

6.2.5.3. Aviation

The continuation of the SAF mechanism would lead to fiscal costs for Member States if they were to use national budgets to replace the reduced ETS revenues allocated to them, or in any case would reduce Member State revenues. See Annex 10, Table 27, for figures on the amount of allowances set aside for ETS-financed SAF support.

Other economic impacts on public authorities are covered in the section on administrative effort in section 6.2.2 above, since there are no significant changes specifically for public authorities.

6.2.5.4. Maritime

The SMAP mechanism would lead to fiscal costs for Member States if they would use national budgets to replace the reduced ETS revenues allocated to them.

The extension of the EU ETS to smaller vessels under PO2 and PO3 is expected to increase the workload for public authorities responsible for MRV and ETS administration. This may require additional resources and staff training, to ensure accurate reporting, effective compliance monitoring, and timely implementation of the system. Total additional recurrent administrative costs are estimated at EUR 0.74 million per year for PO2 and EUR 1.46 million per year for PO3.

6.2.5.5. Carbon leakage prevention

The simplification measures included in all the policy measures on carbon leakage protection will reduce administrative burden also for public authorities, in particular for ETS Competent Authorities.

For ICC compensation, in Option ICC1 each Member State would continue to have the option to use some of its share of auction revenues to fund an ICC State aid scheme, retaining the option to balance the importance of providing this aid against other revenue uses.

Option ICC1 would also ask Member States to provide additional information on how their ICC compensation measures contribute to decarbonisation. The additional burden from these requirements is expected to be modest since it would amend an existing reporting requirement in the ETS Directive rather than create a completely new one. Article 10a(6) already requires Member States to make information on ICC compensation publicly available.

Option ICC2 would create an additional administrative burden for public authorities at both national and EU levels due to the need to establish and administer an additional fund.

6.2.5.6. Waste

Under both PO2 and PO3, the carbon price is expected to be at least partially passed through up the waste value chain, extending the price signal to local waste collection and disposal authorities and contributing to incentivise improved waste prevention, reduction, collection and sorting at source. Around one fifth of stakeholders in the public consultation expressed concerns on the need to balance potential price impacts for households through waste collection fees or local taxation. Evidence from Member States already applying carbon pricing on municipal waste incineration indicates the impact on households is manageable, with average household waste management fees increases in the order of EUR 10-15 on annual basis[95]. A substantial share of the impact can further be mitigated through improved waste prevention, reduction, collection and sorting measures by local waste disposal authorities. For this, it is essential that local authorities channel the incentive through targeted and proven waste measures and policies with a positive steering effect offering households a choice to avoid the additional cost of mixed waste disposal (see Annex 13, Section 1.3.1.). Complementary circular economy policies and financial instruments can support local authorities to implement those circular economy measures steering waste disposal in line with the waste hierarchy and helping households to manage impacts.

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[95] EUR 10 in Sweden based on average 2025 EU ETS price; EUR 13 in Germany based on average 2025 German ETS price; EUR 15 in Norway based on average 2025 EU ETS price as mirrored by the Norwegian carbon tax.

ETS revenues from inclusion of waste disposal activities are projected to be significant and in the range of EUR 4.75 billion annually on average over 2031-2040 in case of an extension of the cap to municipal waste incineration and double to triple this amount in case of a full extension to all waste incineration and landfilling. Existing, proven measures and policies such as improved separate, weight-based and Pay-As-You-Throw collection schemes and strengthened Extended Producer Responsibility schemes can support cost-effective mitigation of emissions and carbon costs throughout the waste value chain and play an important role to manage the impacts on local waste collection and disposal authorities and ensure a smooth transition for the waste sector, balancing environmental benefits and circularity with the social impacts of waste management as a public service, as explored in detail in Annex 13, Section 1.3.

6.2.6. Impacts on the functioning of the internal market

6.2.6.1. Instruments to support investments

For the IDB, the options on ensuring geographical balance would be those that also have the most tangible impact on the internal market. Most likely and at least in the short term, the best efficiency and the best outcome for the internal market from the IDB would be achieved through the pure EU-level competitions that favours the most mature projects, with the best locations, benefiting from the most favourable natural endowment (in terms of renewables potentials), industrial structures, infrastructure and ecosystems and supportive national policies.

In the long term, however, this option can lead to missing some opportunities in countries/regions that are hampered by lack of administrative capacity/lack of innovation ecosystem or infrastructure rather than structural factors of their industry/economy. This option would also mean that the leverage and spillover effects due to the IDB is concentrated in some of the regions.

To sum up, strict national allocations (that can also take the form of 'as a service' or right of the first use – see Annex 9) can be perceived as the least efficient option because they limit the benefits of the EU-level competition. In the longer term, however, such approach might help to address some structural problems in certain regions (e.g. if funded activities create sufficient demand for new infrastructure or lead to creation of new industrial structures).

The best balance would be most likely achieved by a mix between the EU level competition and national allocations as it draws to large extent the benefits of the EU-level competitions and yet safeguards part of funding for national projects with all positive leverage and spillover effects that it will bring. This approach would avoid, in the longer-term, missing opportunities in terms of unlocking the potential of all EU Member States in terms of industrial decarbonisation.

Continuation of the Modernisation Fund will further support lower-income Member States' catching-up process relative to higher income ones in terms of modernisation of energy systems and carbon intensity of the economy. Thanks to investments supported by the Fund, beneficiary Member States can develop the needed infrastructure for the clean energy transition (e.g. stable and modern grids, storage capacity, sizeable renewable energy capacity, EV charging infrastructure) and attract more private investments. This is therefore conducive to creating a level-playing field among Member States and alleviating some barriers to the single market.

6.2.6.2. Carbon leakage prevention

For direct emissions, continuation of free allocation is compatible with the internal market, since eligibility for free allocation is harmonised at EU-level in all options considered. For ICC, Option ICC1 would continue the current policy, which allows Member States to decide whether to offer ICC compensation or not. This system results in a somewhat fragmented system where 15 Member States currently offer compensation via separate national schemes[96].

The partial harmonisation of ICC compensation under option ICC2 would reduce this fragmentation by offering some compensation on a harmonised basis at EU-level. This would reduce internal market fragmentation to a limited extent by compensating a fraction of the potential indirect cost through a harmonised fund. Funding equivalent to 5% of 2030-2040 auction revenues is level is suggested based on striking a balance between the benefits of ICC harmonisation, compared to other uses of ETS revenues.

The issue of indirect carbon costs was often raised by industry stakeholders as this is often a cost that they have no direct control over. It is addressed to some extent by national decisions on whether to offer ICC compensation. However, the question of how to reduce industrial electricity prices is broader and depends on national and European efforts to decarbonise electricity supply and modernise the electricity grid in a way that also ensures the price of electricity does not become excessively high in comparison to industrial competitors.

The continuation of indirect cost compensation was consistently supported (with 74% of respondents in favour) by industrial stakeholders during the open public consultation. Overall, harmonisation was supported by 39% of stakeholders who responded to the question of whether indirect cost compensation will remain necessary after 2030 to address the risk of carbon leakage from indirect carbon costs not covered by other measures (such as CBAM). Several respondents in favour of harmonisation, indicated the need to re-visit different sectors' eligibility for ICC compensation, which is outside the scope of this review.

