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IMPACT ASSESSMENT REPORT

Accompanying the document

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757

{COM(2021) 551 final} - {SEC(2021) 551 final} - {SWD(2021) 557 final} - {SWD(2021) 602 final}

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Annex 9: Detailed analysis on the framework to address the risk of carbon leakage

The total ETS cap is divided into a part that is auctioned and a part that is made available to installations for free to address the risk of carbon leakage. For the period 2021-2030, the total cap is set to be divided in a 57% auction share and a 43% free allocation share, once the Innovation and Modernisation Funds as well as the free allocation buffer of 3% are deducted from the cap.

Based on the results of the OPC, there was no agreement on how a strengthened ETS cap should be divided between auctioning and free allocation. While some stakeholders, including the majority of EU citizens and academic/research institutes and some NGOs, argued for an increase in the auction share, many private sector respondents preferred the continuation of the current auction share of 57%. Many respondents selected the option "other" and provided individual replies, for instance asking to abolish free allocation (NGOs) or stressing the risk of carbon leakage and the need to avoid the application of the cross-sectoral correction factor (private sector).

25 ANALYSIS OF THE IMPACTS OF RAISING THE AUCTIONING SHARE TO 70%

The starting point of the ETS Directive is that in principle, all allowances should be auctioned, and free allocation is granted transitionally[1]. The rule is that everything that is not allocated for free is ultimately auctioned. Providing a percentage figure for the auction share increases transparency, predictability and the functioning of the carbon market.

Increasing the auctioning share would increase revenues that can be used to invest in climate-related purposes, but it would also reduce the number of allowances available for free allocation and therefore reduce the protection against the risk of carbon leakage[2].

In this section we analyse the environmental and economic impacts of the discarded option of increasing the auction share to 70% (increasing auction revenues and

[1] Recital (8) ETS Directive: "The auctioning of allowances remains the general rule, with free allocation as the exception. (…)"

[2] In 2019, a total of 77% of the revenues were used, or are planned to be used, for climate and energy purposes. https://ec.europa.eu/clima/sites/clima/files/strategies/progress/docs/com_2020_777_en.pdf, page 16.

decreasing free allocation)[3] from the year the revised cap strengthening takes effect, i.e. 2024 (AMB2a, AMB2b) or 2026 (AMB1; AMB3c) – AUS1.

25.1 Environmental impacts associated with an increased auction share

A change in the auction share may have an environmental impact, because it influences both the ETS's revenues and its compliance costs. An increase in the auctioning share raises more revenue, which can be used for climate purposes that reduce emissions. It also reduces the free allocation share, resulting in a stronger carbon price signal but also increasing the likelihood of triggering the CSCF, resulting in additional carbon leakage risk.

25.2 Economic effects associated with an increased auction share

Increasing the auction share means reducing the free allocation volume, which in turn has impacts on the risk of carbon leakage.

To determine the final free allocation volume, the contribution to the Innovation Fund (in the existing ETS, 325 million allowances over the 2021-30 period are sourced from free allocation) needs to be taken into account just as the free allocation buffer of 3% of the cap which is sourced from the auction volume and used in case the CSCF risks being triggered.

An update of the auction share to 70% from 2024 or 2026[4] onwards while keeping all other elements unchanged will reduce free allocation volumes and hence impact competitiveness through an early triggering of the CSCF (Table 45). This effect is significant: comparing Table 45 to Table 6 (main text), the CSCF may be triggered between 1 and 3 years earlier and lead to a 25% to 36% lower free allocation budget compared to the respective cap scenario without increase of the auction share.

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[3] To note that one way in which the auctioning share would be increased, but which we do not consider here, is the introduction of a CBAM for a sector and the subsequent switch of that sector's free allocation share into allowances to be auctioned. Alternatively, a CBAM with the current auction share (option 1) would act as increasing the availability of free allowances for the remaining sectors.

Table 54: Impacts of a 70% auction share on free allocation for different cap trajectory options

	Baseline	AMB1 and AUS1	AMB2a and AUS1	AMB2b and AUS1	AMB2c and AUS1	AMB3c and AUS1
Total cap (2021-30) - EU-27+EEA	13781	12 596	12 201	11 712	11 845	12 270
Auction share	57%	70% from 2024 for AMB2a, AMB2b and AMB2c; and from 2026 for AMB1 and AMB3c				
Free Allocation (excluding Innovation Fund)	5601	4419	3931	3785	3825	4322
Free allocation buffer (3%)	413	378	366	351	355	368
Delta to baseline for total free allocation	-	-20%	-29%	-31%	-30%	-22%
Year when CSCF is triggered	-	2028	2026	2026	2026	2028
Average CSCF for the period 2026-30	100%	70%	52%	46%	47%	66%

On the other hand, an increased auctioning share will raise additional revenues and reinforce incentives to reduce emissions. Table 46 below shows that the number of allowances auctioned over the period 2021-2030 would roughly be between 600 million and 1 billion higher with a 70% share compared to a 57% share (the difference depending on the cap scenario, excluding MSR impacts).

Table 55: Total auction volumes under different cap scenarios comparing a 57% and a 70% auction share (in millions, for the period 2021-2030[5]

Auction share	Current Legislation	AMB1	AMB2a	AMB2b	AMB2c	AMB3c
57%	7.091	6.475	6.269	6.015	6.084	6.305
70%		7.147	7.259	6.941	7.028	6.935

For the avoidance of doubt, this analysis does not take into account the increase of the auctioning of the share that may be the consequence of implementing a CBAM for

[5] Indicative cumulative figures for regular auctioning and 10% solidarity redistribution, i.e. funds and free allocation buffer are not accounted.

selected sectors. The possible impact that 'moving' relatively large recipients such as the iron and steel sectors and the cement sector from free allocation to CBAM has been quantified in Section 6.1.2.2.5.

26 EVIDENCE ON EXISTENCE OF CARBON LEAKAGE

Literature on the ETS has found limited evidence of carbon leakage or a related loss of competitiveness in the initial ETS phases. Joltreau and Sommerfeld (2019) estimate that competitiveness impacts in the first two phases of the EU ETS were minimal. They argue that large allowance over-allocation in the initial phases, combined with the ability to pass costs onto consumers in some sectors are the cause for the lack of competitiveness impacts[6]. Branger, Quirion, and Chevallier (2016) estimate there is no evidence of carbon leakage in steel and cement during Phases 1 and 2 of the EU ETS[7]. Many other factors like the cost of production capital, market access or the availability of labour are important for production decisions. In most cases, carbon liabilities are likely only a small component of the production and investment decision, meaning the risk of leakage is low. The relatively low importance of energy costs for EU industries may also limit the competitiveness impacts of the EU ETS. However, the EU ETS has provisions to protect against carbon leakage risk, for example free allocation of allowances to EITE sectors and state aid for indirect costs. This may also help to explain why there has been no evidence of leakage to date. Additionally, EUA prices have been relatively low thus far, so carbon costs have only played a small part in the production decision for periods studied. In the long term, with increasing proliferation of carbon pricing globally, the scope for transferring productive capacity closes; therefore, the risk of competitiveness impacts and leakage is reduced. Free allocation to industries which can pass through costs may lead to windfall profits for firms (assets rising more than liabilities).

27 FREE ALLOCATION FORMULA

The level of free allocation granted to an installation to address the risk of carbon leakage is the result of a calculation:

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[6] Joltreau, E., & Sommerfeld, K. (2019). Why does emissions trading under the EU Emissions Trading System (ETS) not affect firms' competitiveness? Empirical findings from the literature. Climate policy, 19(4), 453-471.

[7] Branger, F., Quirion, P., & Chevallier, J. (2016). Carbon leakage and competitiveness of cement and steel industries under the EU ETS: much ado about nothing. The Energy Journal, 37(3).

Free allocation = Benchmark × Historical Activity Level × Carbon Leakage Exposure Factor (CLEF) × Cross-Sectoral Correction Factor (CSCF)

The following main factors are taken into consideration:

- the benchmark applicable to the different products manufactured in the installation and, when this is not possible, its energy inputs or process emissions. Benchmarks have been used since 2013 and reflect in principle the average emissions of the 10% best installations in the ETS for different sectors;

- the historical activity level of the installations, which is updated when the average activity level of the two preceding years changes by more than 15%;

- the carbon leakage exposure factor (CLEF) that takes into consideration the carbon leakage risk for the specific sector to which the installation belongs. Currently, this factor can only take two values: 100% for sectors considered to be at risk of carbon leakage, and 30% (reducing to 0% by 2030) for sectors not at risk of carbon leakage, with the exception of district heating where it remains set at 30% until 2030. In practice, the current impact of this factor is limited, as around 94% of the emissions from industrial installations originate from sectors at risk of carbon leakage;[8]

- the cross-sectoral correction factor (CSCF): if the free allocation demand exceeds the amount available for free allocation that is determined by the ETS Directive[9], free allocation is adjusted in a uniform manner by applying the CSCF, which reduces the free allocation received by all installations. This was the case in phase 3.

Free allocation is granted for direct emissions. However, in the case of some product benchmarks, the exchangeability of fuel and electricity is taken into account (in order to account for production processes where either fuel or electricity can be used to produce

[8] European Court of Auditors, The EU's Emissions Trading System: free allocation of allowances needed better targeting, 2020.

[9] The total amount available for free allocation depends on the ETS cap trajectory, the mandatory auction share and the amount earmarked for the innovation fund.

heat or mechanical energy). In these cases, an additional factor is used which is the ratio of the direct emissions to the total emissions[10].

28 CARBON LEAKAGE LIST

The impacts of the tiered approach were assessed using the carbon leakage indicators of Table 47. These indicators were calculated for the carbon leakage list applicable for the period from 2021 to 2030, based on data for the period from 2013 to 2015. The use of more recent data, including of updated average emission factors for electricity production would obviously lead to different results.

Table 56. Carbon leakage indicators of selected sectors at risk of carbon leakage

NACE code	Sector	Carbon leakage indicator (CLI)
19.10	Coke oven products	20.119
19.20	Refined petroleum products	3.222
23.51	Cement	2.455
20.15	Fertilisers and nitrogen compounds	2.418
24.10	Basic iron and steel and of ferro-alloys	2.121
20.13	Other inorganic basic chemicals	1.638
23.11	Flat glass	1.457
14.11	Leather clothes	1.147
23.31	Ceramic tiles and flags	1.049
20.14	Other organic basic chemicals	1.049
24.43	Lead, zinc and tin production	1.031
23.52	Lime and plaster	1.021
20.11	Industrial gases	1.021
17.11	Pulp	0.987
17.12	Paper and paperboard	0.836
23.13	Hollow glass	0.631
10.81	Sugar	0.630
20.17	Synthetic rubber in primary forms	0.604
20.12	Dyes and pigments	0.519
10.62	Starches and starch products	0.515

[10] European Commission, Guidance Document N°2 on the harmonised free allocation methodology for the EU ETS post 2020 - Guidance on determining the allocation at installation level, Version 15 February 2019.

24.51	Casting of iron	0.488
24.44	Copper	0.421
23.14	Glass fibres	0.417
23.20	Refractory products	0.412
20.60	Man-made fibres	0.412
20.16	Plastics in primary forms	0.312
24.45	Other non-ferrous metal production	0.280
24.31	Cold drawing of bars	0.259
24.20	Tubes, pipes, hollow profiles and related fittings, of steel	0.229
23.19	Manufacture and processing of other glass, including technical glassware	0.228
23.99	Other non-metallic mineral products n.e.c.	0.221

Source: European Commission, EU ETS phase 4 Preliminary Carbon Leakage List - Carbon Leakage Indicator underlying data, 2018.

29 DESIGN ELEMENT TO MAKE FREE ALLOCATION CONDITIONAL ON DECARBONISATION EFFORTS

The ETS Directive allows ETS countries to compensate sectors or subsectors at risk of carbon leakage for incurred significant indirect costs due to electricity consumption. The recently revised state aid rules for this indirect cost compensation introduced conditionality provisions for granting this aid. A similar conditionality could be introduced for free allocation covering direct carbon costs. By making free allocation conditional on decarbonisation efforts, the specific objective of incentivising the uptake of low-carbon technologies would be supported. This would in turn make industry more resilient against the risk of carbon leakage in the future. Making free allocation conditional on decarbonisation efforts would also be in line with the "Energy Efficiency First" principle enshrined in Article 2(18) of the Governance Regulation[11].

The conditionality provisions in the state aid rules concern installations covered by the obligation to conduct an energy audit under Article 8(4) of the Energy Efficiency Directive. These installations need to spend a part of their compensation to implement improvements under certain conditions. Several possibilities are given, of which one is deemed to be the most relevant in the context of free allocation. The concerned installations should demonstrate that they implement the recommendations made in the framework of the energy audit, to the extent that the payback time for the relevant investments does not exceed a certain number of years and that the costs of their investments is proportionate. Energy efficiency investments with payback periods of up to three years are generally considered to be economically profitable[12]. Compared to that, a conditionality with a longer payback of five years would provide stronger incentives that are better aligned with the increased emission reduction ambition.

The introduction of conditionality is expected to have only a minor effect on the overall framework for free allocation. If installations do not meet the criterion for conditionality, they would see their free allocation reduced. This means that the likelihood or the extent to which a CSCF would need to be applied would be reduced. In this sense, free allocation would become more targeted as it would better protect sectors that are difficult to decarbonise.

The conditionality would affect large installations that are required to carry out an energy audit. The costs of implementing the recommendations of the energy audit would be determined on a case-by-case basis by the auditors and will vary between the various

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[11] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action.

[12] SWD(2020) 190 final.

sectors and installations. The conditionality would ensure that energy efficiency investments are made where the payback periods are considered reasonable. Furthermore, the condition that the costs should be proportionate provides some flexibility during implementation.

The implementation of conditionality would add some complexity to the system, as MS would need to ensure that the recommendations identified in the energy audits have been put into practice. Nevertheless, the ETS already builds on third-party verification for the annual reporting of emissions and activity levels. This system could be extended for taking into consideration the conditionality of free allocation with a relatively low level of effort, for instance by including information on the obligation to carry out audits in the installation, the findings of the audits and the actions taken to implement them.

30 DESIGN ELEMENT TO BROADEN THE SCOPE OF FREE ALLOCATION

Under the current legislative framework, free allocation is granted up to 100% of the relevant benchmark level. 52 product benchmarks and two fall-back benchmarks for heat and fuels were defined for phase 3. The definitions of the processes and emissions covered (system boundaries) are mostly based on the prevailing production routes at the time when the benchmarks were set[13]. Ongoing and future technological developments to reduce GHG emissions might lead to situations where installations would partly or completely lose their free allocation when decarbonising their production activities. As a consequence, the free allocation regime could lead to unequal treatment of industrial installations and effectively act as a barrier to the use of decarbonisation techniques.

The following potential barriers have been identified:

- Installations falling out of the scope of the ETS: This could for example happen when installations partly replace their heat supply provided by combustion through increased use of electricity and therefore fall below the thermal capacity thresholds of 20 MW that apply for some activities listed in Annex I to the ETS Directive. It could also happen when installations completely decarbonise and no longer emit any GHGs.

- Installations falling out of the system boundary definitions of a benchmark: A few benchmark definitions and boundaries refer to specific processes and fossil fuel

[13] Commission Decision of 27 April 2011 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council.

inputs which might not encompass less carbon-intensive production routes. For example, the product benchmark for hydrogen refers to steam reforming of hydrocarbon feedstock, but the production of hydrogen through electrolysis of water is not described.

- Benchmarks with exchangeability of fuel and electricity: For 14 of the 52 product benchmarks, the consumption of electricity is taken into account in the determination of the benchmark value. Therefore, the benchmark value is higher compared to a situation where those indirect emissions would not have been considered. However, for the purpose of free allocation, these benchmarks are multiplied with a factor to ensure that emissions related to electricity consumption are excluded. The factor is defined as the ratio between the direct emissions and the total emissions, defined as the sum of direct and indirect emissions, attributed to the sub-installation. This definition can disincentive GHG emissions reductions. First, if an installation reduces its direct emissions through means other than electrification and indirect emissions remain unchanged, free allocation will decrease. Second, if an installation switches from fossil fuel to electricity as heat source, free allocation will decrease unless it is a very carbon-intensive fossil fuel such as coke or lignite that is replaced. This is because the factor that is used for calculating the indirect emissions relates to electricity use. In some cases, such installations could be eligible for indirect cost compensation, thereby mitigating the risk of barriers to electrification. However, not all ETS countries grant indirect cost compensation, not all benchmarks with exchangeability of fuel and electricity correspond to sectors exposed to a genuine risk of carbon leakage due to indirect emission costs, and the maximum aid intensity for indirect cost compensation is generally limited to 75%.

The broadening of the scope of free allocation would provide additional incentives and/or reduce barriers for installations to reduce GHG emissions, enabling the stronger emission reductions required post-2030 by using low-carbon technologies to achieve climate neutrality by 2050.

An example may illustrate this effect: A plant that decides to produce green hydrogen from electricity instead of using the conventional natural gas-based process would, under current rules, fall out of the ETS. The plant would thus not face carbon costs and it would not get free allocation. In the case of a very efficient conventional fossil-fuel-based plant that is already operating below the benchmark and can thus sell surplus allowances on the market, these additional revenues would be lost. This would come on top of the investment costs and the increased operating costs. Broadening the scope would effectively prevent that those plants converting to low- or zero-carbon technologies are facing competitive disadvantages. Once there are a few plants in a sector using low- or zero-carbon technologies, the related benchmarks will also be further reduced during a subsequent update. This would then provide further incentives for other plants to also reduce their emissions.

Potential changes in the ETS Directive or relevant implementing legislation to broaden the scope of free allocation in order to incentivise the use of low-carbon technologies include:

- Avoid the use of thresholds expressed as total rated thermal inputs in Annex I to the ETS Directive: Annex I could refer to production capacity thresholds for the concerned activities (i.e. production or processing of ferrous and non-ferrous metals, production of secondary aluminium, production of gypsum (products) and production of carbon black). Furthermore, relevant activities that are currently only covered by the activity 'combustion of fuels in installations with a total rated thermal input exceeding 20 MW' could be explicitly listed, also adding production capacity thresholds.

- Avoid that installations with partly or completely decarbonised processes fall out of the ETS or cannot enter it: This would for example concern installations that reduce their total rated thermal input below the aforementioned threshold values or installations that do not have any GHG emissions due to complete electrification or use of hydrogen as only fuel.

- Revise benchmark definitions in relevant implementing legislation: To align with the principle of 'one product, one benchmark', relevant product benchmark definitions could be redefined to remove references to specific feedstock or production process so that they will include future low-carbon production routes. The heat benchmark definition could be revised to include heat produced from electricity.

- Abandon the concept of exchangeability of fuel and electricity in relevant implementing legislation: The benchmark definitions would be revised and the values updated in order to only take into account direct emissions. Using a revised benchmark definition, an installation that partly electrifies would keep the same amount of free allocation.

Regarding possible changes to benchmark-based allocation, stakeholder opinions were divided whether additional product benchmarks or revised definitions of product benchmarks should be introduced to incentivise innovation. While industry representatives were more sceptical, other stakeholders were more positive (see Annex 2).

If changes to the definitions of the activities covered by the ETS and to the boundaries and definitions of the benchmarks used to attribute free allocation were introduced, this could mean that more production would be eligible for free allocation. This is for example relevant for installations producing hydrogen and ammonia which could benefit from free allocation even if the hydrogen were produced via electrolysis using green electricity. The production of these energy carriers is likely to increase in the future. The hydrogen strategy sets the target of installing at least 6 GW of renewable hydrogen electrolysers in the EU by 2024 and 40 GW of renewable hydrogen electrolysers by 2030.[14] Each 1 GW of electrolyser capacity produces between 40 000 and 100 000 tonnes of renewable hydrogen per year.[15] With the current benchmark value for hydrogen production of 6.84 EUAs/t, free allocation would thus be in the range of 1.6 to 4.1 million allowances in 2024 and in the range of 11 to 27 million allowances in 2030. On the other hand, it is expected for many other sectors that low-carbon technologies rather replace existing technologies and would thus not affect the overall framework for free allocation. In essence, the impact depends on the extent to which low-carbon technologies are used in the future.

If only direct emissions were to be considered for benchmark setting purposes, the installations that electrify would have an even higher impact on the benchmark update rates. This would push most benchmarks in which there is exchangeability of fuel and electricity towards the maximum benchmark update rates (32% under current legislation) therefore slightly reducing free allocation demand. On the other hand, the power sector is decarbonising fast and this trend is expected to continue, therefore most of the benchmarks considering the exchangeability of fuel and electricity should be updated at high rates in any case.

In general, higher and earlier demand of innovative low-carbon technologies will likely speed up their development and the process of reducing their costs. In the long run, abatement costs for energy-intensive industry sectors will therefore likely decrease. However, this positive economic impact on industry is expected to be rather limited until 2030.

The broadening of the scope of free allocation requires some changes to the ETS Directive and related implementing legislation. Moreover, the number of installations under the scope of the ETS could slightly increase resulting in a small increase of the administrative burden.

Overall, it is expected that the impact of broadening the scope of free allocation on the framework to address the risk of carbon leakage is rather limited. Nevertheless, the likelihood or the impact of the CSCF could slightly increase. On the other hand,

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[14] COM(2020) 301 final.
[15] https://www.hydrogen4climateaction.eu/2x40gw-initiative

installations using innovative technologies or electrifying would benefit from an increased protection against the risk of carbon leakage.

The broadening of the scope would allow installations introducing innovative low-carbon technologies to benefit (more) from free allocation. It can be expected that this would speed up the uptake of such technologies triggering a positive and sustainable impact on employment, i.e. for technology providers.

31 INDIRECT COST COMPENSATION

31.1 Introduction

Article 10a(6) of the ETS Directive provides that MS should adopt financial measures in favour of sectors or subsectors which are exposed to a genuine risk of carbon leakage due to significant indirect costs that are actually incurred from GHG emission costs passed on in electricity prices. These financial measures need to be in accordance with State aid rules and should not cause undue distortions of competition in the internal market. The state aid guidelines for indirect cost compensation were revised in the period from 2018 to 2020 for their application in phase 4 of the ETS[16]. Indirect cost compensation is based on Union-wide benchmarks for electricity consumption per unit of production and on the weighted averages of the CO_2 intensity of electricity produced from fossil fuels in the concerned geographic areas.

The revised state aid guidelines foresee to update the electricity consumption efficiency benchmarks, the geographic areas, and the CO_2 emission factors in 2025. By that time, the Commission will also assess whether additional data is available that allow improving the methodology used to calculate the CO_2 emission factors. Finally, following the review and possible revision of all climate-related policy instruments to achieve the 2030 climate target (notably the ETS Directive) and the initiative for the creation of a CBAM, the Commission will check whether any revision or adaptation of the guidelines is necessary to ensure consistency with, and contribute to, the fulfilment of the climate neutrality objective while respecting a level playing field.

Only 20% of the respondents in the OPC find that MS should maintain flexibility to grant indirect cost compensation or not, subject to state aid control. 80% are in favour of some form of change, but there is no clear majority for a preferred change. 50% of respondents

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[16] Communication from the Commission. Guidelines on certain State aid measures in the context of the system of greenhouse gas emission allowance trading post-2021. OJ C 317, 25.9.2020, p. 5.

are in favour of further harmonisation of indirect cost compensation at EU level. The large majority of these respondents originate from the private sector. Only four federal authorities from MS replied to this question, out of which three were in favour of further harmonisation, while one preferred that MS maintain flexibility. Approximately 25% of respondents stress that the rapidly on-going decarbonisation of the electricity production in the EU should lead to a phase-out of indirect cost compensation. The majority of these respondents represent EU citizens and NGOs. Few respondents (5%) suggest binding requirements so that MS granting compensation do not spend more than a fixed share of their auctioning revenues.