6.2.6.3. Waste

PO1 does not increase the scope of the EU ETS compared to the baseline, consequently no change from the baseline is expected in terms of the functioning of the internal market. The current situation is characterised by the heterogeneous application of carbon pricing to waste disposal. This unlevel playing field contributes to competitive distortions within the waste management sector, between Member States, and between sectors. First, the co-incineration of municipal waste in industrial installations is subject to the ETS carbon price, while municipal waste incineration is generally not – except in selected Member States, at different levels. Second, under the current climate framework (Effort Sharing Regulation), Member States apply different price signals and instruments, while a majority apply no dedicated carbon price signal or instrument for the sector, leading to competitive distortion on the internal market for waste. Third, while power generation installations are covered by the EU ETS, waste-to-energy installations are generally not, contributing to an unlevel playing field with renewable energy production. Extending the EU ETS to municipal waste incineration installations under PO2 would contribute to harmonise coverage of waste incineration under the EU ETS, ensuring a level playing field and addressing competitive distortions within the waste sector, between

[96] Report from the Commission to the European Parliament and the Council on the functioning of the European carbon market in 2024, COM(2025) 735 final, 3.12.2025, https://climate.ec.europa.eu/document/download/ddc1b1de-652b-49ed-8f15-d9fa8badd39f_en?filename=com_2025_735_en.pdf.

sectors and between Member States. First, extending the EU ETS to all non-hazardous waste incineration installations would harmonise the application of the polluter-pays principle within the waste incineration sector, addressing the current heterogeneous coverage of emissions from waste incineration depending on the waste type and Member States' classification of installations. Second, an extension would harmonise the application of the polluter-pays principle between waste incineration and the co-incineration of waste in industrial installations, such as cement kilns, and between energy produced from different sources, ensuring a level playing field between waste-to-energy and power generation installations that are connected to a common grid or district heating system. Third, an extension would also harmonise the application of the polluter-pays principle between Member States, addressing competitive distortions resulting from the current differentiated coverage of waste-to-energy installations in the EU ETS in selected Member States.

The additional extension of carbon pricing to hazardous waste incineration and landfilling under PO3 would further contribute to harmonising the application of the polluter-pays principle within the waste disposal sector, in addition to addressing potential competitive distortions between waste incineration and landfilling for residual waste resulting from different price signals, where dedicated fiscal and regulatory policies on landfilling (including bans on landfilling of specific residual waste streams and taxes) are not already sufficiently prohibitive to avoid such competitive disadvantages. However, depending on how the EU ETS price is translated to gate fees for landfilling, the price gap closing effect could vary per waste stream, as PO3 would predominantly price methane emissions from biogenic waste rather than emissions from fossil waste streams such as plastics.

6.3. Social impacts

6.3.1. Impacts on employment and skills

6.3.1.1. Cap

The employment impacts of the ambition level and cap scenarios are explained below in the section on carbon leakage. They were assessed with the GEM-E3 model.

6.3.1.2. Carbon removals

Removal integration into the EU ETS can influence employment mainly through its impact on the pace and predictability of domestic removal deployment and associated supply chains. Measures that provide predictable demand and bankable revenue streams for removals (PO1) are more likely to catalyse near-term investment and job creation in the European removal industry. Operator-integration measures (PO2-3) can deliver similar employment benefits if complemented by removal policy support outside the ETS. If such support is absent however, the weaker visibility of demand may delay investment decisions and temper job growth. Some jobs in the removal industry may represent a shift rather than net-increase (e.g., if cheaper removals displace abatement action in certain sectors).

Estimates from Boston Consulting Group conclude that the development of the CDR industry could not only bring substantial economic growth but also significant job creation. They conclude that by 2050, the CDR sector in Europe could support up to 670,000 jobs. This growth

trajectory indicates substantial employment opportunities across various sectors involved in CDR, including engineering & manufacturing, energy, and (digital) services[97].

Concretely, if CDR develops as modelled in the 1.5°C- and 2°C-compatible scenarios, the job potential in the CDR industry is expected to increase gradually, with a relatively modest growth in the next years. By 2035, however, the sector could already support 125,000-180,000 jobs in broader Europe. The job potential is estimated based on current sector ratios of jobs per EUR 1 million value added.

6.3.1.3. Instruments to support investments

IDB is proposed to be one of the key elements of the enabling framework that will be essential to achieve 2040 climate target. 2040 climate target as confirmed in the modelling exercise underpinning the 2040 climate target proposal is unlikely to be a major driver of GDP growth and employment levels in and of its own. The transition will nevertheless imply transformations in production and consumption patterns.

IDB can bring positive employment impacts in all sectors of economy. All economic sectors (not only industry) will be affected by the IDB because they all consume products of industry (e.g. fertilisers needed for agriculture are produced by chemical industry, services rely on electricity that together with industry is in the ETS).

More broadly, society as a whole will be affected (as all society actors will consume products of industry, some will work in the industry, some will have part of their pensions linked to performance of industrial stocks).

6.3.1.4. Aviation

The impact on **employment** of EEA aircraft operators is mainly dependent on demand. Demand is projected to grow in the baseline and all options, with greatest growth outside Europe (see 6.1.1.5) in areas which are mainly serviced by non-European airlines. Nevertheless, employment is also projected to grow for EEA airlines, with limited differences between the options (2.3% difference maximum from the baseline, in PO1 in 2040). By 2040, compared to 2024, employment is modelled to grow by 28% in PO1, and by 26% in PO2/3. This suggests that the ETS policy options do not lead to materially different employment trajectories.

The SAF industry offers a route for jobs in the refining sector to shift toward green economy, while simultaneously leveraging the industry's experience and existing infrastructure. In **PO1**, SAF support would expire at the end of 2030. This option does not allow for an increase in employment in SAF industry and related supply chain compared to the baseline. SAF production mandated by ReFuelEU[98] is already included in the baseline. Additional SAF support under **PO2** and **PO3** compared to the baseline could trigger more investment in the SAF sector and increase employment. This is not specifically modelled, because it is uncertain

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[97] Patrick Herhold, Johanna Pütz, Karan Mistry, Robin Bierganz, Phillip Spiekermann, Louisa Maier, German Association for Negative Emissions (DVNE) & Boston Consulting Group (BCG), *Europe and Germany's Role in Catalyzing a Trillion-Euro Industry*, 2024, https://pyreg.com/wp-content/uploads/240620_dvne_bcg_cdr_economic_potential_en.pdf.

[98] The study supporting the impact assessment of the ReFuelEU Aviation initiative (European Commission, 2021) estimated that it is expected to create more than 200,000 net additional jobs in the SAF production industry by 2050. European Commission: Directorate-General for Mobility and Transport, E3M, Ricardo, Oeko, Giannelos, G. et al., *Study supporting the impact assessment of the ReFuelEU Aviation initiative – Executive summary*, Publications Office, 2021, https://data.europa.eu/doi/10.2832/680399.

how much, if any, additional SAF will be available (beyond mandated levels) and where it will be produced (in Europe our elsewhere). For example, plants in Europe (FR[99], UK[100], DE[101]), are expected to create 0.2 to 1.8 jobs for 100 tonnes of SAF produced per year, depending on type of SAF, type of jobs (high/low skilled), inside/outside sector, and the pace of development of the SAF production.

Impact on households

Carbon pricing on air travel promotes fairness relative to other, taxed transport modes (such as road and rail). From the consumer perspective ticket price–to–income ratios remain broadly stable over time across all route types and passenger segments, and passenger travel demand continues to grow across all route types in all policy options. Highest and lowest income households are least likely to respond to carbon price incentives. Those who can afford the most expensive tickets are least sensitive to price increases (see 6.2.1.4 above). Those who cannot afford the cheapest tickets now, would continue to face similar barriers without carbon pricing. Economy- and low-cost passenger demand is more sensitive to price increases than business/ first class (see Annex 10, section 4.1).

In **PO1**, the impact on overall access to air travel across different income households is assessed to be minor and positive compared to the baseline. Demand is projected to increase across all travel classes, while average fares remain below the baseline levels (see Table 13 in Annex 10). Demand profiles differ between travel categories, where Business/ First class extra-EEA flights are on average 5900 km one way throughout 2035-2040, with less than 0.1% difference between the baseline and policy options. Economy class flights are shorter (~4900 km) and show a slight variation between baseline and policy options (0.3% or less difference in 2040 compared to the baseline). Low-cost flights are shorter at around 2900 km, with a maximum variation of 1.2% compared to the baseline in 2040. Similarly to PO1, **PO2 and PO3** would result in a very limited increase of demand for air travel, in comparison to the baseline, while average fares remain below baseline levels.

For **outermost regions, islands and remote territories** (including Iceland), no ETS-driven socio-economic impacts due to connectivity changes are expected under any policy option, compared to the baseline. In all cases, domestic flights to/from outermost regions are included in the EU ETS from 2031, with average ticket fares expected to remain the same for **PO1** and the baseline. Thanks to the prolonged ETS support for SAF uptake in **PO2** – and to a greater extent in **PO3**, the aviation support study expects average ticket fares for flights between outermost regions and their domestic mainland to be slightly lower relative to the baseline, depending on ticket type and destination in 2035 (e.g. 1.6% reduction in the ticket price for an economy class fare between Paris and Guadeloupe or for a low-cost carrier flight between Madrid and Gran Canaria in PO3). Similarly to the baseline, PO2 and PO3 would most likely

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[99] In France, 4 projects will produce 270 kilotons of SAF per year by 2030 and 510 jobs, which amounts to 1.8 jobs per 100 tons. French Government, *France 2030 : Le Gouvernement dévoile les 4 lauréats de l'appel à projets Carb Aéro, en faveur de la décarbonation du transport aérien*, 2025, https://www.info.gouv.fr/upload/media/content/0001/13/31506bf1bb147a6ca091685004ce8deb1303c3bf.pdf

[100] In the UK, it is estimated that 0.6 MT of SAF will be produced in 2030, and 10,350 jobs created, which amounts to 1.7 jobs per 100 tons. ICF, *Roadmap for the development of the UK SAF industry*, 2023, https://www.sustainableaviation.co.uk/wp-content/uploads/2023/04/Sustainable-Aviation-SAF-Roadmap-Final.pdf.

[101] In Germany, a new plant will produce 30,000 t of eSAF annually, for 65 jobs created, which amounts to 0.2 jobs per 100 tons.

only impact flights between Ireland and North America, and Iceland and North America. However, the aviation support study determined the risk of carbon leakage, thus of social and economic impacts, at the Irish and Icelandic airports to be low.

6.3.1.5. Maritime

Effects on employment, compared to PO1, are expected to be marginal for most EU27, similar to the macroeconomic effects. For countries most dependent on transport from smaller vessels, employment effects could be up to -0.025% (Finland). In third countries, employment effects are also expected to be negligible.

Due to the possibility to further **mitigate the transhipment relocation risks** in PO2 and PO3, the wider social impacts of possible transhipment relocation for EU ports and their hinterlands are likely to be reduced.

The **expansion of the EU ETS to smaller vessels under PO2 and even more PO3** could affect the connectivity of essential shipping services, particularly those serving islands and remote coastal areas, by increasing shipping costs. These services, often provided by ferries, are vital for social and economic integration, and cost pressures may lead to reduced service frequency, route consolidation, or fare increases.

Around 58% of ferries calling at EU ports were estimated to be between 400 and 5000 GT, which means that a large proportion of ferry services are likely to be affected by the extension of EU ETS to smaller vessels. Tourism-based economies could feel this impact.

However, public service obligations and contracts (PSO/PSC), which regulate pricing and service levels, already help protect these routes, and EU ETS derogations for PSO/PSC-covered services, small islands and outermost regions could further mitigate negative impacts.

The outermost regions and small islands require a special attention in this regard. The carbon price would represent a proportion of total voyage cost, though in most cases not exceeding the cost impact of regular fuel price volatility. Still, removing **derogations** would mean that sudden increases in fuel or carbon prices could pose a risk to stable, predictable maritime connectivity for these EU regions. Since ensuring connections is essential for small islands and outermost regions, some of the transport services are conducted under public service obligations. In these cases, ending derogations would not induce increased ticket prices but require larger budgets from public funding.

In the particular case of ice class ships (ICS) discontinuing of ICS derogations could be a challenge for maintaining critical logistics and regular services when ice conditions would otherwise prevent conventional vessels from reaching these locations[102].

6.3.1.6. Carbon leakage prevention

The GEM-E3 model was used to estimate the impact of the implementation of policy measures on employment levels. The largest employment gains occur in chemicals and non-metallic minerals sector, which also records the highest production increase by 2040. Across sectors and policy measures, the overall employment impact ranges from -0.56% to 1.76%. Among the scenarios, PO1R shows the highest employment increase, driven by the volume of free allowances provided along with the alternate revenue recycling option, whereas PO3 records

[102] However, Heikkilä et al. (2024) concluded that not all of the assessed ICS ship types have higher fuel consumption and thus emissions.

the lowest due to the complete phase-out of free allowances after 2034 and due to the lower production in market services.

The issue of employment is also directly linked to the long-term viability of industrial production in Europe. During the stakeholder engagement (and further supported by OPC inputs), industrial associations and businesses consistently argued that the competitiveness of EU producers would be undermined without the continuation of free allocation and if not ensuring that the necessary enabling conditions are in place for decarbonisation rather than deindustrialisation was frequently cited by stakeholders.

Continuation of **ICC** compensation (whether State aid or harmonised) is expected to have a positive impact on employment by protecting against carbon leakage and supporting the business case for electrification of industrial processes. In particular, it strengthens the business case for electrification investments by ensuring beneficiaries will not be disadvantaged by indirect carbon costs.

6.3.1.7. Waste

The application of the carbon price signal to waste management activities (PO2 and PO3) is projected to contribute to employment creation in the circular economy by further incentivising sorting and recycling. Circular economy activities already represent around 1-2% of EU GDP and 2.2% of employment, with the potential to create up to 2.5 million additional jobs by 2030[103]. As recycling activities are more labour-intensive than incineration of waste or landfilling, the integration of waste disposal activities in EU ETS is projected to result in additional employment.

6.3.2. Impacts on fundamental rights

In accordance with the Better Regulation Guidelines, the policy options were assessed to understand if there is impact on the fundamental rights endorsed by the EU Charter of Fundamental Rights. Following a screening of the fundamental rights, the judgement was taken that the policy measures do not have a negative impact and are likely to have a positive impact on the fundamental right with regards to environmental protection under Article 37.