31.2 **Target for maximum indirect cost compensation**

In accordance with the ETS Directive, MS shall seek to use no more than 25% of the revenues generated from the auctioning of allowances for indirect cost compensation. Each year, MS providing such financial measures are required to publish the total amount of compensation provided per benefitting sector and subsector. The report shall also set out the reasons if the compensation exceeds the target of 25% of the revenues generated from the auctioning of allowances. Table 49 summarises the data published by MS on indirect cost compensation.

Table 57: Indirect cost compensation by Member State

Member State ([1])	**Duration of the scheme**	**Compensation disbursed for indirect costs incurred in the preceding year (in EUR million)**			**Number of beneficiaries (installations)**			**Percentage of auction revenues spent on indirect cost compensation**		
		2017	**2018**	**2019**	**2017**	**2018**	**2019**	**2017**	**2018**	**2019**
DE	2013–2020	289	202	219	902	891	898	34.1 %	17.6 %	8.5 %
BE (FL)	2013–2020	46.7	31.7	35.9	107	106	107	43.6 %	27.3 %	11.4 %
BE (WL)	2017–2020	— ([2])	7.5	7.5	— ([2])	30	29	— ([2])		
EL	2013–2020	12.4	16.8	16.8	52	50	50	8.4 %	8.5 %	3.2 %
ES	2013–2020	84	6	172.2	136	151	183	23 %	1.2 %	13.3 %
FI	2016–2020	38	26.7	29.1	55	58	61	40.0 %	28.2 %	11.6 %
FR	2015–2020	140	98.7	102.1	296	296	286	60.0 %	31.8 %	12.4 %
LT	2014–2020	1	0.24	0.3	1	1	1	4.8 %	0.8 %	0.3 %
LU	2017–2020	— ([2])	3.4	4.2	— ([2])	2	4	— ([2])	50 %	23.2 %
NL	2013–2020	53.5	36.9	40.3	92	96	92	37 %	19.5 %	8.0 %
SK	2014–2020	10	10	6	5	7	8	15.4 %	11.4 %	2.6 %

([1]) Poland and Romania started indirect cost compensation schemes for costs incurred from 2019 onwards.
([2]) The Walloon and the Luxembourgish compensation schemes were approved by the Commission in 2018 for costs incurred from 2017 onwards.

Source: Carbon market reports for 2017[17]*, 2018*[18] *and 2019*[19]*.*

The total indirect cost compensation granted by the 10 EU MS in 2019 for costs incurred in 2018 amounted to around EUR 633 million. That was almost EUR 200 million more than the amount paid out in 2018. The notable increase compared to the previous year can be explained, on the one hand, by the significant budget increase of Spain (from EUR 6 million in 2018 to EUR 172 million in 2019), and on the other hand by the slight increase of the carbon price used to calculate the compensation[316].

The indirect cost compensation granted by Norway in 2017, 2018 and 2019 amounted to NOK 469 million, 513 million and 1.39 billion, respectively (equivalent to EUR 50 million, 53 million and 141 million)[20].

Approximately half of the MS with an indirect cost compensation scheme in place exceeded the 25 % target in 2017 and 2018, while no exceedance was reported in 2019. Two main reasons were given by MS for exceeding the 25 % target:

- In some MS (e.g. France), the GHG intensity of the electricity produced is relatively low which implies lower auctioning revenues. However, the same MS might have a large cluster of electricity-intensive industries which are eligible for indirect cost compensation.
- The carbon price used for indirect cost compensation was based on the year that precedes the year whose carbon price was used to determine the auction revenues. A decrease in the carbon price therefore led to an increase in the percentage of auction revenues spent on indirect cost compensation.

31.3 **Further harmonisation of indirect cost compensation**

The main argument in favour of further harmonisation of indirect cost compensation at EU level is to avoid potential market distortions, as some Members States provide compensation while others do not. At the time of writing this document, 12 EU MS (i.e. Belgium, Finland, France, Germany, Greece, Lithuania, Luxembourg, the Netherlands,

[17] COM(2018) 842 final, 17.12.2018.
[18] COM(2019) 557 final/2, 16.1.2020.
[19] COM(2020) 740 final, 18.11.2020.
[20] Consultation on the revision of the ETS Guidelines on certain State aid measures in the context of the amended EU Emissions Trading Scheme 2021-2030 – response from the Norwegian Government.

Poland, Romania, Slovakia, and Spain) and Norway provide compensation for indirect costs.

The option of a mandatory Union-wide compensation scheme, financed by using national auctioning revenues, was assessed during the last revision of the ETS Directive. The analysis indicated that more harmonised arrangements for indirect cost compensation had benefits, but that care was needed to avoid red tape and lock-in of emission-intensive production methods[21]. Finally, the Commission proposal for a revised ETS Directive retained the system that indirect cost compensation is granted at MS level[22]. The European Parliament and the Council agreed to this approach during co-decision.

The update of the state aid guidelines for indirect cost compensation for phase 4 of the ETS included a number of modifications. Some of these changes aimed at reducing potential market distortions, such as more targeted aid to fewer sectors, better calculation of costs and updated CO_2 emission factors.

31.4 **Phase-out of indirect cost compensation**

The GHG emission intensity of total electricity generation in the EU-27 was 45% lower in 2018 than in 1990 (decreasing from 510 g CO_2 equivalents/kWh to 281 g CO_2 equivalents/kWh over the period). Since 2010, the decrease has been almost exclusively because of the transition from fossil fuels to renewable fuels in electricity generation, with carbon costs increasing in relevance especially since 2019[23]. The reduced carbon intensity of electricity production should thus result in reduced indirect carbon costs. However, for the purpose of calculating indirect cost compensation, only the price-setting plants are taken into consideration, because it is the price-setting plants that determine how much carbon costs are passed on. In the near future, it is expected that fossil-fuelled power stations will continue to set the marginal electricity price for a significant part of the hours. Even though fossil-fuelled power generation will likely shift from coal to gas, carbon costs will thus continue to be passed through to consumers to a significant extent. Moreover, these carbon costs will reflect increasing carbon prices due to the strengthened cap. Therefore, indirect carbon costs, although potentially declining, can be considered still relevant in the period from 2021 to 2030.

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[21] SWD(2015) 135 final.
[22] COM(2015) 337 final.
[23] European Environment Agency: Indicator assessment - Greenhouse gas emission intensity of electricity generation in Europe, https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment, retrieved 30 April 2021.

31.5 Conclusion

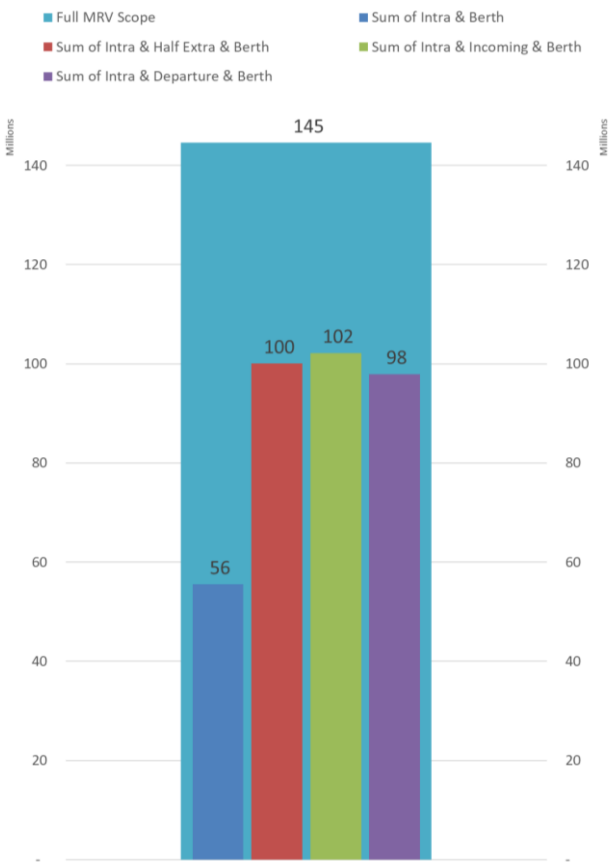
The current and expected future trend of decarbonising electricity generation makes it hard to justify additional measures for indirect cost compensation, but the expected increased carbon price justifies continuing with the current approach of the ETS Directive until 2030. The respective state aid guidelines were recently updated to adapt them for phase 4 of the ETS, also with a view to reducing potential market distortions. In any case, the guidelines are foreseen to be checked after the revision of the ETS Directive and the establishment of a CBAM. Important elements of the guidelines will be updated in 2025.

Annex 10: Detailed analysis on the economic and social impacts of the maritime initiative

32 Impacts of the different maritime geographical scopes

The choice of the geographical scope is key as it directly influences the amount of CO_2 emissions that would be covered by carbon pricing. The following graph illustrates that the covered emissions can vary up to threefold depending on the selected geographical scope.

Figure 77: Share of CO_2 emissions covered for different geographical scope based on past EU maritime transport MRV data (EEA including EU28)

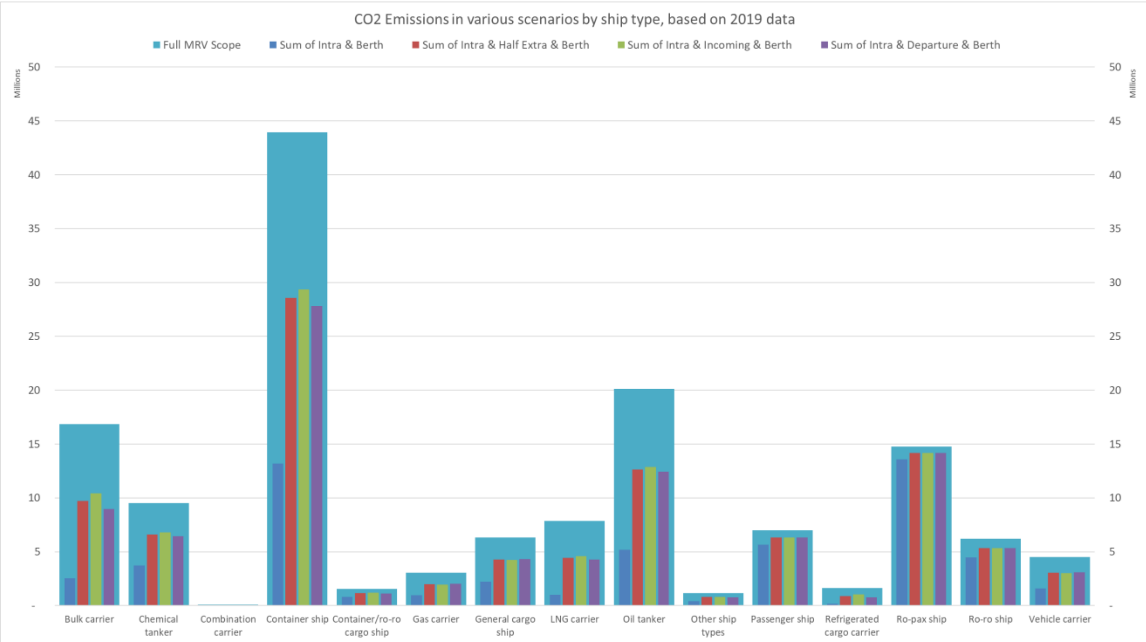


Source: EMSA, 2019 data from THETIS-MRV

The two following graphs illustrate the impact of the geographical scope on market actors. The first one shows that a measure focusing on emissions from intra-EEA voyages (MINTRA) would typically cover most of the emissions from ro-pax ships (roll-on/roll-off passenger vessels), passenger ships and ro-ro (roll-on/roll-off ferries carrying cars and other wheeled cargo), as most of their voyages happen between ports located in the EEA. On the contrary, it would only cover around a third of the emissions from container ships and tankers, and around a quarter of the emissions from bulkers. Addressing extra-EEA emissions would significantly increase the proportion of emissions coming from the largest trading segments i.e. deep-sea shipping.

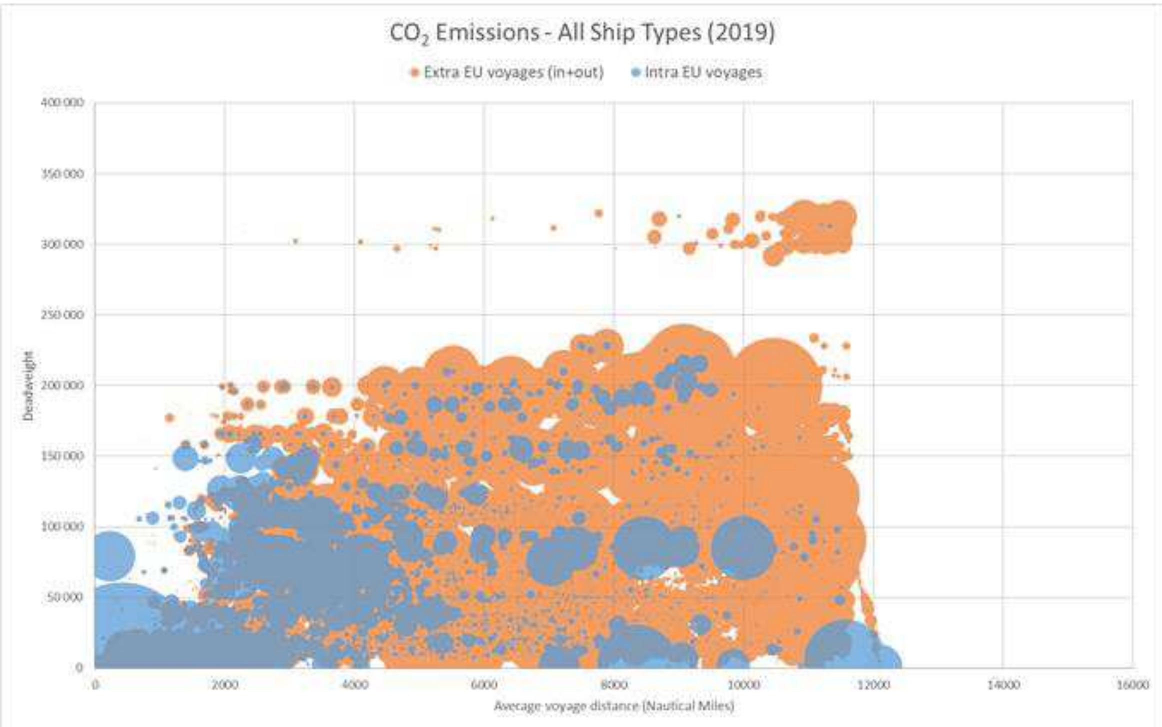
The second graph shows that, in general, intra-EEA voyages involve smaller ships on shorter distances.

Figure 78: Share of CO_2 emissions covered for different geographical scope and different ship type



Source: EMSA, 2019 data from THETIS-MRV

Figure 79: CO_2 emissions related to intra EEA and extra EEA voyages per average voyage distance and ship size (dwt)



Source: 2019 EU MRV annual report on CO_2 emissions from maritime transport

Finally, the graph below shows that independently from the selected geographical scope, most of the CO_2 emissions covered by carbon pricing would come from ships owned or operated by an EEA based companies.

Figure 80: CO_2 emissions per origin of companies for different geographical scopes

Source: EMSA, 2019 data from THETIS-MRV

33 IMPACTS ON THE EU INTERNAL MARKET

33.1 Impacts on competition between shipping operators

No maritime policy option is expected to put the EEA shipping operators in a disadvantaged position compared to non EEA shipping operators. Indeed, as any policy option will be flag-neutral, the policy will apply equally to all ships calling into EEA ports. However, ships calling more often into EEA ports may have the advantage of shorter pay-back periods when investing in GHG mitigation measures.

Moreover, as shown in previous analysis and as supported by some industry stakeholders views, the use of a size threshold would not create a general distortion of trade competition between short sea shipping and deep sea shipping activities as they are not serving the same market (e.g. short sea shipping competes mainly with road transport). However, as shown in the table below, exempting vessels below the threshold of 5.000 gross tonnage might advantage the ships right below that size limit in comparison to the ones just above, particularly for general cargo ships and chemical tankers.

Table 58: Share of the global maritime fleet by type of vessel and size category

Vessel type	Share of size by vessel type		
Size category (GT)	**100-400**	**400-5000**	**>5000**
Oil Tankers	10.0%	39.9%	50.0%
Bulk Carriers	0.0%	0.0%	100.0%
Container ships	0.0%	6.6%	93.4%
Chemical Tankers	7.3%	36.9%	55.8%
Crude Tankers	0.0%	0.0%	100.0%
General Cargo	19.3%	72.1%	8.6%
LNG Carriers	0.0%	1.8%	98.2%
LPG Carriers	0.9%	45.5%	53.6%
Ro-Ro	3.8%	24.9%	71.3%
Cruise Ships	2.8%	24.5%	72.7%
Car Carriers	0.0%	2.8%	97.2%
Multi-purpose	0.0%	53.2%	46.8%
Ferries	38.7%	45.4%	15.9%
Refrigerated	0.0%	57.9%	42.1%
Dredgers	18.6%	52.8%	28.6%
Tugs	26.7%	66.3%	7.0%

Source: Ricardo analysis based on Clarksons[24] fleet data

33.2 **Impacts on modal shift**

The increased cost of shipping resulting from carbon pricing could eventually cause a shift from maritime transport to other modes of transport, provided that those are not covered by similar measures or carbon pricing. Road transport under the MIX scenario will be subject to a number of decarbonisation policies fostering the use of more sustainable modes of transport. Risk of modal shift under MAR1 is therefore considered inexistent and unlikely under MAR4. From an environmental point of view there is a

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radical difference in shifts to road transport (negative) or shift to electrical trains (positive). The geographical scope is not expected to have much impact on modal shift, as only the intra-EU voyages are likely to compete with other modes of transport.

This modal shift is confined to transport routes where alternatives via other modes exist. If it does occur, it will most likely happen in unitised (e.g. containers, pallets, trucks) short sea shipping, including roll-on roll-off ships and lift-on lift-off ships, which represent a significant part of the CO_2 emissions reported in the EU maritime transport MRV system. For intercontinental shipping, other transport mode alternatives hardly exist. Elasticity estimates of short sea bulk transport suggest that these are not very sensitive to price, which is interpreted as being caused by little competition with other modes of transport. To substitute a medium-size bulk carrier by road transport may require hundreds of trucks. Small changes in overall cost are therefore not likely to make bulk cargo-owners change to another mode. In 2015, the introduction of the Sulphur Emission Control Area lead for instance to an increase of EUR 181/tonne of fuel without having a significant impact on modal shift[25].

On routes where unitised cargo is transported and maritime transport competes with road transport and rail, modal shift is also unlikely due to a range of climate and transport policies applying to other modes of transport, such as CO_2 standards, fuel tax, possible ETS extension to road transport, speed and daily driving limits but also practical obstacles such as congestion. On the maritime side, the relative low cost of freight transport by sea or the influence of long-term contracts are noticeably likely to restrain market actors from switching to other modes of transport. Also, EU investments in port infrastructure incentivise a modal shift from road to waterborne transport. A study estimates that the taxes paid by trucks in 2019 were much higher than for shipping under the MAR1 and MAR4 options[26].

The likelihood of a modal shift to road or rail is thus linked to the cost of the option chosen as well as the unlocking of existing rail cargo infrastructures. All policy options will have an impact on fuel costs, and hence on the total costs associated with short-sea shipping. A case study presented in this annex evaluates the increase of modal shift under the assumption that no additional measures compared to the actual situation are taken for road transport. A cross elasticity of 0.31[27] is assumed for shifting cargo from short-sea shipping to road. This will mean that for a 10% increase in total costs the share of road transport is estimated to increase by 3.1%. Under those assumptions, it is estimated a

[25] SECA Assessment: Impacts of 2015 SECA marine fuel sulphur limits (CE-Delft 2016)

[26] https://www.transportenvironment.org/press/top-shipping-polluter-overtakes-power-plants-coal-shuts-down

[27] Indicator measuring the sensitivity of freight operators to changes in the cost of short-sea shipping as calculated in a recent study, Comi and Polimeni (2020) which developed a modal choice model for Ro-Ro competition with respect to road and rail transport in the Mediterranean basin.

4.9% increase in modal shift for MAR1. Modal shift is estimated to be higher for MAR2 and MAR3 (20%) as the carbon price will be higher than for MAR1 and MAR4. However, as mentioned before these impacts will be lower as measures under the Green Deal and Smart and Sustainable Mobility Strategy will incentivize a shift towards the least carbon intensive modes of transport (rail, inland navigation and maritime transport). The Smart and Sustainable Mobility Strategy has set for milestone to increase rail freight transport by 50% in 2030 and waterborne transport by 25%. This will require investments to address the scarcity of transhipment infrastructures and multimodal terminals and a better integration of maritime transport in the entire logistic chain.

33.3 Impacts on the price of a selection of ten commodities

Section 6.2.2.4 outlines the impacts on commodity prices and international trade flows for a selection of 10 commodities, which were selected for detailed analysis based on the following criteria:

- The **relevance** of the commodity in terms of EU competitiveness, considering factors such as the size of the sector in the EU, the share of exports and imports, profit margins, transport costs, and the evolution of the seaborne trade balance of the commodity. Competitiveness is defined at the EU-27 level, considering the position of all MS as a trading bloc relative to the rest of the world, and examining impacts at the aggregate level.
- The **technical feasibility** of the analysis, in terms of readily available data on commodity prices, current trade flows, own price elasticities, cost pass-through rates, initial demand and market shares of domestic and overseas producers.

The **following commodities were selected:** Crude oil, Refined petroleum products, Natural gas, Iron ores, Iron and steel, Cereals, Perishable goods, Office and IT equipment, Motor Vehicles, Organic chemicals.

The scale of the impacts from the policy measure, and the agent bearing these impacts (producer, manufacturer, retailer or consumer) depends on the following factors:

- **Cost pass-through.** The extent to which a change in freight rate is passed on from ship operators to their customers. For each commodity, three of the most common trade routes with the EU are selected to illustrate the change in freight rate for each commodity according to the geography of its trade. It is important to note that the analysis assumes that freight rates change in response to the real costs of shipping, with an aim to capture the upper bound of effects of an increase in shipping costs. However, freight rates may not directly reflect costs of shipping, especially given that contract structures in the maritime industry are complex and may be agreed for long time periods in certain cases.

  It is assumed that if freight rates increase, shipping operators absorb the additional cost for commodities which are price elastic, but pass it on to their customers for commodities which are unresponsive to price changes. Cost pass-through also relates to the ability of producers, manufacturers and retailers to pass costs through to the next link in the supply chain. This in turn depends on levels of market concentration, demand price elasticity, and substitutability of inputs.