7. HOW DO THE OPTIONS COMPARE?

Following the assessment of the economic, social, and environmental impacts, as well as their distribution across stakeholders, the following section compares the different policy options with regard to their effectiveness, efficiency, and coherence.

7.1. Effectiveness

To compare the effectiveness of each of the policy options it is necessary to assess the extent to which each policy option addresses the general and specific objectives that were originally set in the problem tree diagram.

The matrix is colour-coded as follows

Strongly negative	Weakly negative	Neutral	Weakly positive	Strongly positive

[103] OECD, *The Circular Economy in Cities and Regions of the European Union*, 2025, https://www.oecd.org/en/publications/the-circular-economy-in-cities-and-regions-of-the-european-union_e09c21e2-en.html.

Table 14: Overview on the effectiveness of the measures

	PO1	PO2	PO3
General objective 1.1: Incentivise further emission reductions			
Enable investments (SO.1.1.1)	Neutral as the continued carbon leakage protection, while providing additional space for companies, provides no additional incentives for investment Neutral as limited additional incentives to invest in carbon capture and the lack of level playing for CCU restricts investments. Weakly positive impact of IDB PO1 that addresses well the funding gap of industrial decarbonisation projects but represents operational complexity, risk of projects' dropouts, administrative burden and geographical imbalances. Weakly positive impact as PO1 maintains MF with slightly increased level of environmental ambition Neutral, limited additional incentives for maritime sector to decarbonise.	Strongly positive impact under PO2 as the inclusion of conditional free allocation and hybrid downstream and midstream accounting for CCU may prompt additional investments. Strongly positive of IDB PO2 that addresses well the funding gap of industrial decarbonisation projects and offers simplification, attractive financial model as well as clear rewards for 'front-runner' projects. The risk of unspent resources is minimised. There is a strong alignment of funding with the scale and type of the decarbonisation challenges and proposal strikes a balance between the EU-level competition as well as geographical balance. Strongly positive impact as PO2 maintains the MF with an importantly increased level of environmental ambition, fully aligned with 2040 policy package Strongly positive impact to narrow the price gap between fossil fuels and the alternative fuels and propulsion technologies for maritime	Weakly positive impact under PO3 as the inclusion of hybrid midstream accounting incentivises additional investments in carbon capture and CCU. However, the phase out of free allocation under PO3 significantly increases the exposure of companies to carbon costs, which may affect their ability to invest. Moderate impact of IDB PO3 that addresses well the funding gap of industrial decarbonisation projects but with some design complexity and incentives for more risky projects. There is a risk of projects' dropouts and administrative burden. Strongly positive impact as PO3 maintains the MF with an importantly increased level of environmental ambition, fully aligned with 2040 policy package Strongly positive impact to narrow the price gap between fossil fuels and the alternative fuels and propulsion technologies for maritime
Ensure full carbon price signal (SO.1.1.2)	Weakly positive effect as under PO1 the current approach for free allocation is maintained for non-CBAM sectors. However, the gradually reducing free allocation due to the benchmark updates and operation of the CSCF will increase exposure to the carbon price signal.	Weakly positive effect as under PO2 free allocation is more conditional so depending on levels of compliance the exposure to the carbon price will vary but will be more than PO1 but less than PO3. Weakly positive impact due to inclusion of municipal waste incineration.	Strongly positive effect as under PO3 free allocation for non-CBAM sectors is phased out. Positive impact due to inclusion of landfills as well as municipal and hazardous waste incineration.

	PO1	PO2	PO3
	Neutral on waste management, as no scope extension is introduced in PO1. Weakly positive effect as smaller ships between 400GT-5000GT remain outside of the scope.	Positive effect as the ship categories emitting the most among smaller ships are included.	Strongly positive impact as all smaller vessels from vessel types non-exempted from MRV, plus fishing vessels and non-commercial yachts are in the scope.
Address carbon leakage risk[104] (SO.1.1.3)	Strongly positive effect as impact of the less stringent cap reduces carbon leakage list and free allocation continues under current approach for PO1 without further conditionalities applied to free allocation. Strongly positive effect on the mobilisation of private investment for industry decarbonisation via IDB. Neutral, no effect in diminishing maritime evasion risk in comparison to baseline	Strongly positive effect as impact of the less stringent cap reduces carbon leakage list but support is conditional on investments so the level of free allocation available under PO2 is less certain than under PO1 but still better than under PO3. Strongly positive impact due to faster mobilisation of investments for industry decarbonisation. Positive effect in diminishing evasion risk in maritime due to the revision of the list of neighbouring container transshipment ports and revised rules for offshore ships.	Weakly positive effect as impact of the less stringent cap reduces carbon leakage risk in PO3 but by less than in PO2 and PO1 due to the accelerated phase out of free allocation for non-CBAM sectors. Positive effect in diminishing evasion risk in maritime due to the revision of the list of neighbouring container transshipment ports and revised rules for offshore ships.
General objective 1.2: Reaching a pre-set emissions reduction target within the budget provided by the 2040 policy package and with a net emissions calculation			
Removals integration (SO.1.2.1)	Strongly positive effect as PO1 offers more support for removals suppliers, guarantees inflows of units into the EU ETS, providing guaranteed emissions space without compromising the net target (unless public authority is not endowed with the budget calculated to procure sufficient removals, or the budget is insufficient). Medium mitigation	Weak positive effect as PO2 exposes the removals to the EUA prices which is good for cost effectiveness and economic efficiency, but entry is not guaranteed if EUA prices < removal supply costs. Lowest to medium mitigation deterrence compared to the baseline. Medium CDR support.	Strongly negative effect as PO3 provides added flexibility to reach the EU ETS target but 'one in one out' approach is expected to lead to missing pre-set net reduction target unless support measures are introduced to cover the price differential. Highest mitigation deterrence compared to the baseline. Lowest

[104] For non-stationary (i.e. aviation, maritime) this effectiveness in the achievement of this sub-objective is addressed in the specific sections.

	PO1	PO2	PO3
	deterrence compared to the baseline. Highest CDR support.		CDR support, absent complementary measures.
Adjust EU ETS cap in line with pre-set target (SO.1.2.2)	Cap is adjusted according to ambition level in 2040. All POs would be based on same trajectory / budget.	Cap is adjusted according to ambition level in 2040. All POs would be based on same trajectory / budget. Higher certainty about contribution from municipal waste incineration.	Cap is adjusted according to ambition level in 2040. All POs would be based on same trajectory /budget. Higher certainty about contribution from municipal and hazardous waste incineration and landfilling.
General objective 1.3: Ensure effectiveness of EU climate action on international transport while avoiding double effort			
Ensure effective action on EU's fair share of int. aviation emissions (SO.1.3.1)	Depending on the outcome of the CORSIA assessment, weak negative effect: if the assessment is positive there is an effective carbon price on the EU's fair share of international aviation emissions, without a change to the ETS scope. However, PO1 results in the highest global international aviation emissions (600 $MtCO_2$ in 2040, compared to 590 $MtCO_2$ in the baseline).	Strong positive effect by ensuring effective carbon pricing on the EU's fair share of international aviation emissions (departing flights), while allowing for the deduction of any CORSIA offsetting costs. Global international aviation emissions are projected at 595 $MtCO_2$ in 2040.	Weakly positive effect by ensuring effective carbon pricing on the EU's fair share of international aviation emissions (departing flights), while allowing for the deduction of any CORSIA offsetting costs. However, PO3 results in higher global international aviation emissions than PO2 (same as PO2 in 2040, but higher emissions in 2035 due to higher SAF support, causing higher traffic).
Preserve effective action on EU's fair share of maritime emissions and maximise	Comparable to the baseline in terms of maritime emissions, with cumulative GHG emissions over 2030-2050 of 1,985 $MtCO_2e$ and residual GHG emissions of 20 $MtCO_2e$ in 2050. Derogations are running out after 2030 in PO1 (representing 5% of maritime GHG emissions under the ETS cope).	Positive impact on emissions with cumulative GHG maritime emissions over 2030-2050 of 1,890 $MtCO_2e$ (5.0% reduction compared to PO1) and residual GHG emissions of 12 $MtCO_2e$ in 2050. Positive effects in terms of regulatory efficiency as the deduction avoids the double pricing under the IMO measure (once adopted) and EU ETS.	Positive impact on emissions with cumulative GHG maritime emission over 2030-2050 of 1,865 $MtCO_2e$ (6.2% reduction compared to PO1) and residual GHG emissions of 11 $MtCO_2e$ in 2050. Positive effects in terms of regulatory efficiency as the deduction avoids the double pricing under the IMO measure (once adopted) and EU ETS.

	PO1	PO2	PO3
regulatory efficiency (SO.1.3.2)	Weakly positive impact of costs savings due to simplification and process enhancement measures (up to EUR 9 million /year)	Recycling of ETS revenues is expected to improve the economic case for complying with ETS and the IMO measure. Additional weak positive impacts of cost savings due to simplification and enhancement measures (up to 9 million EU/year). Positive impact by inclusion of smaller ships from the categories emitting the most, representing 13% of ETS emissions in 2023. Weakly negative impact as derogations will diminish the emissions subject to ETS by 5%. More than half (50.8%) of them benefit outermost regions and around a third benefit small island.	Recycling of ETS revenues is expected to improve the economic case for complying with the IMO measure. Additional weak positive impacts of costs savings due to simplification and enhancement measures (up to 9 million EU/year) Positive impact by inclusion of all small ships (17% of ETS emissions in 2023). Weakly negative impact as derogations will diminish the emissions subject to ETS by 5%. More than half of them benefit outermost regions and around a third benefit small island.
General objective 2.1: Ensure efficient market functioning			
Increase size of the market (SO.2.1.1)	No impact on the increase in the size of the market in relation to waste management and aviation as no further extension of the scope occurs in PO1. Integration of removals in PO1 is a net cap integration, but the public authority commits to purchasing the removals, resulting in the emissions space of the gross cap as in PO3. The risk of removals generation falls on the public authority, with a positive impact for the size of the market.	Positive effect on the increase in the size of the market but PO2 is less ambitious than PO3 as scope is only extended to all municipal waste incinerator installations. For aviation, positive effect compared to PO1 as the size of the market is increased to departing flights. Integration of removals in PO2 allows the market to increase with the integration of removals by operators. The cap is set at the net level, and the gross depends on the cost competitiveness of removals and support policies.	Positive effect on the increase in the size of the market with PO3 extending the scope of the EU ETS to all municipal and hazardous waste incinerator installations and landfilling of non-hazardous waste. For aviation, positive effect as the size of the market is increased to departing flights. Integration of removals in PO3 results in the cap being set at the gross level. The uncertainty in the removals generation falls on the climate ambition, as the attainment of the net objective

	PO1	PO2	PO3
		Positive effect as the ship categories emitting the most among smaller ships are included	is uncertain, with a positive impact for the size of the market. Strong positive impact as all vessel types non-exempted from MRV, plus fishing vessels and non-commercial yachts are in the scope
Adjust MSR parameters (SO.2.1.2)	Weakly positive as PO1 broadly achieves the two primary objectives of the MSR. First, the MSR contributes to reducing the historical surplus of allowances by removing supply of allowances and preventing a drop in carbon prices and weakened investment signals for low-carbon technologies. Under PO1 the MSR starts releasing allowances to keep the market balanced. However, while in the short-term prices are evolving relatively stable until 2034, as from 2035 PO1 observe a relative steeper increase of ETS prices as compared to PO2 and PO3. Second, PO1 enhances the resilience of the EU ETS and performs well in response to future demand shocks.	Strongly positive as PO2 and fully achieves the two primary objectives of the MSR. First, the MSR contributes to reducing the historical surplus of allowances by removing supply of allowances and preventing a drop in carbon prices and weakened investment signals for low-carbon technologies. Under PO2 the MSR starts releasing allowances to keep the market balanced. Second, PO2 enhances the resilience of the EU ETS and performs well in response to future demand shocks.	Strongly positive as PO3 as it entails the same design features for the MSR as PO2. Therefore, PO3 fully achieves the two primary objectives of MSR as it employs the same MSR parameters. First, the PO3 contributes to reducing the historical surplus and provides for the most stable and steady price evolution until 2040. Second, PO3 also enhances the resilience of the EU ETS and performs well in response to future demand shocks.

7.2. Efficiency

The efficiency of each policy option can be assessed by comparing the expected benefits (i.e., reduction of direct costs or externalities) against the respective expected costs incurred for the delivery of each the policy options. Therefore, efficiency concerns the extent to which objectives can be achieved for a given level of resource/at least cost.

The combined measures under the different POs have economic, social, and environmental impacts. The major costs of the policy options come in the form of an increase in the adjustment costs, administrative and indirect costs for the private sector to implement the requirements of the policy options. Additionally, EU Member State authorities are expected to benefit from an increase in revenues from higher volumes of auctioned allowances and this will offset costs associated with the implementation of the reforms.

Given that all policy options envisage a less stringent ETS cap, the costs and investments are expected to be less compared to the baseline. These lower system costs (excluding auction payments) in PO1 and PO2 are mainly driven by changes in the cumulative annual expenses borne by final energy users, which include operating and capital expenditures as well as taxes.

In PO1 providing certainty and thus lower capital costs for removals will benefit both removals producers and consumers. However, it does result in a burden placed on the public authority to either deliver on the removals or face non-attainment of the environmental objective. If a limit is applied to the removals that can be purchased the full theoretical economic benefits would also be limited to a maximum, although the guaranteed availability of removals would allow higher gross emissions, as well as lower prices for the removals.

In PO2, the higher uncertainty for removals producers leads to higher discount rates and lower volumes. As a result, abatement efforts expected to be higher, particularly in industry (as reflected in higher capital costs relative to the baseline), but the total costs of removals are lower, as a result of smaller removal volumes. The higher EU ETS price in such a scenario increases auction revenues, which could be recycled into the economy, also to support or expand removal activities. This feedback could partially offset the higher EU ETS price, though the net effect remains uncertain due to efficiency and transaction cost considerations. When including auction payments, system costs would be higher.

In PO3 modelling results for removals would be driven by the constraint of attaining the targets for 2040 and 2050. However, the higher uncertainty for removals and the lack of incentive for reducing below the gross emissions cap might well lead to an underachievement of the removal objective and therefore an underachievement of the 2040 target. As this consideration is not modellable, it should be acknowledged qualitatively.

In sum, the most efficient option for removals would be PO1, as this option gives highest certainty to the removals sector allowing it to scale and learn, and as it gives gross emissions space to EU ETS operators.