- ***Ad valorem*** – *i.e.* the percentage of the price of the commodity attributed to the cost of shipping: higher *ad valorem* of freight rates will lead to greater changes in the price of the commodity. As mentioned above, in order to reflect the variety of freight rates across routes, multiple trade routes are selected for each commodity.
- **The own-price elasticity of demand** for the commodity. This reflects the percentage change in consumer demand relative to the percent change in the price of the commodity. High elasticities (with an absolute value close to or greater than one) suggest a strong consumer response to the change in price, while low elasticities (with an absolute value closer to zero) suggest only a very small consumer response to the change in price.
- **Armington elasticities** - the ability to substitute imports with domestic products. Armington elasticities compare the change in the price of an imported good with the demand for the same good produced domestically. They therefore assess the extent to which imported and domestic goods are substituted for each other, and thereby the degree to which an increase in the cost of imports would make local products more competitive. However, it is important to note that Armington elasticities are difficult to estimate empirically, with few data or literature sources available.

33.4 Impacts on EU countries and regions heavily dependent on shipping

The level of exposure to changes in shipping costs has been assessed based on a series of indicators, which resulted in EU countries having been classified into three broad groups as detailed below:

- **Most exposed** (countries with high levels of international trade, which are heavily reliant on shipping) :
  - Ireland, the Netherlands, Cyprus, Greece, Malta, Sweden.
- **Exposed** (Countries with high indicators for one of any of the following: high levels of international trade compared to GDP and relying on sea transport for more than half the volume of international trade, be it intra- or extra-EU or Countries where international trade is mostly undertaken by sea) :
  - Shipping most important for intra-EU trade: Finland, Estonia, Latvia, Lithuania, Croatia.
  - Shipping most important for extra-EU trade: Portugal, Spain, Italy, France, Bulgaria, Germany, Belgium.
  - Shipping important for all trade: Denmark, Romania.
- **Least exposed** (do not rely on maritime transport):

- Austria, Czech Republic, Hungary, Poland, Slovakia, Slovenia, Luxembourg.

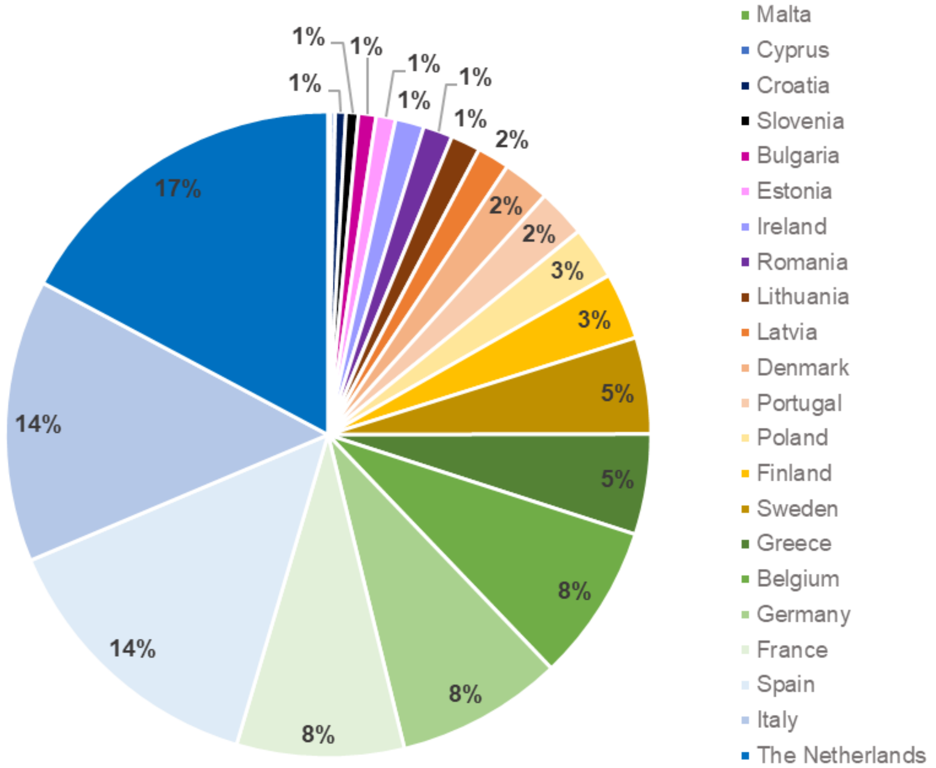
Exposure can manifest itself through a loss of competitiveness on the global market as a result of more expensive exports, or through reduced competition and standard of living as a result of more expensive imports. It can also be beneficial, should the policy result in a drop in freight rate, although this is likely to be smaller as cost savings would be retained by shipping operators.

To identify EU countries and regions most affected by changes in the shipping sector, a number of key indicators have been used:

Freight activity

In 2019, 3.5 billion tonnes of goods were handled (loaded and unloaded) in the key EU-27 ports (Eurostat, 2020a). The primary countries handling goods in the EU-27 are the Netherlands (17%), Italy (14%) and Spain (11%), which together, comprise nearly half of the total weight of goods handled in the EU-27.

Figure 81: Proportion of gross weight of goods handled in key EU 27 ports by Member States in 2019



Source: Eurostat, 2020

Whilst the graph above conveys the spatial distribution of goods handled in the EU, it does not communicate the importance of shipping to individual national and regional economies.

International trade intensity

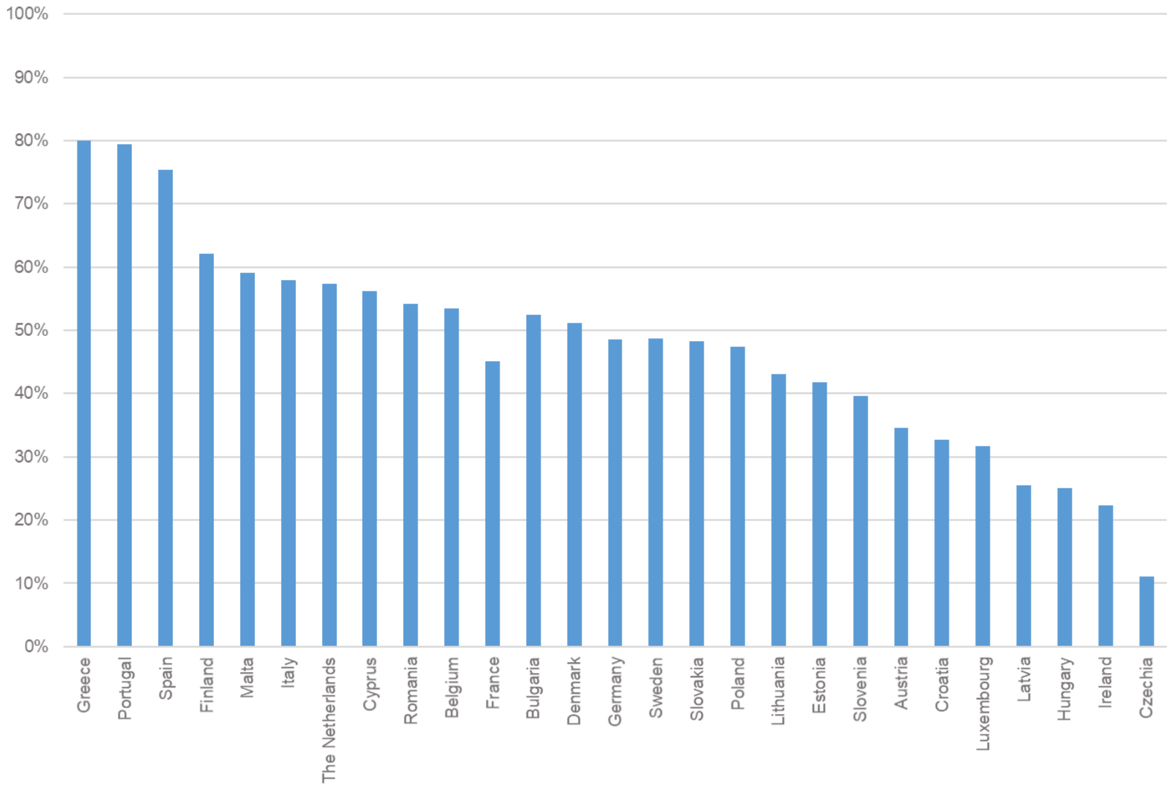
In 2019, the EU-27 exported €5.2 trillion and imported €5 trillion worth of products and services. Intra-EU trade comprised 59% of exports and 61% of import. Germany accounted for the most significant proportion of activity, comprising 23% of intra-EU trade and 26% of extra-EU trade. This was followed by the Netherlands (11% intra-EU trade, 14% extra-EU trade) and France (10% intra-EU trade, 11% extra-EU trade) (Eurostat, 2020b).

In 2019, total exports and imports represented 49% and 46% of EU-27 Gross Domestic Product (GDP), respectively. However, there are signification variations between MS, and some national economies are less reliant upon trade than others. From the figure below, it is clear that Luxembourg, Malta and Ireland are particularly reliant upon trade.

Extra-EU trade by sea

In the EU-27, extra-EU imports and exports transported by sea account for 51% of the total value of traded goods (Eurostat, 2020d). This proportion is much higher for island countries such as Malta and Cyprus, and Greece, as well as countries with significant stretches of coastline, including Portugal, Spain and Italy. In these countries, extra-EU imports and exports transported by sea account for over 50% of the total value of traded goods. Although Ireland is an island economy, the value of shipped imports and exports comprises 22% of total traded goods, due to the high value associated with goods which are transported e.g. via air . This shows that even within island economies, some are likely to be more impacted by a change in the cost of shipping than others. The high value of goods transported via maritime transport to Spain and Portugal can be attributed to their geographical location, as these countries are often the first ports of call in Europe for ships travelling from North and South America, as well as from the west Coast of Africa and South Africa. Extra-EU maritime trade is prominent in the EU's outermost regions, in particular in the regions located in the Caribbean Sea, which have a high maritime transport connectivity with neighbouring third countries.

Figure 82: Extra-EU trade (imports and exports) by sea as a proportion of total extra-EU trade in 2019, measured in €



Source: Eurostat, 2020

Intra-EU trade by sea

As with extra-EU trade, any substantial change in shipping costs will disproportionately affect countries which rely on sea transport rather than other modes to transport in order to import and export products and services within the EU. This is an important factor to examine, as for all EU-27 countries (with the exception of Ireland), intra-EU trade is greater than extra-EU trade (Eurostat, 2020b).

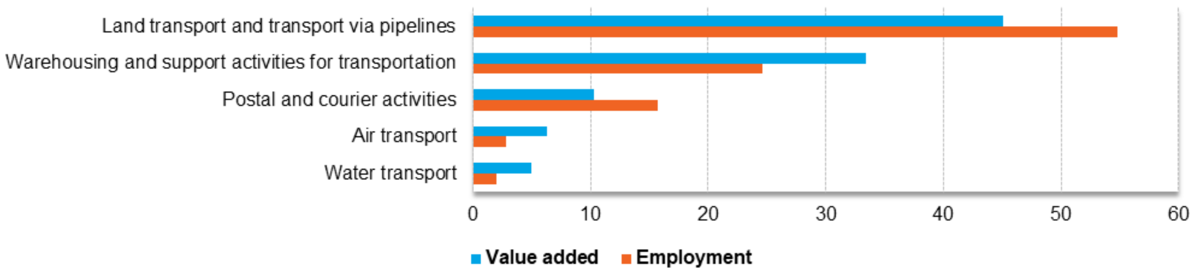
Top cargo port regions

Rotterdam, Antwerp and Hamburg have maintained their positions as Europe's key ports from 2009 to 2019. Of the key ports, seven were located in the Mediterranean (Algeciras, Marseille, Valencia, Trieste, Peiraias, Barcelona and Genova), eight were located in the North Sea region (Rotterdam, Antwerp, Hamburg, Amsterdam, Le Havre, Bremerhaven, Dunkerque and Wilhelmshaven), three ports were located in the Baltic Sea (Göteborg, Riga and Talinn), one in the Black Sea (Constanta), and one on the Atlantic coast (Sines). It is important to note that although some regions are not represented in the top 20 ports, this could be linked to the composition of their national port infrastructure. For example, Denmark and Finland have a relatively high number of medium-sized ports, rather than a lower number of larger ports.

Employment

Given the significance of maritime transport to these port regions, it is important to consider the level of employment in the maritime sector. Employment in water transport comprises the smallest segment of the transportation and storage sector in the EU-27, at 5% (next Figure). However, it is clear that the proportion of value added from the water transport segment greatly exceeds the proportion of employment in the sector. In addition, the water transport subsector recorded the highest wage-adjusted labour productivity in 2017, with apparent labour productivity equivalent to 230% of average personnel costs (Eurostat, 2020f).

Figure 83: Sectoral analysis of transportation and storage value added and employment in the EU-27 in 2017 (% share of sectoral total)



Source: Eurostat, 2020

Specific climatic conditions

From the stakeholder consultation, the Swedish Shipowners Association indicated the importance of accounting for the cost burdens faced by countries in/near the Arctic region, particularly during the winter. They noted that it is important to cover measures on how to mitigate any negative consequences derived from an EU ETS for ships operating in winter conditions, for instance, in the Baltic Sea.

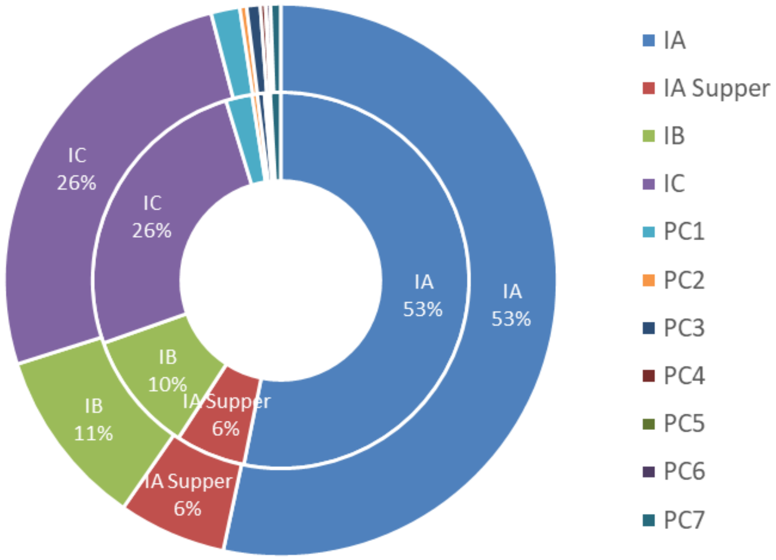
Similarly, the Confederation of Finnish Industries stated that Finland's foreign trade depends heavily on maritime transport, due to its geographic situation (80% of foreign trade is associated with maritime transport). They noted that their maritime operators are challenged by Arctic winter conditions, which add an additional cost burden. Given this, they have some concerns that a cost increase in maritime transport associated with the proposed policy options may result in carbon leakage in industrial sectors and transport routes, as well as a transition to land transport where possible, due to the sensitivity of the region to increasing maritime sector costs.

According to information transmitted by Finnish stakeholders, ice-strengthened ships may consume 20% to 60% more fuel depending on their route when sailing in ice covered waters in the Baltic Sea area, in comparison to sailing in the same area under open water conditions. In addition, due to their hull form and propeller being less optimal for operation in open water, ice-strengthened vessels may on average consume approximately 2-5% more fuel in open water conditions than ships designed solely for sailing in open water. Ice strengthening also reduces a ships capacity, meaning they are capable of transporting less freight per voyage than a ship of similar size which has not be ice-strengthened.[28] However, data in the literature about the effect of ice class vessels on energy consumption is limited, with diverging results.

Based on a recent analysis (Ricardo 2021), carbon pricing would result in minor additional commodity prices for goods transported in ice-strengthened vessels, assuming 6 months of ice-navigation per year and a range of ad valorem transport costs between 1% and 15%. In this sense, the competitiveness of industry sectors reliant on maritime transport in Nordic and Arctic regions is not expected to be significantly affected in general terms.

According to data from the EU maritime transport MRV regulation, 17% of the monitored ships voluntarily reported Ice Class in 2019, compared to 16% in 2018. More than half of these ships have ice class IA, which means that they are capable of navigating in difficult ice conditions, with the assistance of icebreakers when necessary.

Figure 84: Distribution of reported ice class in the EU maritime transport MRV regulation (Inner-circle 2018, Outer-circle 2019)



Source: EMSA, data from the EU maritime transport MRV Regulation

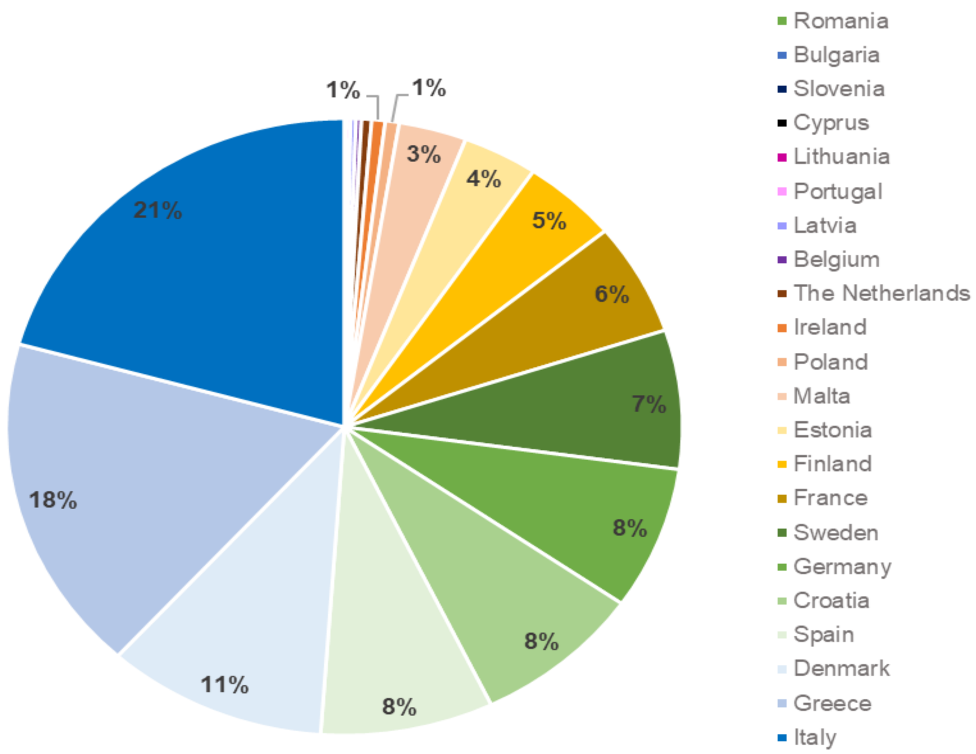
[28] Besides fuel consumption, shipping in Arctic regions requires additional investments in hull construction, specialised seafarers and additional insurance to cover for risks associated with icebergs and ice sheets, resulting in higher capital, labour costs and insurance costs than normal (Solakivi, Kiiski, & Ojala, 2018) (Solakivi, Kiiski, & Ojala, 2019). However, these additional costs would not be affected by the carbon price and have not been considered.

In addition, the EU maritime transport MRV regulation gives the possibility to companies to report on a voluntary basis the distance travelled and the time spent at sea when navigating through ice. However, in 2018 and 2019, less than 0.01% of the reported distance travelled was categorised as "distance travelled through ice".

Sea passengers

In addition to freight ships, passenger ships (e.g. ferries and cruise ships) will also be affected by all policy options under consideration. In 2019, 419 million passengers embarked and disembarked in EU-27 ports. Italy and Greece are the focus of this activity, together accounting for 38% of all passengers. This is followed by North Sea countries (Denmark, Sweden and Germany), as well as Spain and Croatia. These figures indicate the prominent role of these countries as sea passenger hubs in Europe, pointing to the economic importance of passenger shipping to their economies.

Figure 85: Passengers embarked and disembarked in all port

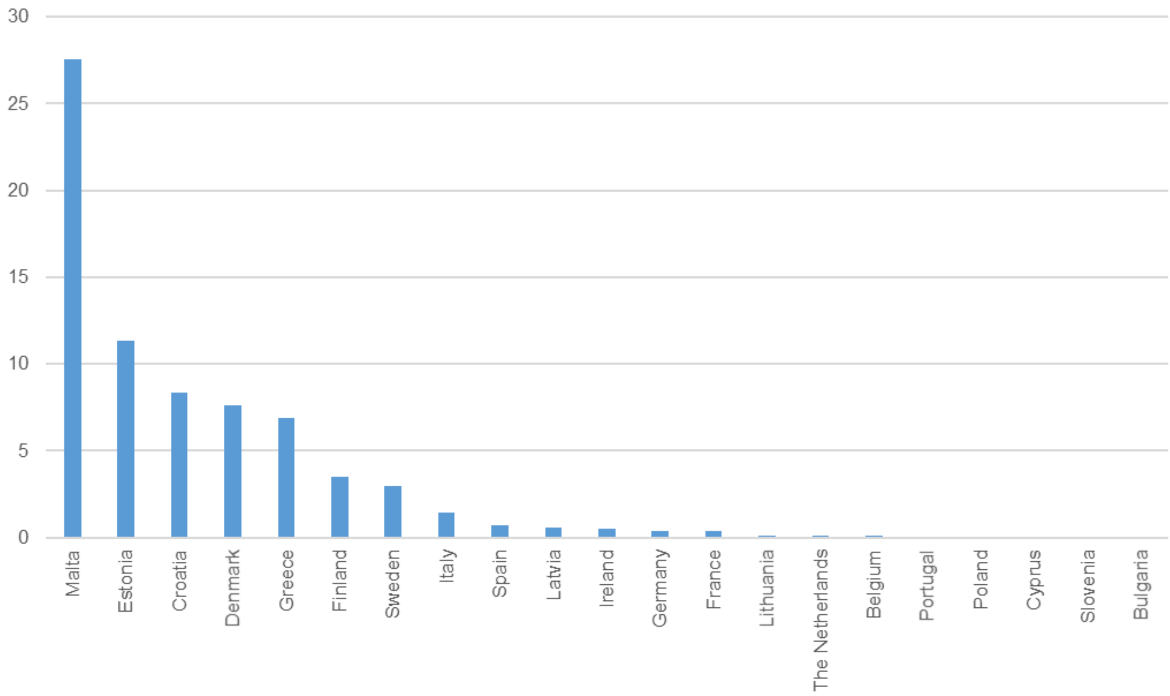


Source: Eurostat, 2020

A number of countries in the Mediterranean region, as well as in the Baltic regions have passenger transport linked to maritime tourism. Maritime tourism is the biggest maritime sector in terms of gross value added and employment (European Commission, 2020).

The number of passengers per inhabitant is particularly high in Malta, Estonia, Croatia, Denmark and Greece. This indicates that these countries are more reliant upon sea passenger traffic activity than other MS. This is likely to be linked to tourism, as maritime passenger travel is largely used by tourists. These MS, their maritime tourism industries, and their maritime passengers (should costs be passed on) are likely to be more sensitive to a change in the cost of maritime travel associated with the proposed policy options, than other MS.

Figure 86: Number of passengers embarked and disembarked per inhabitant, in 2019



Source: Eurostat, 2020

33.5 Economic impacts on imports/exports and sectors heavily dependent on shipping and ports

An increase in the maritime transportation costs associated with the payments of ETS allowances or carbon taxes along with the cost of abatement measures (e.g. alternative fuels) has different effects for upstream and downstream economic sectors in the EU. The impact on downstream sectors is driven by the direct effect of increasing the transportation costs of the final product and by the indirect effects of increasing the production costs of intermediate inputs.

Overall, all policy options will have greater impacts on the primary (e.g. agriculture and fishing) and secondary (e.g. manufacturing) sectors rather than the (tertiary) service sector, as most shipping activity is for the transport of goods and raw materials. Aside from services related to the shipping industry, the main service sector which may directly benefit from measures is tourism through the changes in the cost of operating cruise ships and ferries.