In addition to the costs and benefits from the cap, waste management integration and carbon removals, results have been integrated in this impact assessment through GEM-E3 modelling that focuses on the macro-economic costs and benefits that focuses on a comparison of PO1 to the 85% PRIMES scenario. The impact of changes to free allocation envisaged under PO2 and PO3 are reflected and the modelling output does take into account the potential change of scope (i.e. inclusion of waste management activities), but not of other measures included in policy measures PO1-3.

Table 15: Summary of costs and benefits per policy option compared to the 85% PRIMES scenario based on GEM-E3

		Difference to the baseline		
	Unit	**PO1**	**PO2**	**PO3**
Operators				
Adjustment cost				
Unit cost of production	%	0.02	-0.04, -0.02	-0.12
Public authorities				
GDP change	%	0.01	-0.01, 0.00	0.02
Sectoral Employment - ETS sectors (% change from baseline)	%	0.01	-0.05, -0.03	-0.06
Households				
Total private consumption (% change from baseline)	%	0.02	-0.08, -0.05	-0.10

To supplement the modelling outputs, further quantitative analysis has been undertaken to understand further the costs and benefits associated with the policy options. In terms of the administrative costs, it is envisaged that PO2 will result in some increase in administrative costs compared with the baseline as it will involve changes to free allocation with further conditionality requirements included, as well as additional MRV costs for waste incineration installations (the later would also be an additional cost for PO3). These estimates for administrative cost have been transparently calculated based on existing literature and stakeholder input (i.e. survey and interview processes). Importantly it is expected that the potential maximum revenues that will be generated from each of the policy options are likely to offset these additional administrative costs.

Table 16: Summary of costs and benefits per policy option compared to the baseline based on further quantitative estimates

		Difference to the baseline		
	Unit	**PO1**	**PO2**	**PO3**
Operators				
Adjustment cost				
Cost of phasing out free allocation	Bn EUR	-55	-67	49
Administrative costs				
Applying for free allocation cost	M EUR	0	8	0
MRV costs for inclusion of waste activities	M EUR	0	7.8 - 78	<7.8 - 78

Public authorities				
Benefits				
Revenues	Bn EUR	315	335	540

Overall, all policy options result in **net benefits** relative to the baseline, on these elements. This is evident from the output from the modelling runs from PRIMES and GEM-E3 as well as the further quantitative estimates.

For aviation, PO2 is the most efficient policy option because (other than the baseline) it results in the highest emissions reductions and the highest revenues to be used for climate purposes. It also sets aside more allowances for ETS-financed SAF support than are currently available or would be available in the baseline/ PO1 (which do not allow for further ETS-financed SAF support). See Annex 10, Section 1.3, 1.5, 2.3, 2.4 and 3.1.

Regarding maritime transport, the efficiency of the different policy options is compared in terms of their social Net Present Value (NPV), which compares discounted benefits of emission savings from the maritime sector against discounted abatement costs and administrative costs. ETS or possible IMO payments are excluded from this analysis as they represent a transfer between agents from the perspective of the society. Results presented in Table 17 show that both PO2 and PO3 would lead to a positive social NPV, compared to PO1.

Table 17: Social Net Present Value (NPV) of policy options PO2 and PO3 compared to PO1 (million EUR)

	PO2	**PO3**
Monetised GHG emission benefits	22,075	27,790
Monetised air quality benefits	64	53
Additional costs excl. EU ETS revenues	-14,404	-16,171
Administrative costs	-436	-860
Administrative and enforcement costs for national authorities	-17	-33
Social NPV	7,283	10,778

All policy options can work in full synergy with the FuelEU maritime initiative as carbon pricing will reduce the price gap between sustainable low carbon alternative fuels and traditional fossil fuels, and it will trigger energy efficiency improvements that will make the switch to alternative fuels more affordable by reducing the overall fuel consumption. Simplification introduced in all options reduces administrative burden on shipping companies coherently with the requirements under FuelEU.

The ETS funded Sustainable Maritime Alternative Propulsion mechanism assessed in PO2 and PO3 could be used to advance innovation and accelerate the deployment of renewable and low-carbon fuels, and clean propulsion technologies beyond the proposals submitted under the Innovation Fund calls from 2023, 2024 and 2025. Such a dedicated support

mechanism would complement other policies (e.g. carbon pricing, fuel standards) and help create a predictable demand for these fuels and technologies. It would stimulate their selection and deployment, as well as the gradual technological improvement of yet immature solutions. In this context, it would complement the IMO measures (once adopted) by making sustainable maritime propulsion more economically viable.

For the Industrial Decarbonisation Bank, the efficiency is best achieved by the allocation mechanisms of auctions as well as variable premium in terms of form of support (both included in PO3). Still to be stressed that actual efficiency of any funding mechanism will rely on features much more granular than addressed in this IA (e.g. completion bonds, monitoring arrangements etc). Also, while PO3 is the most efficient, it inherently attracts more risky projects that in the end might not be implemented (if faced with adverse market conditions etc) so to the detriment of effectiveness.

For the Modernisation Fund, PO3 importantly increases administrative costs as subjecting all priority investments to Investment Committee governance would require a substantially heavier process, involving many more actors. PO2 has the lowest administrative costs since it gives more limited space to non-priority investments (5% max, compared to 10% max in PO1), the approval process of which is more burdensome and no additional role to the Investment Committee.

In terms of abatement costs, PO3 (through a total ban on gas infrastructure) can gear investments of beneficiary Member States more towards new renewable capacity which are becoming increasingly cheaper than investments in gas. PO2 and PO1 also but to a relatively lesser extent. However, the abatement costs will continue to be mostly determined by the nature of the investments that Member States decide to support, within the eligible activities permitted by the Fund.

Options PO2 and PO3 introduce a deduction from the surrendering obligations of emissions priced under IMO measures (once adopted). This deduction ensures that regional measures and global measures work efficiently together in terms of carbon pricing, preventing double payments and allowing at the same time the EU ETS maritime to continue contributing to the implementation of the 2040 EU targets and climate policy objectives.

7.3. Coherence

The ETS is a well-established cornerstone of the EU's policy to combat climate change and its key tool for reducing greenhouse gas emissions cost-effectively. With its focus on markets and economic emission reduction incentives, it is coherent with other EU policies which primarily address non-price barriers. The EU ETS evaluation (see Annex 15) highlighted the coherence of the instrument with complementary policies for energy sector, such as the Renewable Energy Directive and the Energy Efficiency Directive. Together, these instruments were responsible for significative emissions reductions in the energy sector.

Increasing the environmental contribution of the ETS with an enlarged scope, as in PO2 and more extensively in PO3, does not change its technology-neutral character, allowing it to continue to run alongside sector-specific policies. The Market Stability Reserve will continue to enhance policy synergies by mitigating supply/demand imbalances regardless of their origin, for instance by reducing the impact that complementary and overlapping policies in the area of renewables or energy efficiency can have on the carbon market. PO2 and PO3 are most coherent for the MSR as they allow to maintain narrower TNAC-to-emissions ratios through timely releases whilst preserving deeper post-2040 intervention capacity. Both options also demonstrate the lowest inter-annual price volatility with smooth

trajectories resilient to shocks and provide for the most optimal market conditions balancing responsiveness with transparency.

For aviation, including departing flights under PO2 and PO3 is coherent with the scope of application of ReFuelEU Aviation and automatically unlocks additional ETS-financed support for SAF. Both PO2 and PO3 are supportive of multilateral action, as they allow the deduction of CORSIA offsetting costs.

For maritime, all policy options are fully consistent with existing EU legislation such as the EU maritime transport MRV framework and FuelEU. The deduction mechanism in PO1 and PO2 would ensure coherence with future IMO measures (once adopted)

The integration of carbon removals in all POs and the recognition of non-permanent CCU in PO2 and PO3 are coherent with the policies being developed under the Industrial Carbon Management Strategy and the broader framework of the Clean Industrial Deal, fostering the competitiveness of the EU. PO1 would be most coherent as it provides the greatest support for removals while provide the greatest certainty to industry on the space available under the ETS and for the achievement of the net target, in coherence with the European Climate Law.

The inclusion of the waste management sector into the EU ETS in PO2 and PO3 is coherent with the objectives of Waste Framework Directive, fostering the transition to a circular economy, and the broader environmental policy framework of the EU.

There are no marked differences between the POs on Industrial Decarbonisation Bank in terms of coherence. The IDB as a whole, however, needs to ensure coherence with other climate policies. As climate action progresses and the hardest to abate emissions have to be reached, the use of ETS's revenues to support investment become more relevant to ensure the investments take place. The strengthened EU-level support provided by the continuation of the Innovation Fund and new Industrial Decarbonisation Bank are from an EU single market perspective coherent with the carbon price signal and regulatory framework (both also driving the investments but currently not fully sufficient). Coherence with other EU-wide funding mechanisms can be fostered by focusing on specific stages of the technology development or 'investment journey' (avoiding overlaps with other programmes) as well as by creating an aligned governance framework of ECF and IDB. The coherence with other ETS based support instruments and the national use of ETS revenues continues to be fostered, including via State aid rules that enable the funding on the national level. Additionally, the set-up of the 'as-a-service' feature could enable even better integration of the State aid and EU-level funding if applied to the IDB funding instruments.

Expanding eligibility of priority investments to CCS and direct electrification of industry in all POs is coherent with the policies being developed under the Industrial Carbon Management Strategy and the broader framework of the Clean Industrial Deal. After 2030, hard-to-abate sectors will still need deployment of solutions like CCS and direct electrification which are costly. The phase out of public support to investments involving natural gas and waste-to-energy is also consistent with the EU's 2040 decarbonation targets since lower-emitting alternatives exist. In that respect, PO3 is the most consistent with the EU's decarbonation targets, followed by PO2 and finally by PO1.

7.4. Summary

Table 18 below provides a summary of the comparison of the options against the baseline scenario in terms of effectiveness, efficiency, and proportionality. The following ranking symbols have been used: from '+' (more effective/efficient/coherent than the baseline) to '+++' (much more effective/efficient/coherent than the baseline).

Table 18: Summary of the comparison of the policy options against the baseline scenario

	PO1	PO2	PO3
Effectiveness	+	+++	++
Efficiency	++	++	+
Coherence	++	+++	++

8. PREFERRED OPTION

8.1. Identification of the preferred policy option

All policy options achieve the same ETS emissions reduction target, although for variable scope / share of the economy-wide emission with PO2 and PO3 each adding additional scope. The decision on the preferred policy option is informed by their relative effectiveness and efficiency. While each PO has been primarily modelled with CAP2, each PO could be implemented under CAP3, with the same relative impacts as in above comparison table of the policy options relative to the baseline scenario.

PO2 was considered to be the preferred policy option. Together, its measures strengthen the environmental effectiveness of the system while maintaining proportionality, regulatory stability, and fairness across sectors, and safeguarding competitiveness.

Whilst PO3 was in some regards more effective (i.e. in terms of extending the scope further and reducing the phase out of free allocation to enhance the price signal), the efficiency of this option was lower due to the additional costs in terms of adjustment and administrative effort compared to the other policy options.

PO1 was also deemed to not be the preferred policy option as it did not achieve all the objectives that were set for the assessment. For example, this option was not considered to be effective in addressing future concerns regarding the functioning of the market as it did not increase the size of the market to new activities such as in the waste sector, and it had the weakest improvements in terms of enabling investments. It also showed the weakest results towards ensuring effectiveness of EU climate action on international transport while avoiding double effort.

The proposed reforms brought by PO2 maintain the existing compliance framework of the EU ETS, while introducing new obligations and funding streams, mainly during the 2031-2040 period, that are considered the preferred options:

- From 2031, the revised cap (and from 2028 the reformed MSR parameters) would apply to all ETS sectors, reducing the decreasing rate of cap, lowering the carbon prices and improving market predictability.
- Free allocation is continued as a carbon leakage prevention mechanism, but part of the free allocation is gradually made conditional on decarbonisation investments. Additional free allocation is made available to CBAM sectors to address residual carbon leakage risks.
- Public authorities, both at the national and EU level, would extend ETS registries and oversight systems to cover new operator categories and activities, and verify conditionality compliance for free allocation. These new administrative tasks are expected to build on existing processes and to be operational by 2031.

- The ETS Directive would continue to encourage Member States to compensate indirect carbon costs via State aid, while calling for this aid to contribute to the sectors' decarbonisation.
- An effective carbon price would apply also to the EU's fair share of international aviation emissions, and the approach would be coherent with the ReFuelEU Aviation scope of application. ETS support for SAF uptake would be increased compared to today, while ensuring that Member States still receive ETS revenues to tackle decarbonisation further.
- The preferred approach for maritime would introduce an ETS-funded mechanism to support the uptake of sustainable fuels and clean propulsion technologies, combined with a partial ETS scope extension to smaller vessels, reflecting the needed balance between environmental benefits and implementation costs. Simplification and enhancement measures would be implemented to improve the effective implementation of the system, also in relation to the risk of evasion, and an IMO deduction mechanism would be introduced to ensure the coherence of the ETS with future IMO global measures.
- The inclusion of all municipal waste incinerators would enter into force from 2031, allowing to implement the hybrid downstream and mid-stream accounting for non-permanent CCU. New regulated operators, such as e-fuel distributors and waste incinerators must obtain ETS permits, prepare MRV plans, report verified emissions, and surrender allowances accordingly.
- The preferred approach for implementation of the IDB would offer a toolbox of funding instruments (in terms of allocation method and type of support to be provided), allowing policymakers to tailor support to evolving policy priorities and industrial needs. With many uncertainties for the industrial decarbonisation projects, there is an urgent need to provide support that creates solid business cases, administratively simple and with predictable cash flows for the projects. This is why, in the early years of the IDB operation (i.e. the 'Investment Booster' announced in March 2026[105], the Commission could start with administrative schemes awarding a fixed premium and striking the balance between the EU-level competition and national allocations (notably for solidarity purposes). As technologies mature, ETS prices increase and regulatory frameworks fully take effect, the Commission could move to auctions for a Carbon Contracts for Difference in order to maximise the efficiency of the support. This approach could be combined with stronger national allocations, in the form of 'as a service' contributions or by applying by the Commission 'right of the first use' to ensure that decarbonisation projects materialise in all countries and bring positive spillover effects to them.

As an exception, PO1 is preferred for carbon removals, as it is considered preferable to provide certainty to the ETS sectors on the gross emissions space available and the CDR industry on the demand for carbon removals, for the benefit of the EU's competitiveness.