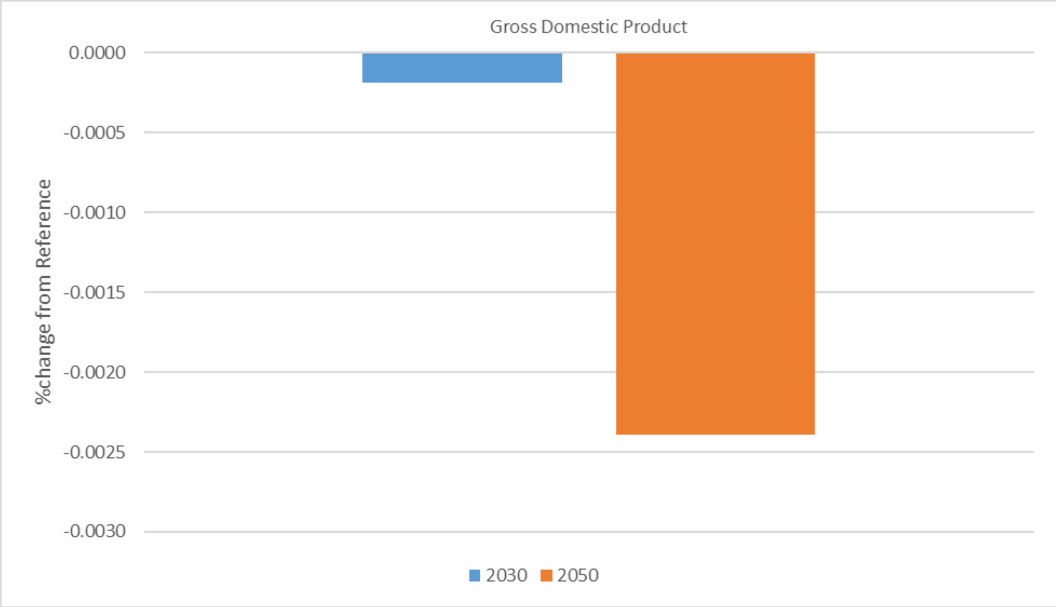
For the affected sectors, changes in commodity prices as a result of increased maritime transport costs that are estimated to range between 0.2% to 0.8% in 2030 and even changes up to 2% expected for 2050 are not expected to be noticeable by the consumer to the extent so as to drive significant changes in their behaviour. Usually, these price changes are within the expected price volatility of a commodity that is driven by non-structural or permanent changes. In this study, to assess the potential macroeconomic effect of carbon pricing measures, it is assumed that economic agents are fully informed, and the outcome depends on behavioural features and technological and income constraints. The response of EU firms and consumers to higher maritime transportation costs has been quantified through the large scale applied CGE model GEM-E3. This estimates the impact of changes in maritime transportation costs on EU Gross Domestic Product (GDP), sectoral production and employment.

The overall net impact on the EU-27 Gross Domestic Product (GDP) as a result of increased maritime transport costs is expected to be marginal (see figure below). In 2030 the GDP is expected to decrease by 0.0002%, while, in 2050 the drop would be larger at 0.002%. This would represent a loss of GDP in absolute terms in 2050 of around €1 bn.

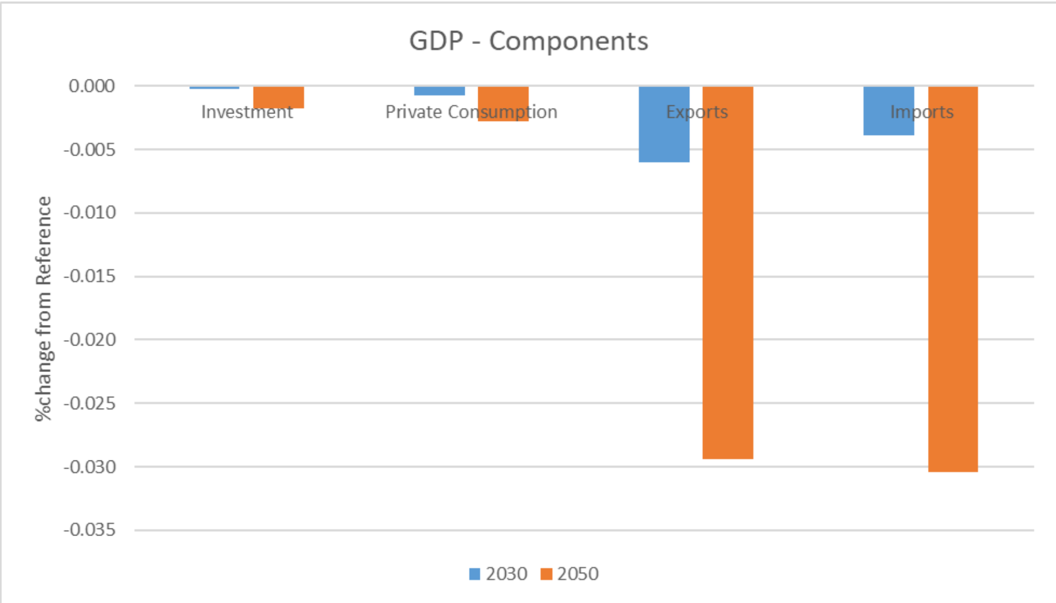
Increasing transportation costs for goods exported to the EU acts in favour of EU domestic production. As a result, imports into the EU would decrease as consumers increase their demand for domestically produced goods. Exports would decrease both due to higher maritime transportation costs and due to higher domestic production costs, as more expensive imports would increase the production costs in the EU indirectly. The shift to more expensive domestically produced and imported goods would increase production costs and decrease households' disposable incomes, which lowers private consumption. The expected changes in imports (€2.2 bn loss in 2050) and exports (€2.4 bn loss in 2050) approximately cancel out each other, hence the overall impact on GDP is even smaller. The results are in line with empirical findings regarding the responsiveness of demand and economic growth to changes in freight rates (Michail, 2020).

It should be noted that the analysis does not take into account the positive impact to the economy that any potential recycling of the ETS or carbon tax revenues would have. Many studies have shown the benefits of ETS recycling schemes, which tend to generate a double dividend.

Figure 87: Impact on a) EU 27 GDP and b) GDP components in 2030 and 2050 as a result of the measure compared to the baseline



a)



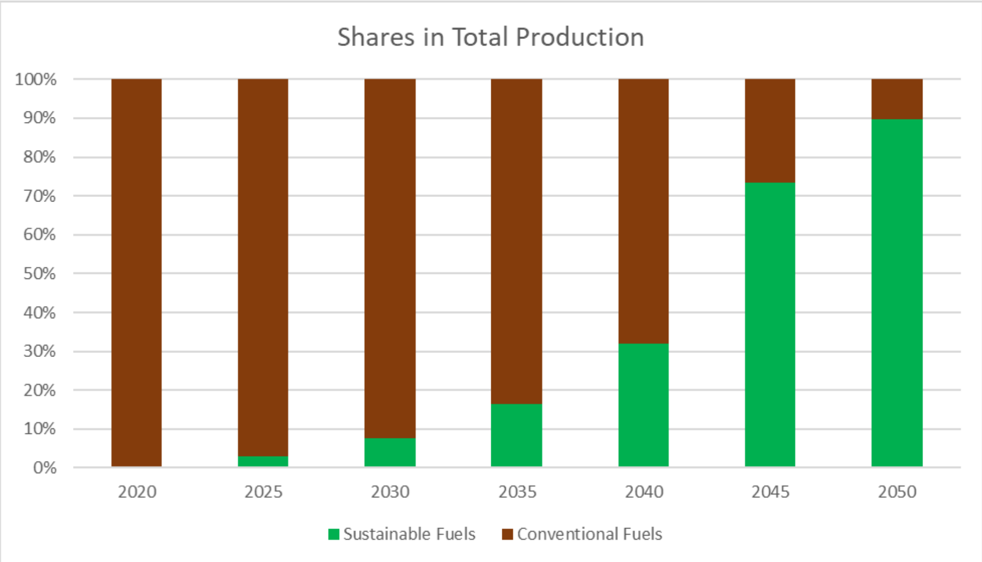
b)

Source: GEM-E3, E3Modelling

The impact on sectoral production (sales by industry) is also generally rather small, but it varies substantially across sectors. Sectors related to the fuel supply chain are expected to reduce their production more than any other sector as carbon pricing drives fuel substitution and energy efficiency improvements on the maritime sector and to a lesser extent due to increasing transportation costs. Goods produced in the EU that are sold within the EU market are favoured by the imposition of a carbon price on maritime GHG emissions as this essentially increases the transportation costs for imported goods leading to higher substitution towards EU production. As the energy intensive industries of the EU are already under the EU ETS and have assimilated the carbon price in their cost structure, the additional cost from transportation increases their overall costs only marginally (i.e. the change in relative prices is larger for imported goods that do not reflect any carbon pricing in the costs structures). In particular the pulp & paper, chemicals and iron & steel sectors that operate under the EU ETS would gain a comparative advantage if the transportation costs of competing imported goods rise. The exports of these goods would not be affected as much because the ETS carbon price has already been assimilated in their cost structures and the additional effect from maritime emissions carbon pricing is relatively small.

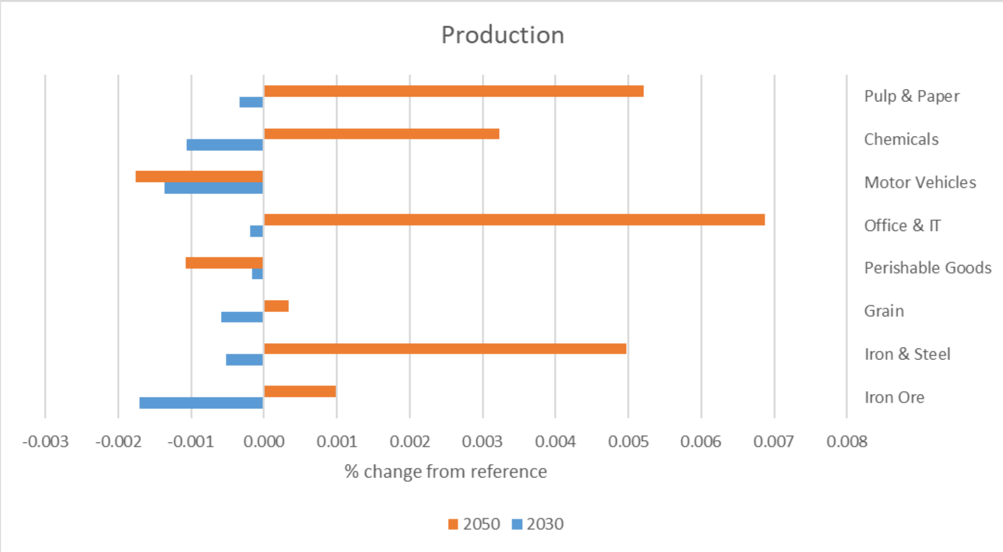
For downstream products, like motor vehicles and perishable goods, the indirect increase in their production costs would lead to lower EU domestic demand. In 2030 the impact on production is expected from the modelling to be virtually zero. In all sectors, very small reductions in all sectors are observed as changes in prices are not sizeable enough to lead to any substitutions and hence they mostly incur additional costs. It should be noted however that while the above discussion focuses on some key mechanisms and trends in production, the absolute impact is negligible.

Figure 88: Evolution in the production of fuels for the maritime sector



Source: GEM-E3, E3Modelling

Figure 89: Impacts on the production of affected sectors as a result of the measure compared to the baseline in 2030 and 2050 in the EU 27



Source: GEM-E3, E3Modelling

Ports play an essential role in reducing GHG emissions from shipping and many ports in the EU have already developed specific programmes to reduce their carbon footprint (ESPO, 2020). At the same time, the competitiveness of some EU ports vis-à-vis non-EU neighbouring ports may be affected by the introduction of the measure.

As per their response to the Inception Impact Assessment, the European ports organisation ESPO expects that transhipment ports, especially Mediterranean ports and ports in the North Sea would be most impacted by the introduction of the measure. Mediterranean transhipment ports (e.g. Algeciras, Valencia) face the competition of ports in North Africa, which would not be subject to the carbon pricing measure. From their side, ports in the North Sea undertaking transhipment operations (e.g. Rotterdam, Antwerp) may increasingly face competition from British ports after UK's withdrawal from the EU as these are no longer subject to the measure. As described in detail in the transhipment case study for Algeciras, transhipment operations are very cost-sensitive and largely depend on the commercial policies of ports in competition (i.e. port fees), available capacity and economies of scale of transhipment operations.

The extension of the measure to extra-EU journeys is expected to cause a higher impact on the competitiveness of EU transhipment ports as international routes calling at EU ports for transhipment operations would be more severely affected and may opt to switch to neighbouring non-EU ports for their large scale transhipment operations.

As regards shipbuilding, although the EU's market share in terms of volumes has declined over the years, the EU has succeeded in retaining a position by building more complex ships with a relatively higher value added, while the production of more standard mass production ships moved to other countries, especially in Asia. The EU also has a relatively strong position in the ship repair market and in the marine equipment sector which supplies ship construction.

At the European level, it still remains an important source of jobs and economic activity in the regions where it does take place. The main concentrations of large ship yards are in Germany, Croatia and Romania, followed by Finland and Spain.

A measure to address GHG emissions of ships will lead to an increase of demand of retrofitting, as well as of high value marine equipment. Therefore, any policy option should lead to net benefits for regions and sectors dependent on shipbuilding. The highest net benefits would be provided by policy options with the highest in-sector emission reduction required.

34 CUMULATIVE REVENUES GENERATED OVER THE PERIOD 2020-2050

For the period 2020-2050, cumulative additional revenues for public authorities are estimated in the table below. Despite higher carbon prices in the long-term, the carbon costs and therefore the revenues would tend to decrease over the years due to lower CO_2 emissions.

Table 59: Cumulative additional total revenues generated 2020 - 2050 by policy options (billion Euro 2015)

POLICY OPTIONS	ETS/ tax revenues in the period 2020-2050 (billion EUR 2015)
MAR1 –MINTRA	37 b EUR
MAR1 _MEXTRA50	74 b EUR
MAR1-MEXTRA100	111 b EUR
MAR2 or MAR3 - MINTRA	124 b EUR
MAR4_-MEXTRA50	74 b EUR

Source: PRIMES Maritime module

35 IMPACTS ON INNOVATION, POTENTIAL TO STIMULATE THE UPTAKE OF ALTERNATIVE FUELS AND INNOVATIVE TECHNOLOGIES

The uptake of innovative technologies and sustainable alternative fuels is key to enable the transition towards a zero-emission waterborne transport, as recognised by the vast majority of stakeholders from the sector.

In general, carbon pricing can contribute to innovation by making innovative solutions more cost-effective compared to conventional technologies and by using possible revenues to finance dedicated research and innovation activities.

In this context, it is expected that all policy options would drive innovation in energy efficiency technologies and support the deployment of solutions such as hybridisation, wind assistance propulsion, air lubrication or waste heat recovery as their marginal abatement cost would become negative on the short-to mid-term[29]. In addition, all policy options would further accelerate the uptake of renewable and low-carbon fuel, in particular MAR2 and MAR3.

All policy options would also trigger a significant amount of revenues that could contribute to support innovation, in particular through the Innovation Fund for the ETS options.

The ability of all policy options to trigger innovation is illustrated in the model by an acceleration of hydrogen and electric ships by 2050 compared to the baseline.

36 IMPACTS AT GLOBAL LEVEL

36.1 Impacts on trade

The implementation of a maritime carbon pricing measure at EU level on maritime transport emissions may have an impact on trade flows with third countries. However it is only expected to impact commodities with very low weight to value ratio (i.e. commodities with high weight and low value). The table below presents the top global trade partners, their proportion of trade with the EU and the value to weight ratio of their main trade flows. The majority of the main global trade partners have a significant share of their export and import trade flows with the EU, but only those where the main export products have a low value to weight ratio (i.e. Russia, China, India) may be affected.

[29] According to the 4th IMO GHG Study, the marginal abatement cost of these solutions are estimated between 6 to 105 USD/tonne CO_2

Table 60: Top global trade partners (in value) and share of imports and exports values from and to the EU in 2019, including all freight transport modes

	Imports		Exports	
Trade partner	% Imports from EU 2019	Value to weight ratio of main imports from EU	% Exports to EU 2019	Value to weight ratio of main exports to EU
China	13%	High	15%	Medium-high
United States of America	18%	High	16%	High
Japan	11%	High	10%	High
United Kingdom	49%	High	46%	High
Hong Kong	5%	High	7%	High
Korea, Republic of	10%	High	9%	High
Mexico	10%	High	4%	High
Canada	11%	High	5%	High
India	9%	High	15%	Medium-high
Singapore	10%	High	8%	High
Russian Federation	9%	High	42%	Low

Source: Ricardo analysis based on UNCTAD trade data

Typically, maritime routes, especially container traffic, are organised in multiple port calls, which means that even if the measure is only applied to intra-EEA journeys, trade flows with third countries could be potentially affected by the EU measure if there are more than one port call in the EEA. However, the impact on third countries will be very limited. The inclusion of extra-EEA journeys in the scope of the measure would increase the possible impacts on trade flows with third countries in case carbon pricing leads to a substantial increase in international transport costs.

36.2 Impact on global climate actions.

While the IMO often needs up to seven years or more between the decision to develop a new mandatory IMO instrument and its entry into force (Kachi, Mooldijk, & Warnecke, 2019), the adoption of EU measures could potentially impact the IMO discussions on mid and long term measures to address GHG emissions. The position of IMO Members could change in two different ways:

- **Support the adoption of a global market-based measure**: The EU adoption of a regional carbon pricing scheme could accelerate the adoption of candidate measures of the IMO Initial Strategy and, particularly, a global market-based measure led by the IMO. This is because the existence of a feasible regional carbon pricing mechanism may improve the situation of those who want to price shipping emissions, while simultaneously reducing the pay-offs for those that are against the measure (Dominioni, Heine, & Martinez Romera, 2018). The example of the aviation sector demonstrates that adoption of regional measures such as inclusion of aviation in the EU ETS accelerated global agreements such as the adoption of CORSIA by ICAO in 2016. Similarly, the adoption of the maritime transport EU MRV Regulation has accelerated the implementation of an equivalent fuel consumption reporting scheme at global level, the IMO DCS.

- **Refrain from implementing a global market-based measure and support the development of multiple regional market-based measures:** The introduction of carbon pricing measures in the EU for the maritime sector could discourage some third countries to push for global measures and it could encourage others to establish their own regional measure. However, there are numerous examples of EU initiatives leading to the adoption of IMO measures rather than multiple regional measures and the risk of having a patchwork of uncoordinated regional regulations would also be discouraged by the maritime transport industry. The European Commission also aims to advance discussions on market-based instruments as a medium-term measure at IMO, as explained in the Sustainable and Smart Mobility Strategy[30].

A general principle from economic contract theory is that for negotiations based on unanimity, parties will prevent the achievement if the pay-off is lower in the agreement than in the current status quo (Dominioni, Heine, & Martinez Romera, 2018). The supporting study from RICARDO compared the pay-off of supporting a global measure or pursuing a separate regional measure under the status quo and under the EU action for the following clusters of countries: main global trading partners, oil exporters, neighbouring countries and developing countries. This political economy analysis suggests that most of the analysed clusters are more likely to agree on a global market-based measure once the regional measure at EU level is implemented. The only exemption being neighbouring countries, which may benefit from potential spill overs of the regional approach. The incentives to achieve an international agreement are greater

[30] COM(2020) 789 - Sustainable and Smart Mobility Strategy – putting European transport on track for the future.

the larger the GHG emissions coverage of the EU measure (Dominioni, Heine, & Martinez Romera, 2018).

If a global market-based measure is adopted after the European one, there are a number of scenarios on how they could interact (this was also considered for aviation[31]). The EU could decide to amend its measure upon implementation of the global measure to avoid double regulation. The European Commission for instance proposed to amend the EU maritime transport MRV regulation to align it with the data collection system developed by the IMO where appropriate. The two measures could cover different scopes. For instance, the IMO measure could be applied at global level but exempt the emissions covered under the EU system. Other linking approaches could be envisaged. In the case of a cap-and-trade scheme, which has obvious similarities with the ETS, emissions allowances could be possibly made fully fungible or there could be limited fungibility (e.g. up to a certain amount or only one-way). In the case of an emissions tax or levy, the link would be harder. Still, the instruments could be coordinated, e.g. by exempting EU related emissions from all or part of the global emissions tax, by using free allowances or by aligning the rate of the global emissions tax with the allowance price in the EU ETS.

36.3 Impacts on LDC and SIDS

Overall, the EU amounts to 11% of the value of imports into SIDS and LDCs. Imports into SIDS and LDCs from Europe tend to be for oil products, food or machinery. The table below shows the top ten LDCs and SIDS in terms of import share from the EU. Cabo Verde and São Tomé and Principe, which are designated as SIDS, have a large dependency on European imports, with more than 60% of their imports coming from the EU. Countries designated as LDC and mostly located in Africa have also more than one third of their imports with origin in the EU and may also be affected by the measure.

Table 61: Main LDC and SIDS importers from the EU

Country	SIDS/LDC status	% Share of imports from the EU
Cabo Verde	SIDS	76%
São Tomé and Principe	SIDS and LDC	60%
Guinea-Bissau	SIDS and LDC	47%
Senegal	LDC	40%
Central African Republic	LDC	40%
Chad	LDC	37%
Niger	LDC	36%

[31] SWD(2017) 31

Cuba	SIDS	33%
Togo	LDC	33%
Guinea	LDC	33%

Source: UNCTAD trade data 2019

A similar behaviour is found for exports, with 12% of overall exports from SIDS and LDCs being shipped to the EU-27. As shown in the next table, some LDCs and SIDS have a significant share of their exports to the EU, which means that their exports could be affected if the increased cost of shipping leads to lower demand levels in the EU or where they are being priced out in comparison to other exporters with lower shipping costs (e.g. closer to the EU market). Cabo Verde and São Tomé and Principe have also a large dependency with the EU in terms of exports, which makes them particularly vulnerable to changes in shipping costs to and from the EU. Open registry states like the Marshall Islands, Liberia and the Bahamas are also among the top exporters to the EU.

Table 62: Main LDC and SIDS exporters to the EU

Country	SIDS/LDC status	% Share of exports to the EU
Cabo Verde	SIDS	83%
São Tomé and Principe	SIDS and LDC	70%
Marshall Islands	SIDS	62%
Liberia	LDC	57%
Antigua and Barbuda	SIDS	50%
Bangladesh	LDC	46%
Guyana	SIDS	46%
Comoros	SIDS and LDC	46%
Bahamas	SIDS	39%
Malawi	LDC	38%

Source: UNCTAD trade data 2019

However, these export and import data doesn't differentiate direct voyages from voyages with intermediary ports calls. In the cases of indirect export or imports (with an intermediary port call), the carbon pricing would be limited to a portion of the emissions, therefore limiting the impacts on these trades. A recent study indicated that for the MEXTRA50 scope under actual carbon prices the transport cost for containers for a voyage between Spain and Singapore will be increased by 0,5 to 1%[32].

Third countries could also be indirectly affected by the measure if their trade flows with non-EU countries use EU ports as transhipment hubs. For containerised cargo, 12% of the total traffic in TEUs moving between EU countries and non-EU countries transits

[32] T&E study 2020 : all aboard!

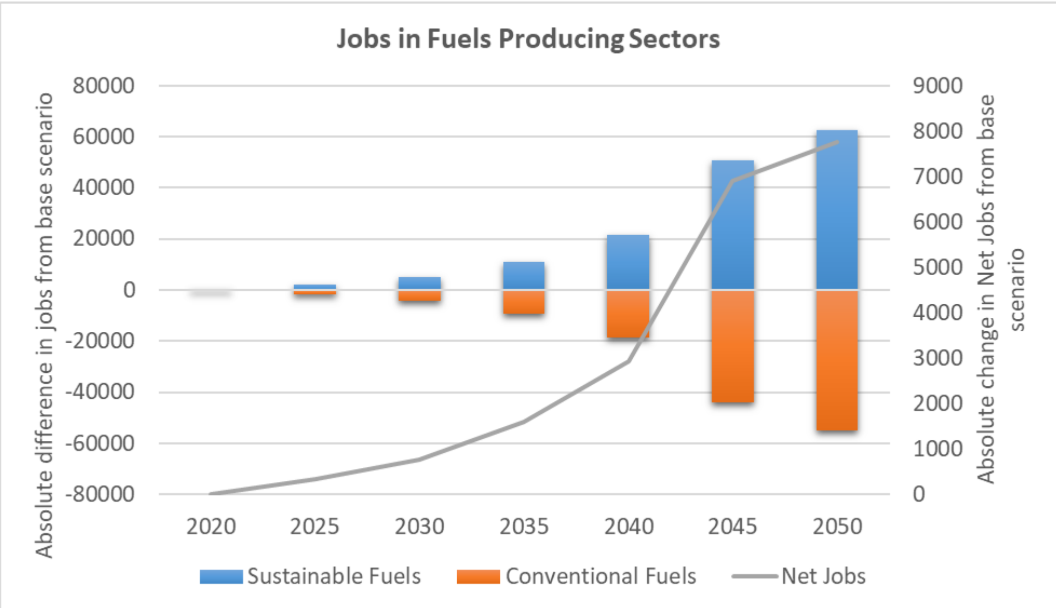
through EU ports but neither originating from EU countries nor destined for EU countries (World Shipping Council, 2020). Containerised products however tends to have a relatively high value, the effect on the final price of the commodity for imports and exports with non-EU partners transiting via EU ports is expected to be marginal. A portion of these shipments would originate from or be destined for LDCs, especially in North and West African locations, which are more likely to be connected through feeder services to EU ports due to their proximity. In that case the MINTRA scope would also have impacts on trade between SIDS and LDCS with non-EU countries, but these are considered rather limited. Impact on SIDS and LDCs will increase with the geographic scope, as with the carbon price. MAR2 and 3 are expected to have more impacts than MAR1 and 4.

37 Social impacts

37.1 Impacts on employment

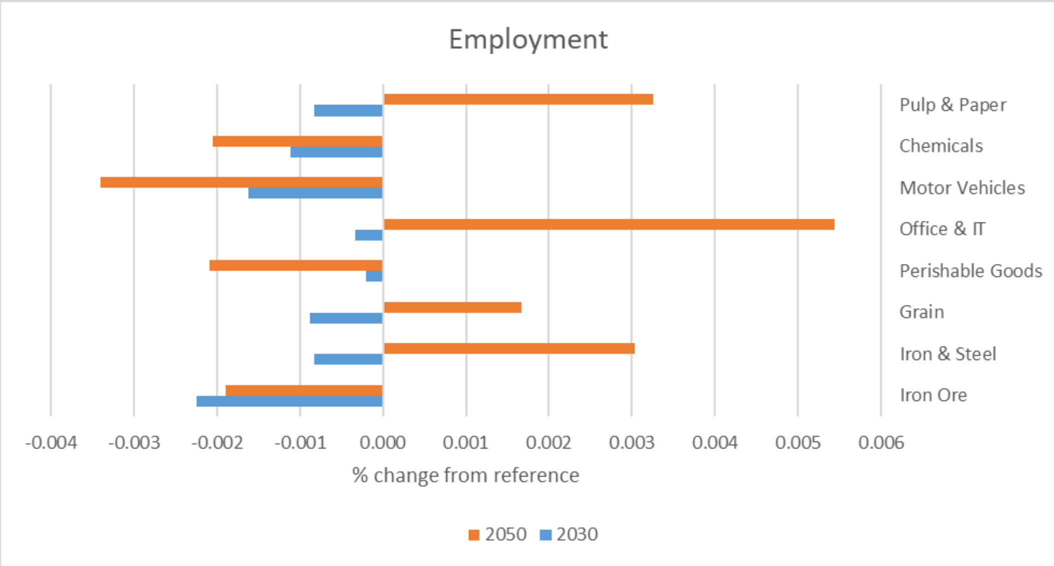
As described in Section 6.2.3.1, the changes in employment for fuel suppliers and other sectors which rely on shipping for trade are limited, as shown below (based on the MAR1 MEXTRA50 option).

Figure 90: Impacts on the employment of fuel suppliers as a result of the measure compared to the baseline in 2030 and 2050 in the EU 27



Source: RICARDO 2021

Figure 91: Impacts on the employment of non-energy sectors as a result of the measure compared to the baseline in 2030 and 2050 in the EU 27



Source: RICARDO 2021

As demonstrated above, the net impact of employment on the energy sector is positive over the period 2025-2050 as the fossil fuels are substituted by sustainable fuels, which are expected to be mostly produced within the EU.

With regard to all other sectors, impacts on employment will be negligible or slightly negative by 2030 and positive by 2050 for all but two sectors. The motor vehicles and perishable goods sectors will likely suffer the greatest negative impacts on employment by 2050, but again this impact will be very small, from about -0.002 to -0.004%.

37.2 Impact on vulnerable households

To assess the impact on vulnerable households, a differentiation has been made by household income class depending on the consumption pattern and sources of income of each class. The GEM-E3 model identifies income classes by deciles.

- **Income effect:** The skillset and the different sources of income (i.e. wages, dividends, rentals etc.) for each household class determine the size of impact. Changes in the sectoral production and employment affect household income. Low income classes derive their income mainly from wages while high income classes both from wages and dividends.
- **Price effect: higher prices reduces consumers' disposable income.** Depending on the consumption patterns the increase in prices of different commodities affects differently each income class.

The overall impact on welfare is negative but small as it can be seen in the table below.

Table 63: Change in Welfare by Income Decile (EU-27 – Hicksian Equivalent Variation – D1 is the lowest income decile)

	In €m		% of Income	
1	-1.3	-82.1	-0.0003%	-0.015%
2	-2.9	-109.2	-0.0005%	-0.015%
3	-4.0	-134.0	-0.0005%	-0.013%
4	-5.8	-168.5	-0.0005%	-0.013%
5	-8.3	-191.0	-0.0006%	-0.012%
6	-7.8	-247.8	-0.0005%	-0.013%
7	-10.0	-289.2	-0.0005%	-0.012%
8	-11.5	-343.0	-0.0005%	-0.012%
9	-11.0	-431.7	-0.0004%	-0.011%
10	-14.5	-924.4	-0.0002%	-0.011%

Source: RICARDO 2021

38 CASE STUDIES EXPLORING THE POTENTIAL RISK OF CARBON LEAKAGE LINKED TO THE MARITIME POLICY OPTIONS

Objectives and scope

Three detailed case studies building upon the support study carried out for this impact assessment (E3M/ Ricardo forthcoming) explored the possible impacts of the maritime policy options on selected regions, routes and vessel types, in particular as regards the potential risks of policy evasion (through evasive port calls, or transhipment at non-EU hubs) and policy avoidance (through modal shift).

In order to explore the potential impacts for specific regions and routes, the following case studies have been selected:

- A **modal shift** case study: assessing the potential for shifting from short-sea shipping (SSS) to road transport between the port of Barcelona (Spain) and the port of Civitavecchia (Italy);
- A **transhipment** case study: assessing the potential for container ships to use Tanger Med (Morocco) as an alternative transhipment hub to the port of Algeciras (Spain);
- An **evasive port call** case study: assessing the potential for shipping operators to engage in evasive non-EU port calls along routes ending at the port of Piraeus (Greece), port of Algeciras and the port of Rotterdam (the Netherlands).

38.1 **Methodology**

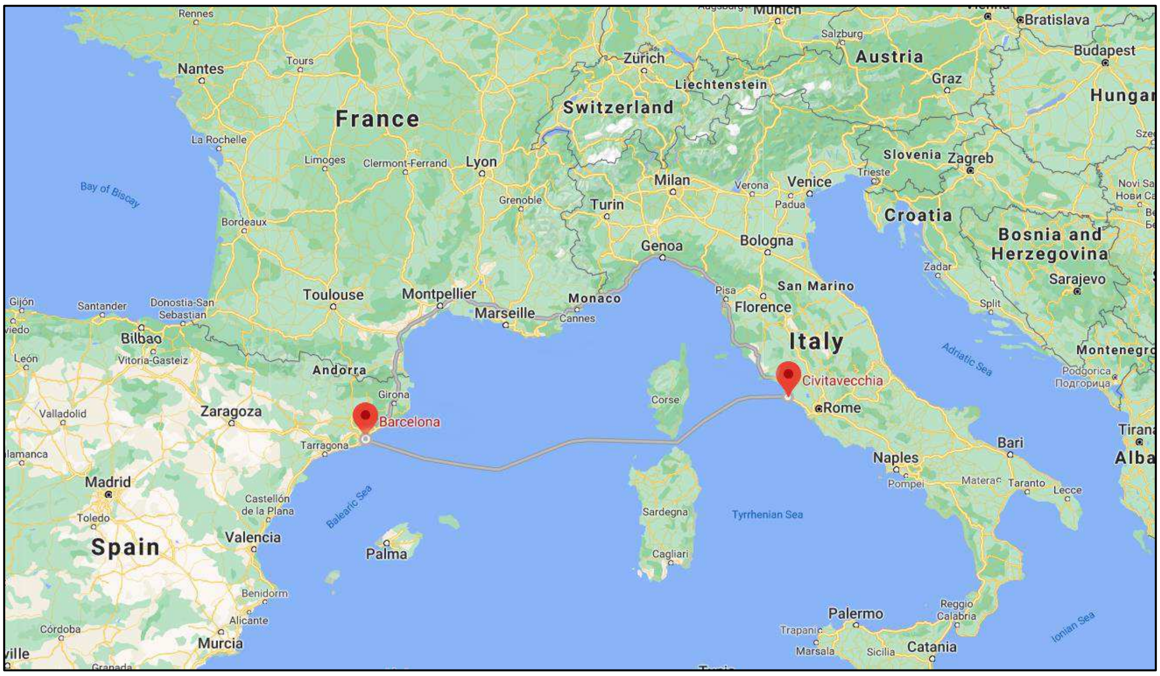
The methodology followed for undertaking the cases studies draws upon the analysis undertaken in the main impact assessment support study, and reflects the approach taken in the 2013 Impact Assessment supporting study[33]. Where specific input data were available on the routes considered, such as distance travelled and speed of vessels, these have been integrated into the calculations. Where possible, assumptions have been refined, through use of more specific data. A thorough review of the relevant literature was conducted, focusing on the potential for modal shift, transhipment and evasive port calls, as well as the specific regions and routes considered. The literature has informed the assumptions and results presented in the respective case studies.

38.2 **Modal shift case study**

This case study focused on assessing the risk of modal shift away from Short Sea Shipping (SSS) freight transport to road freight, as a result of introducing policy measures to control maritime GHG emissions in Europe and in the case road transport is not covered by similar carbon pricing. The Ro-Pax service between Barcelona and Civitavecchia provides a suitable example where maritime transport is in competition with road freight transport, with the existing service running six days a week and taking approximately 20 hours. In addition, to promote maritime transport and due to expected growth along the route, CEF funding aims to support the infrastructure associated with the respective ports in order to drive Ro-Pax traffic further.

[33] Support for the impact assessment of a proposal to address maritime transport greenhouse gas emissions https://ec.europa.eu/clima/sites/clima/files/transport/shipping/docs/ghg_maritime_report_en.pdf

Figure 92: Barcelona – Civitavecchia route



The resulting cost for the open ETS and closed ETS scenarios for this route and the increase in total costs is presented in the table below, assuming no administrative costs for the operator associated with complying with the policy option. The carbon price is assumed to be respectively 45.5 EUR/ton CO_2 and 268 EUR/ton CO_2. The fuel price is estimated at 480EUR per ton of fuel and the consumption per trip of 106 tons of fuel. For the selected route and vessel, the average speed travelled is 21 knots and the gross tonnage is 50.000.

Table 64: Total cost per trip for shipping operators

Parameter	Unit	Value
Total cost of trip without carbon pricing	€m	€ 0.14
Total cost of trip with open ETS	€m	€ 0.15
Total cost of trip with closed ETS	€m	€ 0.19
Increase in total cost of trip with open ETS	**%**	**7**
Increase in total cost of trip with closed ETS	**%**	**36**

Source: RICARDO 2021

An increase in the total cost of the trip could result in an increase in the modal share of road transport. In line with the Comi and Polimeni (2020) study, a 10% cost increase would cause a 3.1% increase in the modal share of road transport, a 7% increase in total costs would result in a potential 2% increase in road modal share, and a 36% increase in total costs would result in a 11% increase in road modal share.

However, modal choice for freight transport depends on a range of factors, including transit time, cost, and flexibility. Although there is the potential for road transport to offer an alternative to SSS along this route, practical obstacles could limit the shift from SSS. Freight operators are already likely to have invested in the use of the SSS route, and would face sunk costs from returning to the use of road transport. In addition, it is necessary for road hauliers to comply with EU legislation, including HGV speed limits and daily driving limits. These legislative measures limit the potential time and cost savings which could be associated with switching back to road transport, as it is likely that either two drivers would be required to complete the route, or a single driver would need to complete the trip over two days.

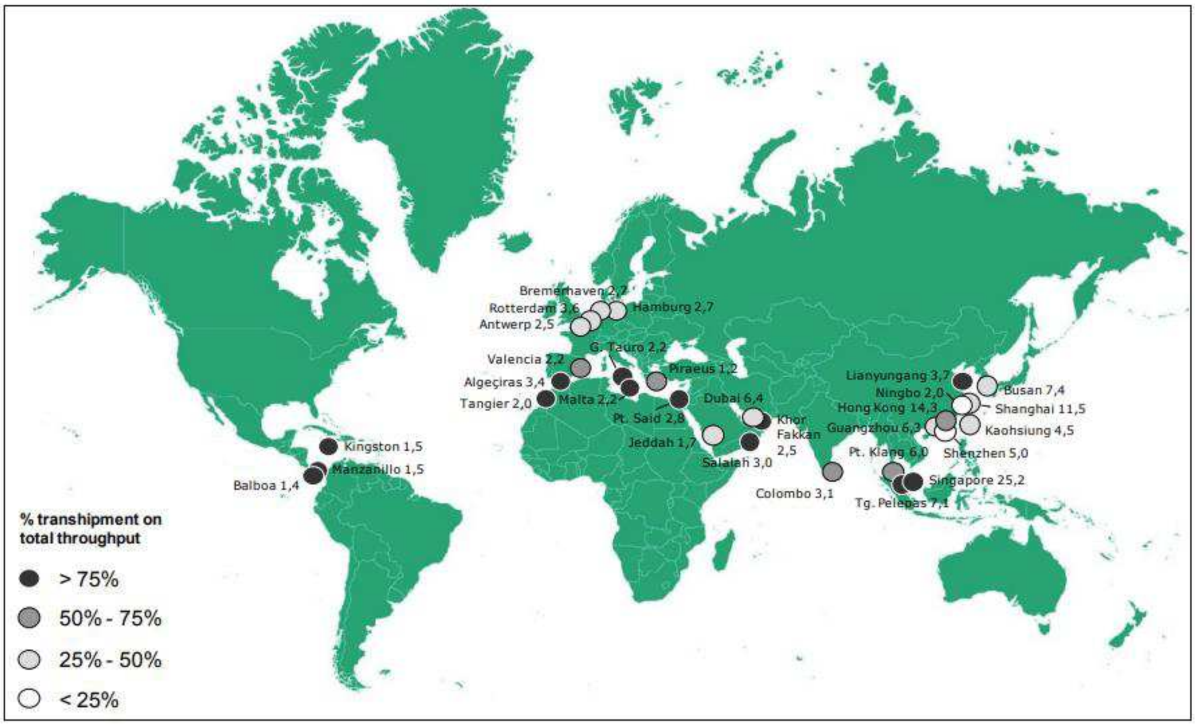
In addition to these operational obstacles associated with the potential shift back to road transport, the use of the Ro-Pax route aligns more closely with the EU's strategic objectives to encourage the use of alternative modes. The cost associated with SSS is also of primary significance in regard to modal choice. As shown before, there is potential for the policy options to have an impact on fuel costs, and hence on the total costs associated with SSS. However, assuming a cross elasticity of 0.31 for shifting from SSS to road, the impact of the increase in total costs of SSS is likely to have a small impact on road modal share along the route in the case of an open ETS (MAR1 or MAR4), and a more significant impact in the case of a closed ETS or a tax (MAR2 and MAR3).

38.3 **Transhipment case study**

Transhipment is the *'unloading of goods from one ship and its loading into another to complete a journey to a further destination'* (Eurostat, 2016). The emergence of containerisation since the 1960s has resulted in the **development of new port connection structures**, such as transhipment, which emerged to optimise resources and benefit from economies of scale (Grifoll, Karlis, & Ortego, 2018)

In line with this, container shipping lines are increasingly sending their vessels to intermediate locations, between the origin and destination, where containers are transhipped. According to Ducruet and Notteboom (2012), on average, a container was handled 3.5 times between the first and final port of call in 2008, indicating the significance of transhipment in the container shipping network. Container shipping lines have been the key players in setting up liner services centred around transhipment hubs, with transhipped containers representing 28% of global container port throughput in 2012 (Notteboom, Parola, & Satta, Partim transsshipment volumes, 2014). Therefore, due to the significance of transhipment to container traffic, this case study focuses on transhipped container traffic.

Figure 93: Main transhipment hubs worldwide: container volumes transhipped, 2011



Source: Notteboom, et al., 2014

This case study focused on assessing the likelihood of freight operators shifting from the use of an EU transhipment hub to a non-EU transhipment hub, as a result of introducing policy measures to control maritime GHG emissions. Tanger Med offers an attractive alternative to Algeciras as a transhipment port, in regard to its close proximity and infrastructural capacity. In addition, recent investments in the port have enhanced the quality of port services.

The practical feasibility of changing transhipment hub depends on a range of important factors, including port location, berth availability, transit time, cost, frequency and service quality. Although cost is an important factor, port location and proximity to primary routes, cities and ports, are key factors which influence transhipment hub choice in Europe.

However, it is also important to consider the costs associated with transhipment, which have the potential to have a significant impact depending on the variation between ports. In the case of Algeciras and Tanger Med, a significant difference in transhipment costs already exists between the two ports. In addition to port fees, it is also essential to consider other operational costs, and the costs associated with fuel, ETS/carbon levy payments and capital costs. Fuel costs in particular comprise a significant share of the total port costs.

Therefore, the potential for shipping operators to use non-EU transhipment ports, as a result of the policy options, will depend both on the operational factors influencing transhipment port choice, and the transhipment costs associated with proximal non-EU transhipment hubs.

Table 65: Percentage cost difference of transhipment operations in Algeciras under the proposed policy options illustrated for two different distances from the port of origin to the transhipment port

Year	**Option**	**Carbon price (€/tCO_2)**	**Geographical scope**	**Total cost increase linked to transhipment operations in Algeciras (%)**	
				1,000 nautical miles from the port of origin	10,000 nautical miles from the port of origin
2030	MAR 1 MEXTRA50	45.5	Intra-EU + 50% Extra-EU	3	6
	MAR2 MEXTRA50	268	Intra-EU + 50% Extra-EU	16	33
	MAR 1 MEXTRA100	45.5	Intra-EU + 100% Extra-EU	5	11

Source: RICARDO 2021

The analysis looked at the increase in cost for calls to Algeciras linked to the different options. The results are showed in the table above. The estimated total cost increase linked to transhipment operations in Algeciras is one of the factors that could exacerbate evasive behaviour in favour of Tanger Med, in particular for MAR2.

38.4 Evasive port call case study

This analysis studies the likelihood of freight operators to engage in evasive port calls at non-EU ports, as a result of introducing policy measures to control maritime GHG emissions. All of the considered non-EU ports offer potential additional port calls, due to their relatively close proximity to the destination EU ports. In addition, the EU MS selected are considered to be subject to a relatively high level of exposure, due to their close proximity to non-EU ports.

The port of Algeciras, with an evasive port call at Tanger Med

In regard to adding an additional port call at Tanger Med, a T&E (2020) study estimated that there is no risk of policy evasion at a CO_2 price of €30/tonne, but a 9% risk at a CO_2 price of €50/tonne. There is potential for a GHG emissions policy to lead to congestion at Tanger Med, which would result in reducing significantly the risk of policy evasion at a CO_2 price of €100/tonne. For the trips travelling to or from Oceania, all trips covered would be motivated to evade at a CO_2 price of €45/tonne. However, none of the 1,194 voyages sailing to or from the UK and Svalbard would be encouraged to evade at CO_2 prices below €215/tonne.

Two evasion cases were assessed in more detail (see next table). The two cases assess the potential for evasion at Tanger Med, along the route ending at the Port of Algeciras. The cases consider container vessels and dry bulk carriers, and draw upon the opportunity costs and additional time incurred in the evasion scenarios presented by the T&E (2020) study. As further inputs of this analysis, results from the PRIMES Maritime module on shipping costs (fuel, operating and capital costs), carbon prices and emission reduction for the different policy scenarios are considered.

Table 67: Port evasion case: Algeciras- Tanger Med

	Evasion case 1	Evasion case 2
EU port	Algeciras	Algeciras
Evasion port	Tanger Med	Tanger Med
Type of vessel	Containers	Dry bulk carriers
Additional distance in evasion scenario (nautical miles)	32	32
Additional time in evasion scenario (days)	0.5	2.5
Evasive port fees (€)	31 368	16 582

Source: RICARDO 2021

The next table presents the distance turning points above which shipping operators would be incentivised to add an additional port call, as a result of the proposed policy options. For distances exceeding 12 000 nautical miles, it is assumed that evasion does not occur, as this is higher than the travel distance to the equivalent point halfway around the Earth's circumference following a straight line.

Table 68: Distance turning points across the proposed policy options for routes to the port of Algeciras with potential evasive port calls in Tanger Med

Year	Option	Carbon price	Distance turning point (nautical miles)	
			Evasion case 1	Evasion case 2
2030	MAR1 MEXTRA50	45.5	No evasion	11 300
	MAR2 MEXTRA50	268	2 900	2 200
	MAR1 MEXTRA100	45.5	8 300	6 000

Source: RICARDO 2021

The port of Piraeus, with an evasive port call at the port of Haydarpaşa

The analysis undertaken by T&E (2020) suggests that it would not be financially attractive for ships to evade policy by calling at the port of Haydarpaşa prior to the port of Piraeus if the CO_2 price was below €30/tonne. The analysis suggests that even a higher CO_2 price of €100/tonne would only result in policy evasion occurring for 0.5% of all journeys. This is due to the additional port, fuel, operational and opportunity costs (and the remaining CO_2 costs), which outweigh the costs associated with policy compliance (T&E, 2020).