For the cap no single option is preferred, and the decision on the cap can be analytically separated from the other issues discussed. However, a sufficiently ambitious cap in the first half of the decade would have significant advantages. From an environmental point of view carbon budgets would be lower. While energy system costs would to an extent be higher, system cost impacts could be mitigated through distribution of ETS auctioning revenues and supporting policies. Investments, when frontloaded in the decade, would be lower in the last

[105] https://ec.europa.eu/commission/presscorner/detail/en/statement_26_663

five years. The frontloading of investments would increase the probability of faster technological developments through scaling up and learning by doing. It would allow a fast electrification of the energy system and increase Europe's energy independence. As pointed out in the 2040 Climate Target IA, this will also depend on Europe's ability to secure supply chains for new technologies. For the final five years of the decade, there is a higher uncertainty regarding the necessary technologies, and a greater need to provide emissions space for industry. For the pathway towards 2040 it would thus be prudent to assume the use of international credits, in order to generate sufficient emissions space for ETS operators, while still keeping an ambitious overall carbon budget.

The assessment carried out in this impact assessment shows that the preferred option, including this exception, is consistent with the European Climate Law's objectives, as required by Article 6(4) of the European Climate Law. The climate impact of the measures and in general the alignment of the ETS towards that objective and the intermediate 2040 target are at the core of this assessment. Where the measures introduce a certain level of uncertainty towards reaching the net climate contribution of the EU ETS (removals integration with a pre-increase of the cap) or can potentially create loopholes in the accounting of emissions (downstream accounting of the CCU) the level of the risks are assessed and justified towards the achievement of the climate objectives more broadly, together with the introduction of mitigating tools (on removals: the measures are justified to achieve the scale-up of removals and avoid carbon leakage, and risks are mitigated with sufficient budget for the purchase of removals; for CCU, the risks are justified to incentivise CCU while introducing mitigation measures for loopholes).

8.2. REFIT (simplification and improved efficiency)

Since the revision of the ETS Directive in 2018, a number of simplifications have been introduced. Article 27a was added to the Directive, allowing Member States to exclude installations emitting less than 2,500 tCO_2e per year. In addition, a number of simplifications, and clarifications have been made through amendments to the Monitoring and Reporting Regulation (Commission Implementing Regulation 2018/2066), and standardised methodologies and tools have been developed to facilitate implementation. These measures are discussed further in the Evaluation Report accompanying this Impact Assessment, with a number of possible measures for additional streamlining and simplification being proposed (see Annex 15).

Several of the measures in this Impact Assessment covering emissions from stationary installations generally do not involve simplification, since they are considering expanding the scope of EU ETS. However, they entail a simplification from a broader perspective, as EU-wide climate action should prevent a piece-meal approach of national or subnational measures that add complexity to the internal market. In addition, the carbon leakage prevention measures assessed consider simplifying the provision of free allocation by not updating the carbon leakage list for Phase V (2031-2040), thereby eliminating administrative burden for operators. The option of expanding conditionality in free allocation would involve some increase in administrative effort, which has to be weighed against the environmental benefits of conditionality and the value of the free allocation (see Section 6.2.1.6). Annex 12 considers the case for including more small installations within EU ETS by lowering the 20 MW thermal capacity threshold. However, it concludes that such an expansion would not be proportionate since most of the relevant emissions will be covered by EU ETS2.

The evaluation carried out on the implementation of the MRV Maritime Regulation (see Annex 15) confirmed that the MRV system functions as a robust framework, which has

successfully handled the changes stemming from the 2023 revision without compromising overall data quality or usability. At the same time, the evaluation identified some divergences and duplications between the MRV system for maritime and other regulatory frameworks on shipping decarbonisation[106], which hold potential for undue burden on operators. The evaluation found that, rather than a structural overhaul of the MRV system, incremental improvements through simplification initiatives could enhance the harmonised and robust implementation of the system, minimise existing duplications and deliver efficiency gains.

Policy measure SI1 for maritime 'Simplification, and targeted enhancement measures' includes specific simplification elements for the MRV maritime system which would enable shipping companies to exploit untapped synergies, minimise undue burden, and ultimately reduce administrative compliance costs. Among other things, the measure would ensure that one entity is responsible for compliance in respect of the emissions of a given ship under the ETS/MRV maritime and the FuelEU Maritime systems and that the monitoring-and-reporting-only-once principle is implemented. The present impact assessment estimates that simplification elements for maritime could deliver to shipping companies' annual savings between 10% and 20% of current annual MRV administrative compliance costs.

9. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

The Commission will continue to monitor and evaluate the functioning of the ETS in its annual Carbon Market Report, as foreseen under Article 10(5) of the ETS Directive. This covers also the impacts of the current revision of the ETS.

Furthermore, evaluation of progress on the application of the ETS Directive is regulated in the current Article 21, which requires Member States to submit to report to the Commission on issues including the allocation of allowances, operation of the Registry, application of monitoring and reporting, verification and accreditation and issues relating to compliance.

The measures above (namely the Commission's annual Carbon Market Report and Member States reporting) shall also apply to the sectors to which emissions trading is extended. The MRV data obtained through the regulation of the new sectors will be a key source for information for the Commission to evaluate progress in the sectors concerned.

With respect to maritime transport, the Commission will notably rely on data collected through the EU maritime transport MRV system and analysis from the annual report on CO_2 emissions from maritime transport, which provides aggregated and explained results. With respect to the possible extension to buildings and transport, the Commission will rely on data collected through the new MRV system for these sectors, while comparing them also with the corresponding GHG inventory data for these sectors.

The integrated governance and monitoring process under the Regulation on the Governance of the Energy Union and Climate action is also expected to make sure that climate and energy-related actions at European, as well as regional, national and local level, including the ETS, contribute to the EU climate neutrality and Energy Union's objectives.

Several market analysts regularly closely follow various aspects of the carbon market and its functioning, and the Commission will continue to monitor this work. Also, through regular contacts with stakeholders, the Commission is alert to their views and concerns about the functioning of the ETS. ETS-related matters are discussed in a dedicated forum, the

[106] Such as the FuelEU Maritime Regulation at the EU level and the International Maritime Organisation Data Collection System (IMO DCS) at the global level.

Climate Change Expert Group (CCEG) which brings together Member States Competent Authorities, stakeholders (industry associations and NGOs) and the Commission. In its different formations, the CCEG discusses the implementation of free allocation, auctioning and issues related to the functioning of the Union Registry. In addition, the ETS Compliance Forum provides the Competent Authorities of all ETS countries (the 27 Member States, Norway, Iceland and Liechtenstein) with a platform for sharing information, learning and experience, leading to effective implementation of the ETS. The forum executes targeted events, such as the Compliance Forum Conference, organized annually and aimed at sharing experiences and facilitating dialogue amongst Member States Competent Authorities, as well as Task Forces dedicated to specific topics and training events. National Accreditation Bodies and verifiers are sometimes invited to participate to the activities of the ETS Compliance Forum, where relevant. Furthermore, the Technical Working Group on ETS MRVA brings together representatives of Member States Competent Authorities to share experiences and suggestions concerning effective and efficient implementation of Commission Implementing Regulation (EU) No 2018/2066 (Monitoring and Reporting Regulation) and Commission Implementing Regulation (EU) No. 2018/2067 (Accreditation and Verification Regulation) to discuss potential updates and improvements of the ETS MRVA Regulations.

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