The port of Rotterdam with an evasive port call at the port of Southampton

The T&E (2020) study concluded that there is no risk of policy evasion for shipping operators completing their journey at Rotterdam, for CO_2 prices under €100/tonne. The study found that the opportunity costs of oil tankers increase at a much slower rate than all other cost types, as the size of the vessel increases. As a result, the opportunity costs represent a proportionately larger share of the total costs of the smallest oil tankers (2%), relative to the largest oil tankers (1%). However, the port of Southampton charges very high port fees, particularly for larger vessels. Policy evasion would result in port costs equating to 30% of total costs for large oil tankers. Large oil tankers would require a higher ETS price to evade policy through a stop in Southampton.

Other cases

The study estimated that all 125 voyages travelling to or from North and South America would consider evading policy at CO_2 prices between €100/tonne and €255/tonne. However, this differed for the trips travelling from Russia or Ukraine, where none of the voyages would be motivated to evade policy at a CO_2 price under €300/tonne. Furthermore, for CO_2 prices below €100/tonne, only six voyages would consider evading policy, and all of these journeys involved ships travelling to or from Asia. These results highlight the importance of the distance travelled in regard to the likelihood to evade policy (T&E, 2020).

Summary

The practical feasibility associated with an evasive port call has the potential to impact the decision of the shipping operator to engage in an evasive port call. For example, it is necessary for shipping operators to already have business at a port to allow them to call at a port, and load or unload cargo. Therefore, shipping operators without existing business in non-EU countries would be required to develop new business activities, to enable them to call at non-EU ports in an attempt to evade policy. This would involve a relatively high level of administrative burden.

It is essential to remain attuned to the significance of port costs on the potential for evasive port calls, as it is possible that proximal non-EU ports will lower their port fees to further attract shipping operators. This would in turn impact the turning point, and therefore, directly influence the number of ships likely to evade policy. However, port fees also comprise a much smaller share of total costs for large container vessels, relative to fuel costs.

It is important to note that it is difficult to make assumptions regarding the response of shipping operators to the uncertainty associated with the proposed policy options. However, it can be concluded that the potential for shipping operators to engage in evasive port calls, as a result of the proposed policy options, will depend both on the practical feasibility of engaging in shipping activity, and the costs associated with engaging in evasive port calls.

Table 69: Summary of risk of evasive port call for policy options in 2030

Year	Option	Risk of evasive port call
2030	MAR1 MEXTRA50	Very low
	MAR4 MEXTRA50	Very low
	MAR2 MEXTRA50	High
	MAR1 MEXTRA100	Medium

Source: RICARDO 2021

Annex 11: Detailed analysis on the Innovation Fund

39 TYPES OF PROJECTS THAT CAN BE SUPPORTED BY THE INNOVATION FUND

Based on the applications to the first call for large-scale projects under the current Innovation Fund, there were applications from all eligible sectors for projects to be located in all EU MS, Iceland and Norway. As the evaluation is still ongoing, it is not known which projects will actually be funded, so the analysis is based on the applications received. Nevertheless, even only the analysis of the applications indubitably shows the potential of the Innovation Fund to play a pivotal role as a key instrument for decarbonising Europe through clean tech solutions.

The analysis of the proposals received reveals multiple technological pathways, applicable across multiple industries and sectors of the economy, which can help reduce emissions both in ETS but also in other sectors such as transport, buildings and agriculture. For instance, there is significant interest from projects related to clean transport – for instance integrated hydrogen distribution and use to various transport modes, e.g. heavy-duty vehicles, buses, fuel cell and hydrogen vehicles, ships; use of carbon capture and use technologies for production of aviation and other fuels; use of bio-based solutions for the production of various fuels. There are also projects providing technological solutions in the renewable heating and cooling of buildings. The call for small-scale projects launched on 1 December 2020 and closed on 10 March is putting further emphasis on projects providing carbon neutrality solutions for buildings or construction products substituting carbon intensive ones.

When zooming into the proposals received for energy-intensive industries, three main pathways can be identified: hydrogen, carbon capture and utilisation/storage (CCU/CCS), and bio-based decarbonisation pathways, with a certain overlap between hydrogen and CCU/CCS proposals. Other pathways include circular economy solutions such as recycling (e.g. scrap metal, plastics), pyrolysis, and electrification.

A deeper analysis of the proposals concerning hydrogen technologies (hydrogen involved as a final or intermediary product), shows that more proposals (12% of the total number of received proposals) can be considered green hydrogen, i.e. they either intend to produce their own renewable electricity or conclude power purchase agreement to secure additional renewable electricity. About 7% of the hydrogen proposals concern blue hydrogen (hydrogen produced from natural gas combined with CCS), and another 7% concern integrated hydrogen distribution and use to various transport modes, while the rest covers different varieties that have not clearly indicated the source of electricity.

A deeper look into the applications concerning carbon capture (a fifth of the total proposals received) shows that most focus on one part of the CCU/CCS value chain, only some proposals integrate all aspects of the value chain from CO_2 capture to utilisation or storage and 7% have the potential for net-carbon removals (negative emissions, net-carbon removals. CO_2 is captured from various sources: bio-refineries, ferrous and non-ferrous metal production, cement and lime, refineries, chemicals, bio- and geothermal combined heat and power (CHP) plants, Waste to Energy or ambient air, showing the cross-cutting application of this technological pathway. The CCU/CCS proposals aim to result in the production of different products: electricity & heat, hydrogen, methanol, aviation fuels, methane, construction materials, other chemicals and other fuels

A deeper analysis of the proposals concerning bio-based products and technologies shows that these amount to about a fifth of the total and they consider various biomass feedstock, mostly waste and residues, while their products are various biofuels, different bio-based chemicals, or combining chemicals and fuels.

In the renewable energy sector, there are proposals employing all types of on- and offshore wind, floating and ground-based foundations, concentrated solar power (CSP), photovoltaics (PV), production facilities for PV cells and modules, as well as tidal, wave, salinity gradient and hydro energy, and deep geothermal energy. Many renewable energy proposals combine different renewable energy technologies (CSP and PV, CSP and biomass, wind and PV) an often variable renewable energy sources are combined with battery or thermal storage or the production of hydrogen.

In the energy storage sector, many proposals aim to find solutions for the inter-daily electricity storage, while others include other storage types (batteries, compressed or liquid air storage, thermal, hydrogen, and hydro storage). Some proposals cover demand-side measures by applying smart grids or virtual power plant solutions and others concern production facilities for batteries.

The wide variety of project applications received for the first call under the Innovation Fund shows that companies are willing to invest in a multitude of technological solutions to decarbonise Europe, and are looking for public funding. This advocates for increasing the size of the Innovation Fund to address this need and to help industry play its role in EU transition to carbon neutrality.

40 LEVEL OF SUPPORT FOR PROJECTS UNDER THE INNOVATION FUND

As outlined above, the oversubscription of the first call for large-scale proposals under the Innovation Fund demonstrates significant interest of companies in investing in low-carbon technologies and the already high capacity for the market to absorb such funds. The Commission impact assessment accompanying the delegated regulation on the Innovation Fund was underpinned by a market study which estimates the potential investment volume to EUR 55 to 68 billion for demonstration projects in the relevant sectors for the period 2021-2030 (a conservative estimate as potential investments may be higher especially in cross-cutting technologies)[34].

Currently, the project costs that can be funded by the Innovation Fund are defined as the additional costs of the innovation and are much lower than the total project costs. Furthermore, the current funding rate of the Innovation Fund is set at maximum 60% of the relevant costs, thus leaving a significant part of the total project costs to be covered by the project proponent or other public and private investors. This financial gap can be very big in absolute terms when it comes to large-scale industrial projects. This may be challenging and compromise the bankability and financial viability of an otherwise promising clean tech projects in terms of emission reductions. The Impact Assessment accompanying the Innovation Fund delegated regulation and academic literature converge on the conclusion that the carbon price on its own is not expected to trigger sufficient investment in many important breakthrough technologies in industry and energy (e.g. CCS, low-carbon technologies for cement, green hydrogen-based steel making, recycling and circular economy solutions).

Therefore, increased level of support under the Innovation Fund is clearly warranted. It can be done in two ways which can be deployed together and address different needs and specificities:

- *a direct increase of the maximum funding rate,*

By increasing the funding rate, the relative and absolute size of the funds that have to be provided by the project sponsor is reduced, thus the financial viability of the project and its bankability are improved. A higher funding rate would allow upscaling technologies that have already reduced their technology risks (thanks to early demonstration) by addressing the remaining market failure, stemming for revenue risk (where the innovative products cannot be fully remunerated on the basis of market prices, as these have not yet internalised the environmental benefits of clean solutions).

- *a complementary mechanism, such as Carbon Contract for Difference (CCFD)*

Such instruments can be based on competitive tendering, and take into account the CO_2 price when determining the actual support, thereby minimising the required amount of funding and optimising the use of the available amount of allowances. This would allow upscaling technologies that have already reduced their technology risks (thanks to early demonstration) by addressing the remaining market failure, stemming for revenue risk

[34] https://ec.europa.eu/clima/sites/clima/files/innovation-fund/swd_2019_85_en.pdf

(where the innovative products cannot be fully remunerated on the basis of market prices, as these have not yet internalised the environmental benefits of clean solutions).

41 CARBON CONTRACT FOR DIFFERENCE

In the context of the Green Deal, several policy documents have highlighted the importance of innovation in carbon/energy intensive sectors, including envisaging dedicated policy initiatives:

- **Green Deal Communication** (annex) : "*initiatives to stimulate lead markets for climate neutral and circular products in energy intensive industrial sectors (from 2020)*"
- **A new Industrial strategy for Europe**: "*the European Green Deal sets the objective of creating new markets for climate neutral and circular products, such as steel, cement and basic chemicals. To lead this change, Europe needs novel industrial processes and more clean technologies to reduce costs and improve market readiness"*
- **Hydrogen strategy**: "*Develop a pilot scheme – preferably at EU level – for a Carbon Contracts for Difference programme, in particular to support the production of low carbon and circular steel, and basic chemicals*.'
- **European Council conclusions (Dec 2020)**: '*The Commission is invited to consider (...) proposing measures that enable energy-intensive industries to* ***develop and deploy*** *innovative climate-neutral technologies while maintaining their industrial competitiveness'*

In the coming years, it can be expected that the Innovation Fund will finance a considerable number of first-of-a-kind demonstration projects, which will enhance the market-readiness of break-through technologies in a range of sectors. This is clearly demonstrated by the success of the first call.

The ETS revision is therefore an opportunity to widen the portfolio of financing instruments. Notably, Carbon Contracts for Difference (CCFD) could be developed as a complementary instrument (next to the existing grant and loan instruments) within the Innovation Fund. Such a new window is well suited for commercial second, or third of a kind projects, to be deployed in the second half of this decade. The operational modalities of this instrument can be further developed later in implementing legislation.

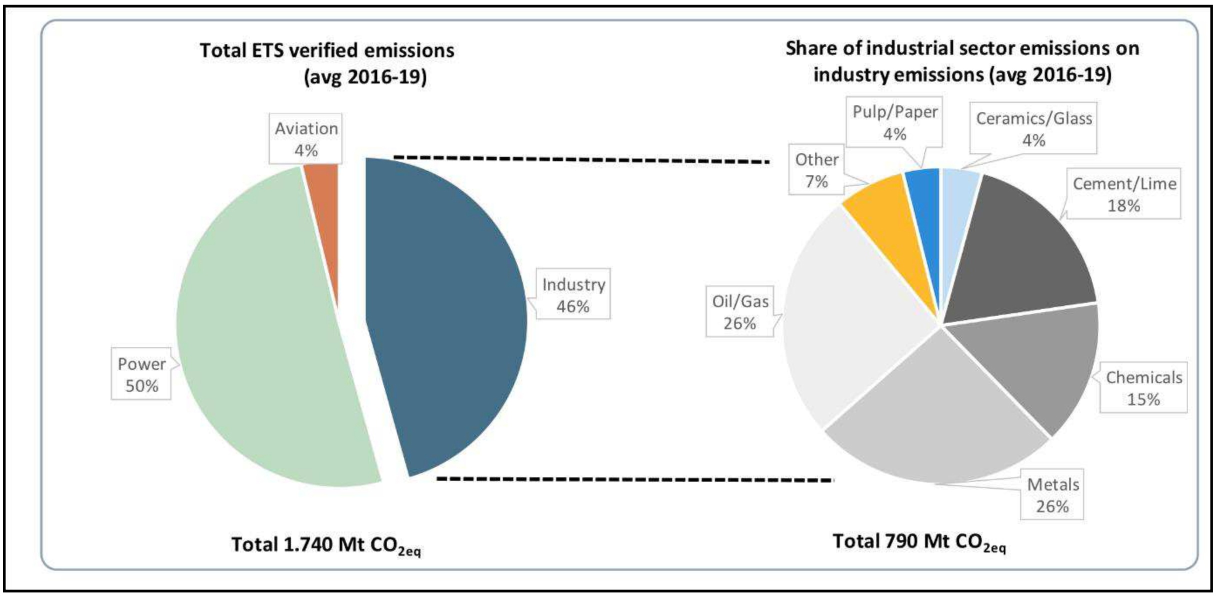
In principle, CCfDs could be applied to the entire range of sectors and technologies that are covered by the Innovation Fund, and broader or more focused approach can be taken, focusing on maximum added value. For instance, a pilot CCFD could focus on a technological pathway bringing GHG reductions across multiple sectors such as for example the production of green hydrogen. In order to ensure that only innovative technologies enabling deep decarbonisation are funded (not for instance incremental investments), all projects should comply with a certain emission performance.

41.1 **Problem definition and rationale**

41.1.1 GHG emissions of energy-intensive sectors

Decarbonising basic materials is crucial to achieving the goal of climate neutrality by 2050. In Europe, their production accounts for 18% of total GHG emissions (around 750 Mt CO_2-eq a year) and have kept relatively stable over the last years. The bulk of these emissions come from just a few multi-purpose products (mainly cement, iron&steel) and few chemical feedstocks (such as ethylene, propylene, hydrogen, methanol).

Figure 94: Share of specific sectors of total ETS emissions – EU-28 (based on the average emissions over the period 2016-19)



41.2 **Why additional policy instruments for early deployment?**

Achieving ambitious emissions reductions targets for 2030 and 2050 will necessarily entail addressing the emissions from basic materials. As 2050 is basically one investment cycle away, major investments in energy intensive industry will still be operational in 2050. It is therefore important to kick-start deployment of such solutions sooner rather than later.

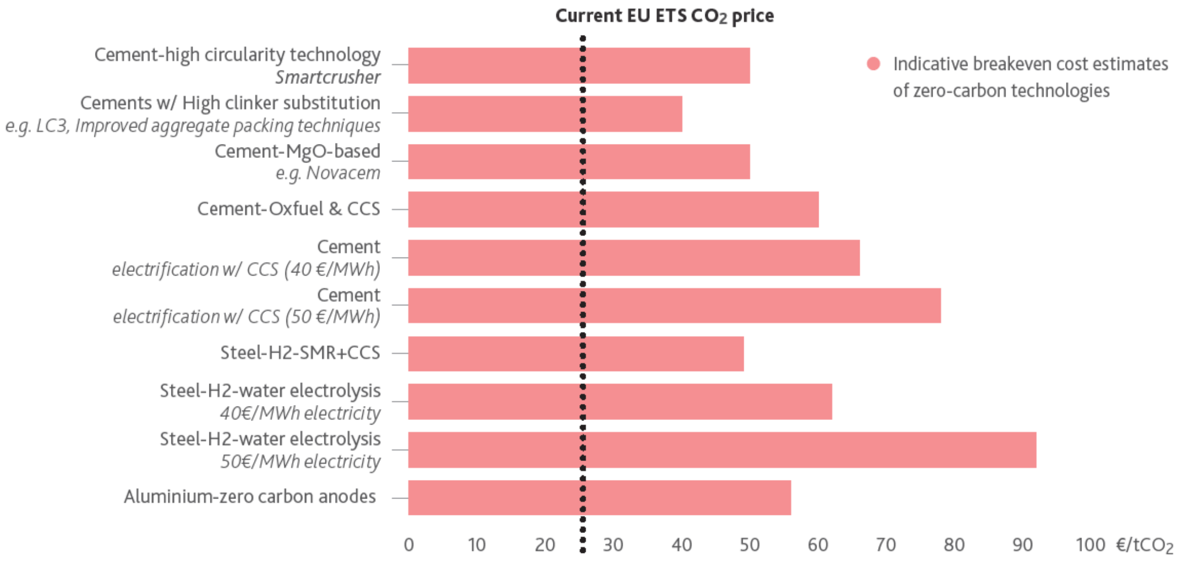
In recent years, limited GHG emissions reductions in the production of basic materials have been achieved, mainly by implementing incremental improvements of the efficiency of production processes and/ or fuel switch.

Nevertheless, a substantial number of industrial break-through technologies have been identified and researched, see e.g. 'Industrial Transformation 2050, Pathways to Net-Zero Emissions from EU Heavy Industry'[35]. However, very few technologies have been scaled beyond the pilot phase.

The prime reason is that current abatement costs for most technologies are today substantially above current ETS prices. The figures below gives break-even cost estimates of low carbon cement, primary steel, primary aluminium, green hydrogen, and basic chemicals. These estimates include increases arising from both investment (CAPEX) and operational costs (OPEX) as compared to conventional production techniques.

Figure 95: Breakeven cost estimates

FIGURE 1. Breakeven cost estimates of very low-carbon cement, primary steel and primary aluminium technologies



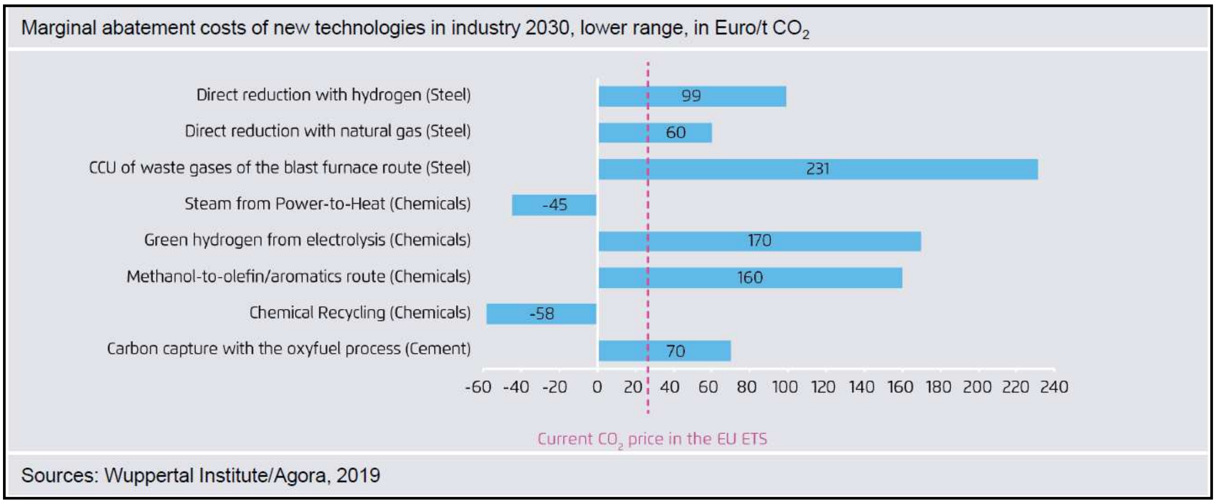
NB. This graphic is simply illustrative and not intended to be an exhaustive list of technologies, nor to reflect precise breakeven cost conditions at all specific site locations.

Source: IDDRI, based on data from Vogl et al (2018), Scrivener et al (2018), Material Economics (2019), IEA, Metalbulletin, IDDRI.

[35] Material Economics et al, 2019

Considering the lack of experience with large-scale applications, there remains a substantial uncertainty on such estimates, and certainly the first investments may face even higher abatement costs. The policy experience with renewable energy has shown that policy induced market deployment and learning by doing can be a powerful tool for cost reduction, although such effects cannot always be transferred from one sector to another on a one-to-one basis.

Figure 96: Marginal abatement costs of new technologies



While the ETS provides an incentive to reduce GHG emissions in those sectors, and this incentive is expected to increase over time (including through a revised ETS in accordance with a strengthened 55% overall target), the uncertainty over sustained increased CO_2 prices over longer periods also implies that the commercial viability is uncertain. As a result the bankability (willingness by third parties to finance such projects) is expected to remain low (too high commercial risk) and investments may not materialize.

In conclusion, achieving deep decarbonisation by 2050 will require the first industrial scale alternatives to be deployed during the coming decade. Complementary policies to the ETS, to create lead markets for low carbon materials, seem justified because of,

(1) the current high abatement costs of these technologies compared to the CO_2 price,

(2) uncertainty as regards CO_2 price developments over the next decade(s) (and associated investment and financing risks) and

(3) the need to first lower costs through learning by doing, industrialization and economies of scale.

41.3 **Carbon Contracts for difference (CCfD's)**

CCfDs are a policy instrument which can be used to develop lead markets for basic materials and hydrogen by creating contracts for difference on the CO_2 price. Such a long-term contract with a public counterpart functions in a similar way as current tendering systems for renewable power, but instead of paying the difference between the electricity strike price and the electricity market price, the public authority would pay the difference between the CO_2 strike price and the actual CO_2 price in the ETS.

The CCfDs are suited for 2nd or 3rd of a kind projects, making them ready for the market in analogy to the support for renewables to make them market competitive and would allow upscaling technologies that have already reduced their technology risks (thanks to early demonstration) by addressing the remaining market failure, stemming for revenue risk (where the innovative products cannot be fully remunerated on the basis of market prices, as these have not yet internalised the environmental benefits of clean solutions).

It bridges in an explicit way the gap in costs (linked to the GHG abatement cost of the technology) between conventional and low carbon alternative technologies in a technology neutral way[36]. A CCfD is therefore compensating the investor for both additional CAPEX and OPEX, covering the entire cost difference between a low carbon product and a conventional product.

Specific advantages of CCfD's are:

- Builds on the ETS, but guaranteeing an investable carbon price to spur early deployment
- Can be allocated through cost-effective, competitive and (if preferred) technology neutral tendering processes whereby different projects submit a bid reflecting the strike price they need to make their technology competitive
- Reduces regulatory risk for investor,
- Enhances bankability, reduces financing cost (lower interest rate for financing)

In terms of implementation, CCfDs involve a contract between a public entity (e.g. national government, European institution) and a producer of basic materials. The contract needs to specify a "strike price" in terms of €/t CO_2-eq and a period of duration to be specified in the tender specifications. In each year over that period, the public entity would pay the producer the difference between the strike price and the realized average allowance price for every ton of avoided CO_2-eq, in accordance with following formula:

Yearly support = (strike price- av. ETS price)*(ETS benchmark - actual em.) * annual production

For instance (see Figure 91), with a strike price of 100 €/t CO_2-eq and an average allowance price of 50 €/t CO_2-eq over a particular year, the producer would be able to sell the surplus allocated allowances that it no longer needs for 50€/t CO_2-eq and receives an additional 50 €/t avoided CO_2-eq from the public entity. The amount of CO_2-eq avoided each year is calculated as the difference between the amount of GHG emissions in accordance with the relevant ETS benchmark and the actual emissions, multiplied by the annual production. This support is paid during a number of years agreed in advance.

Figure 97: Illustration of the policy mechanism of the Carbon Contract for Difference

Illustration of the policy mechanism of the Carbon Contract for Difference

Source: Agora Energiewende, 2019

Annex 12 Modernisation Fund

42 OVERALL CONTEXT

The Modernisation Fund (MF) is a dedicated funding programme to support 10 lower-income EU MS (BG, HR, CZ, EE, HU, LV, LT, PL, RO and SK) in their transition to climate neutrality by helping to modernise their energy systems and improve energy efficiency.

The size of the Fund, its beneficiaries and the sharing of allowances among them and the types of investment that it can finance are regulated in the ETS Directive.

The table below shows the size of the Modernisation Fund in terms of allowances.

Table 70: Size and distribution of the Modernisation Fund in terms of allowances

Member State	Share (Annex IIb)	Allowances (Article 10(1))	Transfers (Article 10(2)(b)& 10c)	Total	Annual amounts
Bulgaria	5,84%	16.095.825	0	16.095.825	1.609.583
Czechia	15,59%	42.968.135	150.184.557	193.152.692	19.315.269
Estonia	2,78%	7.662.054	0	7.662.054	766.205
Croatia	3,14%	8.654.262	5.978.852	14.633.114	1.463.311
Latvia	1,44%	3.968.834	0	3.968.834	396.883
Lithuania	2,57%	7.083.265	8.696.818	15.780.083	1.578.008
Hungary	7,12%	19.623.677	0	19.623.677	1.962.368
Poland	43,41%	119.643.793	0	119.643.793	11.964.379
Romania	11,98%	33.018.490	167.747.579	200.766.069	20.076.607
Slovakia	6,13%	16.895.104	35.011.645	51.906.749	5.190.675
Total	**100,00%**	**275.613.439**	**367.619.451**	**643.232.890**	**64.323.289**

The biggest four beneficiaries (RO, CZ, PL and SK) hold around 87% of the Fund. Half the beneficiary MS decided to transfer additional allowances to the MF, demonstrating their preference for this instrument compared to solidarity or Article 10c derogation.

The table below shows the monetary size of the current Modernisation Fund with different carbon prices and rounded to million EUR. For the period 2021-2030, it pools together a very significant monetary volume ranging from some 19,3 billion EUR with a 30 EUR carbon price to some 25,73 billion EUR with a 40 EUR carbon price. These amounts are significantly above the expectations when the MF was agreed in 2017.

Table 71: Size and distribution of the Modernisation Fund in monetary terms

Member State	Total 2021-2030	With 30 EUR CO2 price (mio EUR)	With 35 EUR CO2 price (mio EUR)	With 40 EUR CO2 price (mio EUR)
Bulgaria	16.095.825	483mio €	563 mio €	644 mio €
Czechia	193.152.692	5.795 mio €	6.760 mio €	7.726 mio €
Estonia	7.662.054	230 mio €	268 mio €	306 mio €
Croatia	14.633.114	439 mio €	512 mio €	585 mio €
Latvia	3.968.834	119 mio €	139 mio €	159 mio €
Lithuania	15.780.083	473 mio €	552 mio €	631 mio €
Hungary	19.623.677	589 mio €	687 mio €	785 mio €
Poland	119.643.793	3.589 mio €	4.188 mio €	4.786 mio €
Romania	200.766.069	6.023 mio €	7.027 mio €	8.031 mio €
Slovakia	51.906.749	1.557 mio €	1.817 mio €	2.076 mio €
Total	**643.232.890**	**19.297 mio €**	**22.513 mio €**	**25.729 mio €**

43 INVESTMENTS TO BE SUPPORTED

A clear majority of respondents to the OPC (74%) supported the streamlining of the Modernisation Fund and the enhancement of its coherence with the Green Deal. About one third of respondents each were in favour to restrict financing to non-fossil fuel based heating and cooling systems (33%) and to remove the exception for financing coal-fired district heating in certain MS (32%). Less respondents favoured that the fund should only finance priority projects to simplify the administration (8%).

43.1 Priority investments

As priority investments defined in Article 10d(2) of the ETS Directive, the Modernisation Fund supports investments in:

- Generation and use of energy from renewable sources
- Energy efficiency
- Energy storage
- Modernisation of energy networks, including district heating, pipelines and grids
- Just transition in carbon-dependent regions: redeployment, re-skilling and upskilling of workers, education, job-seeking initiatives and start-ups

At least 70% of the resources of the MF have to be spent on such priority investments. In the territories covered by a Territorial Just Transition Plan, the just transition investments supported by the Modernisation Fund need to be consistent with these plans designed by beneficiary MS and they have a narrower scope compared to Just Transition Fund as they focus only on the human dimension. So far no beneficiary MS has indicated interest in financing such investments from the Modernisation Fund.

Some examples of priority investments were included in an assessment guidance document developed by the EIB and published[37].

43.2 Non-Priority investments

The ETS Directive sets strong limits for solid fossil fuel investments - no support from the Modernisation Fund shall be provided to energy generation facilities that use solid fossil fuels, other than efficient and sustainable district heating in Bulgaria and Romania. It also defines the priority investments as explained above.

There is a ‘grey zone’ of investments eligible for MF, but are not priority, and these are considered non-priority investments. Such projects could be for instance investments in gas power plants, natural gas infrastructure, industrial gas-fired electricity generators, nuclear power generation projects. The contribution of such investments to the aims of the Modernisation Fund and their potential to reduce emissions needs to be clearly proven, and they are subject to a more complex governance. The main difference with priority investments is that for non-priority investments the EIB conducts a detailed technical and financial due diligence assessment to establish its financial viability and added value to decarbonisation, based on which the Investment Committee assesses the proposal and makes its recommendation on its financing. Therefore, the category of non-priority investments poses some implementation difficulties and administrative burden (different submission and reporting requirements, more detailed assessment, different deadlines etc.)

44 GOVERNANCE

The governance of the Modernisation Fund is adapted to the nature of the investments, whereby MS are in the driving seat.

The **Beneficiary MS** are responsible for selecting and submitting investment proposals for Modernisation Fund support, paying off the support to the project proponents or scheme managing authority(ies) upon the disbursement decision of the Commission, participating in the Investment Committee, monitoring and submitting annual reports on the implementation of the Modernisation Fund investments, auditing the project proponents or scheme managing authorities and taking appropriate measures to ensure

[37] https://modernisationfund.eu/documents/

that the financial interests of the Modernisation Fund are protected, including recovery actions.

The **Investment Committee** is the main governing body of the Modernisation Fund. It is chaired by the Commission, and composed of the EIB (which also acts as its secretariat), 10 beneficiary MS, 3 non-beneficiaries (NL, DE, SE were elected for the first five year period). It is indispensable for endorsing non-priority investments, and is the main forum to discuss any matter pertinent to the Modernisation Fund.

The **EIB** plays a significant role in the implementation of the Modernisation Fund and is responsible for, auctioning the allowances which provide the resources of the Modernisation Fund in accordance with the Auctioning Regulation, confirming whether an investment is a priority or a non-priority one, conducting financial and technical due diligence of non-priority investments, including an assessment of the expected emission reductions, managing the assets of the Modernisation Fund, transferring the respective resources to the beneficiary MS following the disbursement decision of the Commission, and keeping track of the use of MS resources and providing the secretariat of the Investment Committee.

The **European Commission** is responsible for ensuring State aid control over the Modernisation Fund investments, taking the disbursement decision once an investment has been confirmed by the EIB or recommended for financing by the Investment Committee, chairing the Investment Committee and ensuring compliance with the ETS Directive and the implementing act on the Modernisation Fund.

Overall, the governance structure is efficient and simple for priority investments, and significantly more complex and time consuming for non-priority ones.

Annex 13: Auctioning revenues and distributional issues between Member States

45 OVERVIEW OF POSSIBLE ETS REVENUES

The level of ETS revenues varies across the policy options and its total size is determined by both the volume of allowances for auctioning and the allowance price. The below table provides for different policy options an estimate of possible yearly (average) revenues in billion EUR[38] including regular auctioning regardless for which purpose (distribution to MS, solidarity/redistribution, EU own resources) and excludes the allowances set aside in the existing ETS for both Modernisation and Innovation Funds (i.e. Modernisation Fund of 2% of the cap, and Innovation Fund of 450 million allowances, IF0). It does not prejudge potential increases in the use of funds (Innovation and Modernisation Funds, including potential contribution of the new ETS).

For the existing ETS, Table 62 presents estimates for the combination of the four different ETS cap ambition options (AMB1, 2a, 2b, 3) retained for interaction analysis with other options, with different options on the design of the Market Stability Reserve (MSR0+, MSR1, 2). For maritime transport, the focus is on the options covering an ETS extension to maritime considering the three possible geographical scopes (MINTRA, MEXTRA50 and MEXTRA100 for EU 27). For the possible extension to other sectors, results for both scope options (EXT1 and EXT2) are presented.

Future ETS carbon prices are by design uncertain. The carbon price assumptions (expressed in €2020) used are consistent with the central carbon price assumptions for periods described in Section 5.2.1, using a carbon price of EUR 45 for the period 2021-2025 and EUR 55 for the period 2026-30. In that section, also the underpinning ranges of scenario results and related uncertainties are described.

The figures below provide for the assumed carbon prices the **maximum** auction revenues under each option as determined by the following auction shares assumed: 57% for existing ETS[39], 100% for maritime transport and for buildings and transport, and up to 100% for all fossil fuel combustion. In the latter scope, a certain amount of allowances would need to be used for free allocation or other forms of compensation to protect small industry in a similar way against the risk of carbon leakage. For reasons of simplicity and avoidance of prejudgement of political choices, revenues estimated in Table 62, do not

[38] A range is provided where options are grouped, e.g. MSR1 to MSR3 in existing ETS cap options.

[39] The 3% free allocation buffer, sourced from the auction share, is considered to be used for free allocation, which is in line with the analysis on the risk of triggering the cross sectoral correction factor.

consider any split of the total revenues in MS between regular auctions, own resources, Innovation Fund use or solidarity mechanisms including the Modernisation Fund.

Table 72: Estimates of ETS auction revenues available for MS regular auctions, Own Resources and MS solidarity/redistribution per ETS sector (in bn EUR)

Option	**Sector**	**Annual average 2021-2025**	**Annual average 2026-2030**
Existing ETS – stationary[40,41]			
AMB1 +MSR0-2, IF0	Power and industry	[20 - 22]	[14 - 19]
AMB2a +MSR0-2, IF0	Power and industry	[19 - 21]	[14 - 21]
AMB2b +MSR0-2, IF0	Power and industry	[18 - 20]	[16 - 22]
AMB3 +MSR0-2, IF0	Power and industry	[20 - 22]	[16 - 20]
Maritime transport extension[42]			
MAR1, MAR4	Maritime	[0.4 – 1.4]	[1.5 – 4.9]
Extension to buildings and transport or all fossil fuel combustion			
EXT1, IF0	Buildings, transport		[47]
EXT2, IF0	Buildings, transport, other fossil fuel CO2		[up to 57]

The following sections illustrate distributional impacts on MS of the ETS revision and current solidarity/redistribution provisions which use a part of ETS revenues to address such impacts, first for the existing ETS in a strengthening context and then illustrating them in the context of the new ETS. The final section provides an overview of aviation and maritime specific aspects.

[40] The range of estimates is consistent with the MSR modelling exercise for the combination of AMB options with MSR options 0+ to 2 and with analysing the AMB options combined with MSR0+ based on PRIMES MIX modelling results.

[41] Aviation which is also part of the existing ETS is subject to a specific Impact Assessment where options on the sector cap reference and its split between auctioning and free allocation are assessed and auction revenue estimates are presented in a consistent way with this impact assessment.

[42] Assuming a phase-in approach in the period 2023-2025. Options MAR2 and MAR3 with maritime specific ETS or levy are projected to lead to significantly higher carbon prices and therefore significantly higher revenues, i.e. around EUR 6.5 bn of annual average revenues in the period 2026-2030 for MINTRA scope.

46 MEMBER STATE DISTRIBUTIONAL IMPACTS OF STRENGTHENING THE EXISTING ETS

While 90% of auctioning revenues are distributed between MS based on the established auction key, the ETS Directive for the period 2021-30 prolongs the solidarity provision consisting of the redistribution of 10% of the auctioned allowances to 16 low-income MS[43] and introduced the Modernisation Fund for those countries with GDP per capita below 60% of EU average (2013 reference)[44]. While these do not apply to exactly the same countries, it can be estimated that the overall solidarity provisions to low income MS amount to around 7% of the current cap or almost 1 billion allowances (over the 2021-30 period).

Currently, all auction revenues under the solidarity provision and at least 50% of total auctioning revenues distributed to MS should be used for targeted climate purposes. These include measures to provide financial support in order to address social aspects in lower- and middle-income households and measures to promote skill formation and reallocation of labour in order to contribute to a just transition to a low carbon economy, in particular in regions most affected by the transition of jobs, in close coordination with the social partners.

The importance of the Modernisation Fund in addressing distributional concerns was also highlighted by the European Council conclusions of 11 December 2020.

The Modernisation Fund is currently financed with 2% of total allowances (calculated on the basis of the ETS cap). Each beneficiary MS can also decide to top up its own share of the MF with allowances under Article 10c (derogation for free allocation to power generation) and Article 10(2)(b) (solidarity allowances). The top up by MS who have chosen to do so (CZ, HR, LT, RO, SK) amount to 367 million allowances compared to the 275 million allowances initial size of the Fund (see also Annex 12). This indicates that several MS are in favour of streamlining the support instruments available.

In the following we illustrate the MS impacts of the current legislation**:** Solidarity provisions are kept at a proportion of about 7% of the revised ETS cap, (Modernisation Fund of 2% of the cap and solidarity redistribution of 10% of auctioned allowances).

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[43] Eligible MSs: BG; CZ; EE; EL; ES; HR; LT; CY; LV; HU; MT; PL; PT; RO; SI; SK
[44] Eligible MSs: BG; CZ; EE; HR; LT; LV; HU; PL; RO; SK

Given that so far beneficiary MS have shown trust in the Modernisation Fund by transferring additional allowances to it, and bearing in mind the benefits of avoiding a multiplication of support systems, an increase of the size of the Modernisation Fund could be one option to consider. This could be accompanied by a simplification of its governance structure by focusing only on priority investments.

Table 63 compares MS' projected ETS emissions under the REF scenario (with current ETS policy framework) with the MIX scenario (with -55% overall ambition level). The results show that in the scenarios with increased ambition, MS emissions are generally lower than in the reference scenario. This is valid for the 2021-30 period but also for each of the 5 year periods 2021-25 and 2026-30. Table 61 provides the overview of the MS' emission profile for the period 2013-19 (measured as the change of verified emissions (VE) between 2013 and 2019) and their projected changes of emissions for the period 2021-30 under different model scenarios. Comprehensive MS scenario data is presented in the separately published technical note[45].

[45] See the "Technical Note on the Results of the "Fit for 55" core scenarios for the EU Member States".

Table 73: Verified emissions ("VE") 2013 to 2019, projected emissions 2020 to 2030 and projected differences in emissions between the REF scenario (with current ETS policy framework) and the MIX scenario per Member State– scope is power and industry.

	VE change from 13 to 19	REF [2020-2030]	MIX [2020-2030]	REF to MIX		
				2021-30	2021-25	2026-30
EU27	**-16%**	**-18%**	**-37%**	**-12%**	**-6%**	**-19%**
AT	-1%	-28%	-40%	-8%	-4%	-13%
BE	-1%	23%	19%	-3%	-2%	-4%
BG	-11%	-20%	-44%	-16%	-7%	-25%
CY	11%	-25%	-35%	-6%	-3%	-10%
CZ	-8%	-40%	-49%	-8%	-4%	-13%
DE	-25%	-15%	-36%	-14%	-7%	-21%
DK	-44%	-23%	-30%	-3%	-1%	-6%
EE	-47%	1%	-49%	-34%	-23%	-46%
EL	-31%	-39%	-35%	1%	-1%	3%
ES	-11%	-25%	-36%	-16%	-12%	-20%
FI	-26%	-29%	-49%	-9%	-3%	-17%
FR	-18%	-27%	-41%	-9%	-4%	-15%
HR	-14%	-30%	-42%	-10%	-6%	-16%
HU	2%	-22%	-29%	-3%	-1%	-5%
IE	-10%	-26%	-36%	-5%	-2%	-9%
IT	-14%	-15%	-45%	-11%	-1%	-22%
LT	-22%	-9%	-6%	-2%	-3%	0%
LU	-19%	-16%	-28%	-5%	-1%	-9%
LV	-6%	1%	-7%	8%	12%	4%
MT	-56%	-1%	-6%	8%	10%	5%
NL	-4%	-36%	-42%	-11%	-9%	-14%
PL	-11%	-2%	-36%	-17%	-8%	-27%
PT	-12%	-47%	-54%	-6%	-3%	-10%
RO	-14%	-11%	-40%	-21%	-13%	-30%
SE	-7%	-12%	-30%	-9%	-4%	-15%
SI	-15%	13%	-9%	-12%	-6%	-17%
SK	-9%	-25%	-40%	-9%	-3%	-15%

Legend: Negative values (red bar) indicate projected emissions decrease compared to reference, positive values (blue bar) indicate projected emissions increase compared to reference - first two columns compare 2030 to 2020 under each scenario; following columns compare REF to MIX where negative values (red bar) indicate MIX scenario emissions are X% lower than REF for the same period; positive values (blue bar) indicate MIX scenario emissions are X% higher than REF for the same period; MS highlighted are low income MS[46].

To account for differential impacts, since 2013 under the ETS some of its revenues have been redistributed to the lower income MS. The remainder of this section illustrates how the 16 MS that are currently beneficiaries of any such redistribution will be impacted by the different strengthening options.

The strengthening options impact the ETS cap by reducing the overall volume of allowances, which has an impact on the amount of allowances available for redistribution. Within the ETS framework the elements used for redistribution are in general set in relative terms to the cap, e.g. 10% redistribution of the auction revenues or the 2% of the total cap for the Modernisation Fund.

For the full impact on distribution of revenues between MS one has to look at all the elements that generate revenues, i.e. the redistribution elements and the regular auctioning share (currently 90% of the auctioned amount). Applying the current re-distributional elements results in an overall impact for the 16 MS mainly concerned that is proportionate to the reduction of the cap, i.e. those MS all get a relative reduction of their revenues.

The impact per MS thus depends on the allocation of auction revenue, and on how the solidarity elements are defined, such as the size of Modernisation Fund, and the size and eligibility of the “10% redistribution” solidarity[47]. Table 64 shows the results of applying current solidarity framework for different ambition options with the resulting MF size for the period from when the cap is updated. The ambition options are defined as AMB1: 6.24% LRF from 2026 without rebasing; AMB2a: 5,09% LRF from 2024 without rebasing; AMB2b: 3,90% LRF from 2024 with 163 million rebase; AMB2c: 4,22% LRF from 2024 with 119 million rebase; AMB3c: 4,57% LRF from 2026 with 163 million rebase. Because all solidarity provisions are defined as a share of the cap (e.g. MF is 2% of the cap) the relative difference at MS level between the solidarity allowances of different ambition options to the existing framework is equal to the difference of the total

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[46] Low income MS defined as currently defined for Modernisation Fund eligibility (GDP per capita at market prices below 60 % of the Union average in 2013

[47] One additional solidarity element to consider is the share by which MS contribute to the Market Stability Reserve intake, i.e. until 2025, the “10% solidarity” share is not accounted to determine the MS contribution to the MSR intake.

cap (provided the same solidarity framework is used). The relative difference to existing framework/cap is referenced in each ambition option in square brackets.

Under the increased ambition scenarios, as the cap reduces and both solidarity elements are defined in proportion to the cap, the solidarity allocations reduce. Their value however could increase with the projected increase in carbon prices.

Table 74: Existing ETS total solidarity allowances, in million allowances (including 10% redistribution and Modernisation Fund), and changes under the different ETS strengthening options[48] –for period 2021-30

	Existing framework	AMB1 [-8,7%]	AMB2a [-12%]	AMB2b [-15%]	AMB2c [-14%]	AMB3c [-11%]
BG*	77	-9	-12	-11	-9	-9
CZ*	121	-14	-18	-17	-14	-13
EE*	24	-3	-4	-3	-3	-3
EL	36	-4	-5	-5	-4	-4
ES	70	-8	-11	-10	-8	-8
HR*	16	-2	-2	-2	-2	-2
CY	3	0	0	0	0	0
LV*	9	-1	-1	-1	-1	-1
LT*	16	-2	-2	-2	-2	-2
HU*	42	-5	-6	-6	-5	-5
MT	1	0	0	0	0	0
PL*	358	-41	-54	-51	-41	-40
PT	17	-2	-3	-2	-2	-2
RO*	142	-16	-21	-20	-16	-16
SI	5	-1	-1	-1	-1	-1
SK*	48	-5	-7	-7	-5	-5
Total solidarity	985	871	836	845	871	876
MF size for 2021-30	276	244	234	237	244	245
MF share	2%	2%	2%	2%	2%	2%

48 Indicative figures before MSR application and applying the solidarity eligibility criteria in ETS current framework

47 MEMBER STATE DISTRIBUTIONAL IMPACTS OF A NEW ETS FOR BUILDINGS AND ROAD TRANSPORT OR ALL FOSSIL FUELS

The new ETS for buildings and transport will generate substantial auction revenues. Different uses are possible, including contributions to own resources, to the Innovation Fund as indicated in options IF1 and IF2, to the Modernisation Fund, to address social impacts, as well for a specific solidarity element in the distribution of auctioning revenues to MS. Any such use of revenues from the new ETS for solidarity purposes should be seen in the context of the specific impacts on citizens that the extension of ETS to new sectors (notably road transport and buildings) could bring about.

For any auctioning revenues that would accrue to MS, the questions of the distribution key is highly relevant, especially if one were to strengthen the link with enabling MS to address social impacts of carbon prices.

As it has been done for the existing ETS so far, a combination of a general element based on historical emissions and a specific solidarity element appears a reasonable starting point. Such a solidarity element for the new ETS could also be complemented and partly replaced by other instruments, e.g. due to the overlapping scope between instruments to address social impacts and instruments to address MS distributional issues.

Recent historical emissions could serve as proxy for different economic structures and different efficiencies of the capital stock of the sectors concerned. In the context of the new ETS, recent (2016-2018) MS shares of emissions in sectors covered under the new ETS could be used as basis for – or starting point for further considerations on – the general element of the distribution key for MS revenues. This data has been reported for the UNFCCC inventory and comprehensively reviewed as part of the implementation of the Effort Sharing Regulation. It has been used to define the starting point of the national ESR reduction trajectories defining current 2030 ambition related to the sectors covered by the new ETS.

If auctioning revenues were distributed to MS, it could also be considered that a certain share of the revenue in the new ETS would be earmarked for use for specific purposes such as those outlined in Table 4 in Section 5.2.5.

For the solidarity elements specific for the new ETS, the needs mentioned in Table 4 like the risk of energy poverty, the availability of finance for renovations and the availability of transport alternatives e.g. in rural areas would need to be reflected, in line with a just transition and the principle that no one is left behind. With no robust or agreed data to represent vulnerable groups directly, different ways to include GDP as indicator for a MS' capacity to address these appears to be a reasonable proxy for considerations on the solidarity element of the key.

The PRIMES modelling gives an indication of how additional emission reductions for reaching a total of -55% reductions by 2030 compared to 1990 in the relevant new ETS sectors differ between MS in different scenarios with carbon pricing. Table 65 illustrates this for EXT1.

Table 75: Additional reduction in percentage points between 2025 and 2030 in the transport and buildings sector together, per Member State, compared to the Reference scenario

	Reference	MIX (percentage points compared to Reference)
EU	-15%	-9%
AT	-9%	-5%
BE	-13%	-14%
BG	-4%	-5%
HR	-1%	-8%
CY	-14%	-10%
CZ	-10%	-6%
DK	-8%	-4%
EE	-4%	-5%
FI	-22%	-7%
FR	-18%	-11%
DE	-16%	-12%
EL	-16%	-9%
HU	-9%	-11%
IE	-26%	-2%
IT	-19%	-8%
LV	-13%	-4%
LT	-15%	-5%
LU	-19%	-8%
MT	-3%	-5%
NL	-11%	-4%
PL	-12%	-13%
PT	-17%	-4%
RO	-2%	-7%
SK	-2%	-6%
SI	-13%	-7%
ES	-17%	-5%
SE	-17%	-7%

If a new ETS is created for the road transport and/or buildings sector (EXT1), there ought to be full auctioning of allowances (see Section 5.2.4.3 and Annex 5). For option EXT2 auctioning would be by far the dominating allocation method with some free allocation likely to be needed.

By definition, no solidarity and support mechanisms exist today as it is a new system. This Impact Assessment illustrates the impacts if ETS revenues would be used in a similar manner to how revenues are used under the existing ETS. Nevertheless, the potential new sectors have very different characteristics from those in the existing ETS, and the policy choices to address potential impacts of extending the ETS to these sectors will have to take account of a broader set of considerations than the use of revenues generated by the ETS. In particular:

For the road transport sector, there may be less of a need for specific solidarity mechanisms, to the extent that higher-income citizens are likely to drive larger and less fuel efficient cars, and lower income citizens in cities are more likely to use public transport. However, this might not be universally valid, as higher income groups might find it easier to switch to electric vehicles, and some lower income groups live in areas with limited alternatives to the use of (older) cars. This suggests the need for a package of measures that offers citizens an alternative to shouldering the carbon price, for instance in the form of a competitive supply of zero carbon vehicles, access to finance, and adequate infrastructure.

For the buildings sector, the availability of finance for renovations is an issue, and especially the risk of energy poor and low income households who often live in worst performing buildings. ETS revenues can contribute to finance such investments and address energy poverty, notably in the context of the transition to a low carbon economy, although this is an issue which requires broader policies at both the Union and MS level.

Bearing in mind these considerations, the remainder of the analysis here will focus on how the revenues from the extension of the ETS could be distributed if an approach analogous to that of the existing ETS were to be adopted. The following considerations focus on option EXT1, but considerations for EXT2 are similar as the additional amount of emissions added is small.

As the new ETS will in particular impact on vulnerable groups, which exist in all MS but often with higher shares in lower income MS, it will be important how the auctioning distribution and in particular the solidarity provisions address this. With no robust data to represent vulnerable groups directly, such as energy poverty, a GDP/capita related element in the distribution of auction revenues could provide a reasonable proxy. How the MS distribute the revenues to vulnerable groups and apply national policies is crucial for succeeding in a fair and just effect of decarbonisation policies in general, and carbon pricing policies in particular.

Concerning road transport, lower income MS could see a continued faster increase in transport demand, as well as a car fleet more based on second hand cars, and therefore encounter greater difficulties in abating emissions from this sector. Higher income MS, instead, would likely see a faster electrification as well as less growth in transport demand. In the buildings sector, many aspects play a role in the impact, including the heating fuel mix, building types, the use of district heating and combined heat and power and the national policy mix in the Reference. Given the importance of access to finance for buildings investments, this will be a greater challenge for lower income MS.

Table 66 illustrates what the application of current instruments to use ETS revenues to address distributional purposes could mean for the new ETS combines a general element based on recent historical emissions, a 10% solidarity element based on GDP per capita, as in the existing ETS and a 2% contribution to the Modernisation Fund.

If 10% were to be distributed on the basis of a key with a strong GDP/capita element[49] to certain MS to address solidarity as it is in the methodology for the existing ETS, it would have important benefits for lower income MS, and provide them with additional resources to address potential impacts on vulnerable groups (in particular in relation to heating and cooling of buildings).

The amounts available for distribution could be significant, from the time the new ETS comes into operation. Between 2026 and 2030, total allocations for the buildings and road transport sectors could be around 4.4 Gton of allowances. Using 2% of the cap of the new ETS for a solidarity-based fund (like the Modernisation Fund) could generate some 88 million allowances. Using then 10% of the remainder for distributional purposes as in the existing ETS could imply that, in total, some 518million allowances would be available for solidarity purposes

Table 66 illustrates preliminary results under EXT1 the results of applying the solidarity elements of the first illustration, a 2% Modernisation Fund[50] and a solidarity-based 10% distribution based on the GDP/capita as in the existing ETS methodology for distribution would result in.

[49] Using only the GDP per capita component of the auction key formula of the existing ETS, updated with average 2016-2018 GDP, and applied only to member states with GDP/Capita below 90% of the EU average

[50] Assuming the same recipients and distribution key as in the existing ETS

Table 76: Illustration of applying current ETS solidarity elements to the new ETS for buildings and transport (EXT1)

	Distribution of 10% of auctioning revenues according to methodology based on GDP/Cap	Distribution of 2% of auctioning revenue according to current modernisation fund shares	2% of revenues to increase Modernisation Fund, then apply 10% solidarity share to remainder (EXT1)
EU	438.9	87.8	517.9
AT	0.0	0.0	0.0
BE	0.0	0.0	0.0
BG	23.7	5.2	28.4
HR	14.7	2.8	17.2
CY	0.9	0.0	0.8
CZ	28.8	13.8	42.0
DK	0.0	0.0	0.0
EE	2.7	2.5	5.1
FI	0.0	0.0	0.0
FR	0.0	0.0	0.0
DE	0.0	0.0	0.0
EL	23.9	0.0	23.4
HU	38.8	6.3	44.4
IE	0.0	0.0	0.0
IT	0.0	0.0	0.0
LV	6.0	1.2	7.2
LT	9.4	2.3	11.4
LU	0.0	0.0	0.0
MT	0.1	0.0	0.1
NL	0.0	0.0	0.0
PL	181.9	37.9	216.1
PT	17.5	0.0	17.2
RO	52.0	10.5	61.5
SK	15.2	5.4	20.3
SI	4.7	0.0	4.6
ES	18.8	0.0	18.4
SE	0.0	0.0	0.0

MS results illustrating a general element for a distribution key for auction revenues based on historical emissions similar as in the existing ETS (used in illustrations 1 and 2) are shown below for option EXT1 in the second column of Table 67 below, using for that average 2016-2018 emissions as used under the ESR.

The third column presents the above described solidarity share element of illustration 1 in a comparable way to the general element, i.e. as distribution key to MS, calculated based on a 10% redistribution under EXT1. As the comparison with column 2 indicates, such a key element would clearly favour low income MS.

Table 77: Illustration of applying different currently used distribution keys of allowances for the new ETS (buildings plus transport) across Member States,

	Distribution based on 2016 - 2018 average emissions	**Illustration 1: Solidarity distribution of auctioning revenues according to ETS methodology based on GDP/Cap**	**Illustration 2: ESR distribution 2016-2018 GDP-based ESR ambition based on 40% overall ESR target**
EU	100.0%	100.0%	100.0%
AT	2.5%	0.0%	2.0%
BE	3.9%	0.0%	2.9%
BG	0.8%	5.4%	1.3%
HR	0.7%	3.4%	1.0%
CY	0.2%	0.2%	0.2%
CZ	2.4%	6.6%	3.2%
DK	1.2%	0.0%	1.3%
EE	0.2%	0.6%	0.3%
FI	1.1%	0.0%	1.1%
FR	16.1%	0.0%	13.8%
DE	22.7%	0.0%	16.0%
EL	1.6%	5.4%	3.2%
HU	1.9%	8.8%	2.6%
IE	1.6%	0.0%	1.8%
IT	13.6%	0.0%	12.8%
LV	0.3%	1.4%	0.5%
LT	0.5%	2.1%	0.7%
LU	0.6%	0.0%	0.3%
MT	0.1%	0.0%	0.1%
NL	4.4%	0.0%	4.4%
PL	8.3%	41.4%	10.5%
PT	1.6%	4.0%	2.3%
RO	2.1%	11.9%	4.5%
SK	0.9%	3.5%	1.2%
SI	0.6%	1.1%	0.6%
ES	8.9%	4.3%	10.0%
SE	1.3%	0.0%	1.4%

A second illustration combines a general element based on recent historical emissions (second column), a solidarity element based on Effort Sharing targets for 2030 compared to 2005 applied to the new ETS sectors, and a 2% contribution to the Modernisation Fund (as in Table 66, column 3). The fourth column of Table 67 illustrates therefore a distribution key to MS which would result from a solidarity element as used under the Effort Sharing Regulation, proportional to 2030 ESR allocations[51], as calculated for a 40% reduction target, and which incorporate both historical emissions and a GDP/capita component[52]. As the comparison of column 4 and column 2 indicates, this would in general benefit MS with lower GDP per capita, as they receive lower decreases of 2030 allocations compared to 2005 as higher income MS. If it is distributed according to the ESR 2030 target formula for all MS as illustrated, all MS would receive allocations, unlike with a methodology like in the existing ETS.

It is to be noted that the distributive effect of the solidarity elements under illustrations 1 and 2 in column 3 and 4 cannot be directly compared. Illustration 1 is calculated based on a distribution key similar to the current 10% share ETS distribution. If one were to follow the ESR solidarity rationale used for illustration 2, the key would need to be applied to a significantly higher share of the total allowances to give benefits of similar order of magnitude for the lowest income MS as the key used under illustration 1. Under the existing ESR the 2030 element defines 50% of the target trajectory 2021 to 2030, with the other 50% defined by 2016-18 emissions, the general distribution key element illustrated in the second column.

For the residential sector, energy poverty issues are of special importance to investigate in view of possibly distributional impacts between MS but also household income groups. Below tables give an estimate of simple average rises by MS groups in terms of GDP per capita in total residential sector household expenditures as a percentage of consumption between Reference Scenario and the MIX and MIX-CP policy scenarios with a different role of carbon pricing in the policy mix. The expenditure components related to capital costs for investments and to fuel expenses have been presented in Section 6.3.2 and 6.3.3.

[51] Assuming for comparability an ESR reduction target of 40% compared to 2005.
[52] Using 2005 emissions and average 2016-18 GDP as in the ESR review impact assessment.

The total expenditure rises presented in Table 68 are estimated for low, medium and high income groups as defined according to PRIMES modelling and provided as an average characterising different groups of MS: those with a GDP/ capita below 60% of the EU average, those with a GDP/ capita between 60% and 100% of the EU average, and those with a GDP/ capita above the EU average. The figures between the groups are not necessarily comparable, as the high, medium and low income groups are defined relative to the average income of a MS. Note that there are therefore uncertainties involved in the aggregation within the groups.

Total expenditures are likely to rise, due to a rise in annual capital costs.

Table 78: Average rise in total household expenditures in the residential sector, as a percentage of consumption per income group, average for Member States of a certain income level, MIX and MIX-CP percentage point difference compared to Reference

Total expenditures vs Reference in 2030		Lower income Households	Medium income Households	Higher income Households	All households
EU	MIX	1.16%	0.51%	0.33%	0.59%
	MIX-CP	0.76%	0.40%	0.31%	0.45%
MS < 60% GDP/capita	MIX	2.14%	0.96%	0.67%	1.09%
	MIX-CP	2.24%	1.03%	0.74%	1.17%
MS between 60-100% GDP/capita	MIX	1.50%	0.52%	0.27%	0.63%
	MIX-CP	0.39%	0.21%	0.17%	0.23%
MS > 100% GDP/capita	MIX	0.85%	0.42%	0.30%	0.48%
	MIX-CP	0.66%	0.36%	0.28%	0.40%

Source: PRIMES

48 MEMBER STATE DISTRIBUTIONAL IMPACTS OF AVIATION AND MARITIME ETS

In accordance with Article 3d(3) of the ETS Directive, the revenue from auctioning **aviation** allowances, for which a change to full auctioning is analysed in the aviation ETS impact assessment, is proportionate to the share of the total attributed aviation emissions for all MS for the reference year, which is the calendar year ending 24 months before the start of the trading period. MS with higher aviation activity have a higher share, without having regard to other economic aspects. For the fourth trading period of the ETS (which has begun on 1 January 2021) this means that the reference year for the distribution of aviation revenues is 2018. For the increased revenues from an increased share of auctions from the allocation of aviation allowances the same rule could apply, subject to considerations to use ETS revenues as own resources of the EU.

The transition to full auctioning would require the total quantity of allowances for aviation cap to be consolidated, moving from the current bottom-up approach (which defines the cap on the basis of free allocation, itself defined with the help of historical emissions). The cap represented by the total quantity of allowances for aviation and the application of the linear reduction factor on the cap have an obvious direct impact on the revenues. Because the defined cap would continue to be lower than the actual emissions from aviation (in 2019 it covered slightly more than half of the emissions), aviation would represent an additional demand for allowances from other sectors under the ETS. This demand, in practice, will depend to a considerable extent from the pace of the recovery of the sector from the COVID 19 crisis and from the method how the cap will be calculated.

Although **maritime** transport is essential to the competitiveness and economic functioning of the EU as a whole, shipping activity is concentrated in specific regions and countries. Ports attract a range of shipping-related activities, creating a cluster of businesses and jobs which in turn support the local economies, through encouraging expenditure on goods and services.

The parts of the EU-27 which are likely to be most affected by changes in the shipping sector include countries and regions which heavily rely on maritime transport: to import raw materials necessary for domestic industries; to import finished goods to meet the demand of domestic consumers; to export products and services (including tourism) to other parts of Europe; as a key mode of transport for commuters, industry and tourists; and as a significant source of employment and revenue. A detailed analysis of these activities and the extent to which they impact EU MS is presented in Annex 10.

Based on the above considerations, under all policy options, the countries and regions which are most exposed to possible changes in shipping activity are likely to be islands, countries with coastal areas and those which are particularly exposed economically to the shipping sector. These areas rely heavily on maritime transport to facilitate tourism, draw in export revenues and import the primary and secondary goods needed by their residents. Some of these countries are heavily dependent on international trade for their economic performance. A number of Mediterranean and Northern European countries and regions are also heavily dependent on maritime transport, due to the significance of tourism to these economies, including Malta, Denmark and Greece. The EU outermost regions[53] are also heavily dependent on maritime transport for territorial continuity, for

[53] Scattered across the Atlantic Ocean, the Caribbean sea, Latin America and the Indian Ocean, the nine EU outermost regions - Guadeloupe, French Guiana, Martinique, Mayotte, Reunion Island and Saint-Martin (France), the Azores and Madeira (Portugal) and Canary Islands (Spain) - face permanent

imports of raw materials, essential goods and other products, as well as for some exports. In addition, given their geographic location, (some) outermost regions rely on substantial maritime freight transport with neighbouring third countries. The geographical distribution of impacts will ultimately depend on the trade and economic characteristics of each individual country and region. Moreover, for countries where shipping is most important for extra-EU trade, a large geographical scope (MEXTRA50 or MEXTRA100) will have a higher impact compared to MINTRA only.

It might warrant further considerations how to address this, subject to considerations on using ETS revenues as own resources of the EU for repayment of the Recovery and Resilience Facility which also supports investments needed for the transition to climate.

If maritime auctioning revenues were to be distributed to MS, different climate purposes should be considered (e.g. for climate mitigation or adaptation measures, R&D investments or supporting developed countries). In the targeted stakeholders' consultation on the extension of EU emissions trading to maritime, the majority of stakeholders indicated that revenues from carbon pricing could support the decarbonisation of the sector, e.g. by supporting project development costs, reducing upfront costs or reducing the price gap between fossil fuels and sustainable alternative fuels.

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constraints due to their remoteness, small size, insularity, heavy dependence on air and maritime connections to the European continent for goods, access to services and territorial continuity. They have the highest EU unemployment rates and some of the lowest GDP rates. It is in this context that the Treaty on the Functioning of the European Union (Article 349 TFEU), provides for specific measures to support the outermost regions, including derogations on the application of EU law in these regions.

Annex 14: 2030 Climate Target Plan policy conclusions

49 2030 CLIMATE TARGET PLAN POLICY CONCLUSIONS

The Communication on stepping up Europe's 2030 climate ambition - the Climate Target Plan (CTP)[54] and its underpinning impact assessment are the starting point for the initiatives under the Fit for 55 package.

The plan concluded on the feasibility - from a technical, economic and societal point of view - of increasing the EU climate target to 55% net reductions of greenhouse gases (GHG) emissions by 2030 compared to 1990. It also concluded that all sectors need to contribute to this target.

In particular, with energy supply and use responsible for 75% of emissions, the plan put forward ambition ranges for renewables and energy efficiency, which correspond in a cost-effective manner to the increased climate target. The climate target plan also established that this increase in climate and energy ambition will require a full update of the current climate and energy policy framework, undertaken in a coherent manner.

As under the current policy framework, the optimal policy mix should combine, at the EU and national levels, strengthened economic incentives (carbon pricing) with updated regulatory policies, notably in the field of renewables, energy efficiency and sectoral policies such as CO_2 standards for new light duty vehicles. It should also include the enabling framework (research and innovation policies, financial support, addressing social concerns).

While sometimes working in the same sectors, the policy tools vary in the way they enable the achievement of the increased climate target. The economic incentives provided by strengthened and expanded emissions trading will contribute to the cost-effective delivery of emissions reductions. The regulatory policies, such as the Renewable Energy Directive (RED), the Energy Efficiency Directive (EED), the Regulation on CO_2 standards for vehicles supported by the Directive on the alternative fuels infrastructure, and the Re(FuelEU) aviation and maritime initiatives, aim at addressing market failures and other barriers to decarbonisation, but also create an enabling framework for investment, which supports cost-effective achievement of climate target by reducing perceived risks, increasing the efficient use of public funding and helping to mobilise and leverage private capital. The regulatory policies also pave the way for the future transition needed to achieve the EU target of the climate neutrality.

[54] COM (2020) 562 final.

Such a sequential approach from the CTP to the Fit for 55 initiatives was necessary in order to ensure coherence among all initiatives and a collective delivery of the increased climate target.

With the "MIX" scenario, the impact assessment included a policy scenario that largely reflects the political orientations of the plan.

The final calibration between the different instruments is to be made depending, *inter alia* on the decision on the extension of emissions trading beyond the maritime sector and its terms.

The Table 78 below shows the summary of the key CTP findings:

Table 79: Key policy conclusions of the Climate Target Plan

POLICY CONCLUSIONS IN THE CTP	
GHG emissions reduction	• At least 55% net reduction (w.r.t. 1990) • Agreed by the European Council in December 2020 • Politically agreed by the European Council and the European Parliament in the Climate Law
ETS	• Corresponding targets need to be set in the EU ETS and the Effort Sharing Regulation to ensure that in total, the economy wide 2030 greenhouse gas emissions reduction target of at least 55% will be met. • Increased climate target requires strengthened cap of the existing EU ETS and revisiting the linear reduction factor. • Further expansion of scope is a possible policy option, which could include emissions from road transport and buildings, looking into covering all emissions of fossil fuel combustion. • EU should continue to regulate at least intra-EU aviation emissions in the EU ETS and include at least intra-EU maritime transport in the EU ETS. • For aviation, the Commission will propose to reduce the free allocation of allowances, increasing the effectiveness of the carbon price signal in this sector, while taking into account other policy measures.
ESR	• Corresponding targets need to be set in the Effort Sharing Regulation and under the EU ETS, to ensure that in total, the economy wide 2030 greenhouse gas emissions reduction target of at least 55% will be met.
LULUCF	• Sink needs to be enhanced. • Agriculture forestry and land use together have the potential to become rapidly climate-neutral by around 2035 and subsequently generate removals consistent with trajectory to become climate neutral by 2050.

CO_2 standards for cars and vans	• Transport policies and standards will be revised and, where needed, new policies will be introduced. • The Commission will revisit and strengthen the CO_2 standards for cars and vans for 2030. • The Commission will assess what would be required in practice for this sector to contribute to achieving climate neutrality by 2050 and at what point in time internal combustion engines in cars should stop coming to the market.
Non-CO_2 GHG emissions	• The energy sector has reduction potential by avoiding fugitive methane emissions. The waste sector is expected to strongly reduce its emissions already under existing policies. Turning waste into a resource is an essential part of a circular economy, as is prevention of waste, addressed by both Circular Economy and the Zero Pollution Action Plans. Under existing technology and management options, agriculture emissions cannot be eliminated fully but they can be significantly reduced while ensuring food security is maintained in the EU. Policy initiatives have been included in the Methane Strategy.
Renewables	• 38-40% share needed to achieve increased climate target cost-effectively. • Renewable energy policies and standards will be revised and, where needed, new policies will be introduced. • Relevant legislation will be reinforced and supported by the forthcoming Commission initiatives on a Renovation Wave, an Offshore Energy strategy, alternative fuels for aviation and maritime as well as a Sustainable and Smart Mobility Strategy. • EU action to focus on cost-effective planning and development of renewable energy technologies, eliminating market barriers and providing sufficient incentives for demand for renewable energy, particularly for end-use sectors such as heating and cooling or transport either through electrification or via the use of renewable and low-carbon fuels such as advanced biofuels or other sustainable alternative fuels. • The Commission to assess the nature and the level of the existing, indicative heating and cooling target, including the target for district heating and cooling, as well as the necessary measures and calculation framework to mainstream further renewable and low carbon based solutions, including electricity, in buildings and industry. • An updated methodology to promote, in accordance with their greenhouse gas performance, the use of renewable and low-carbon fuels in the transport sector set out in the Renewable Energy Directive. • A comprehensive terminology for all renewable and low-carbon fuels and a European system of certification of such fuels, based notably on full life cycle greenhouse gas emissions savings and sustainability criteria, and existing provisions for instance in the Renewable Energy Directive. • Increase the use of sustainably produced biomass and minimise the use of whole trees and food and feed-based crops to produce energy through inter alia reviewing and revisiting, as appropriate, the biomass sustainability criteria in the Renewable Energy Directive,

Energy Efficiency	• Energy efficiency policies and standards will be revised and, where needed, new policies will be introduced. • Energy efficiency improvements will need to be significantly stepped up to around 36-37% in terms of final energy consumption[55]. • Achievement of a more ambitious energy efficiency target and closure of the collective ambition gap of the national energy efficiency contributions in the NECPs will require actions on a variety of fronts. • Renovation Wave will launch a set of actions to increase the depth and the rate of renovations at single building and at district level, switch fuels towards renewable heating solutions, diffuse the most efficient products and appliances, uptake smart systems and building-related infrastructure for charging e-vehicles, and improve the building envelope (insulation and windows). • Action will be taken not only to better enforce the Energy Performance of Buildings Directive, but also to identify any need for targeted revisions. • Establishing mandatory requirements for the worst performing buildings and gradually tightening the minimum energy performance requirements will also considered.

[55] The Impact Assessment identifies a range of 35.5% - 36.7% depending on the overall design of policy measures underpinning the new 2030 target. This would correspond to a range of 39.2% - 40.6% in terms of primary energy consumption.