Background paper | 13.05.2021

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Including transport sectors in the EU ETS

Background paper for the ENVI Committee

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Key conclusions

- The EU ETS currently covers the emissions of large stationary installations and aviation emissions from intra-EEA/EFTA flights. With the increased EU climate ambition, the scope might be extended to further sectors including road transport and shipping.
- The current scope of the **aviation ETS** is valid until the end of 2023; one of the main issues to be decided in the Fit for 55 package is the relationship between the EU ETS and CORSIA, developed under ICAO. The level of ambition under CORSIA is lower than that under the EU ETS; substituting (parts of) the ETS with CORSIA would lead to lower climate ambition of the EU.
- Since 2018, the MRV regulation for **shipping** has been in place. This provides the necessary data for introducing a regulatory instrument like an ETS. Limiting the scope of the shipping ETS to intra-EU routes only would have the lowest environmental impact but be the easiest to implement.
- Including **road transport** in the ETS would increase the covered emissions by about 50 %. To avoid unintended consequences, careful planning and data gathering exercise would be needed. A uniform CO_2 price across the EU would hit poorer Member States strongest; a form of solidarity mechanism such as a redistribution of auctioning revenues would therefore be needed. A share of these revenues should directly benefit the affected households to avoid undue burdens.
- **Abatement costs in the transport sectors** tend to be higher and/or demand is inelastic; an integration of these sectors in the EU ETS would likely lead to a higher CO_2 price for stationary installations. An integrated ETS might lead to lower economy-wide costs but it is most likely that emission reductions would mainly take place in the stationary ETS. A separate ETS or restrictions on the fungibility of allowances would lead to higher CO_2 prices for the transport sectors, but would ensure that these sectors also reduce emissions.
- The overall **impact on stationary installations** due to the inclusion of further transport sectors in the EU ETS depends largely on the rules for these sectors but also on the overall ETS design. If the historic surplus is removed from the market, e.g. through an enhanced Market Stability Reserve, and the ETS is short, any net demand from transport would lead to additional reductions from the stationary sector. If the historic surplus remains or the cap adjustment is not strong enough, the transport sectors would mainly reduce an oversupply of allowances.

1 Introduction and background

With the European Green Deal, President of the European Commission Ursula von der Leyen announced the intention to increase the EU's climate ambition "to at least 50 % and towards 55 % compared with 1990" (EC 2019). One year later, the Council adopted the new Nationally Determined Contribution (NDC) under the Paris Agreement, which included a target of at least 55 % (EUCO 2020). The European Parliament had been in favour of increasing the EU's ambition to 60 % but this was not agreed in the Trilogue negotiations.

As part of the preparation for increasing the EU's climate ambition, the Commission published the Climate Target Plan in September 2020 (EC 2020c). The plan includes policy options that would extend the EU ETS to further sectors, especially road transport, heating and shipping.

Emissions from road transport grew steadily between 1990 and 2007, decreased somewhat in the following five years but then rose again to almost 780 Mt CO_2 in 2018 (EEA 2020b). In the scenarios included in the Climate Target Plan, these emissions need to decrease by about 25 % by 2030. Specific data on EU's maritime transport emissions (domestic and international) became available in 2018 through the implementation of the EU MRV regulation (EU 2015). Globally, GHG emissions from maritime transport rose during the last decade. In the EU, CO_2 emissions from maritime transport constituted 3 % (138 Mt CO_2) of overall emissions in 2018 (EC 2020b). Within the transport sector, maritime transport's share is approx. 13 %. Future growth of emissions from the sector is expected as the demand for maritime transport is highly dependent on economic growth.

For aviation, the main question in the context of increased climate ambition is the relationship between the EU ETS and CORSIA. The Inception Impact Assessment included six different options ranging from a reversal to the full scope of the aviation ETS to a replacement of the ETS by CORSIA. Other options include the new cap up to 2030 and the share of auctioning.

This background paper provides an overview of the design options for the inclusion of these sectors in the EU ETS, possible impacts on emissions in these sectors and the impacts on the stationary ETS.

2 Aviation

2.1 Current legislative framework

Since 2012, the aviation sector has been included in the EU ETS. Its full scope covers all flights starting and/or landing in airports in the European Economic Area. Due to strong international resistance and the ongoing negotiations on a global regime for aviation in the International Civil Aviation Organisation (ICAO), a derogation until the end of the year 2023 limits the scope to flights within the EEA only. The main features of the aviation ETS are:

- A cap of 5 % below the average emissions in the years 2004 to 2006 until 2020; from then onwards, the linear reduction factor of the stationary sector will also be applied to aviation. Under the current ETS legislation, the cap in 2030 would be 27 % below the reference period.

- 82 % of allowances are allocated for free based on a benchmark. An additional 3 % are allocated for free from a special reserve for new and fast-growing airlines; the remaining 15 % of all aviation allowances are auctioned. Over the third trading period, allowances allocated for free covered 56 % of the verified emissions

- Until 2020, aviation allowances could only be used by the sector itself. In the fourth trading period, these allowances are fully fungible and can be used for compliance of stationary installations as well.

In 2021, the implementation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) began. This scheme was developed under the ICAO and intends to halt the net growth of CO_2 emissions from international aviation. To do so, CORSIA contains a basket of measures including increased energy efficiency, the use of sustainable fuels and offsetting through other sectors. Countries can decide whether they intend to participate during the pilot phase 2021–2023 and the first phase 2024–2026; from 2027 onwards participation becomes mandatory with exceptions for Least Developed Countries, Small Island Developing States and Landlocked Developing Countries. Emissions from flights between participating countries are covered by CORSIA independently of the flag of the carrier. 88 countries signed up for the pilot phase, which cover 75 % of international revenue passenger kilometres (ICF Consulting et al. 2020) with China, India, Brazil and Russia the most relevant countries that are not participating.

CORSIA only addresses emission growth above a baseline value. For the pilot phase, only 2019 emissions are used as the baseline; the original intention was to use average emissions of 2019-2020 but this was changed due to the Covid-19 pandemic. As a result, very little to no offset demand is expected during the pilot phase (Schneider and Graichen 2020). It has not yet been decided whether the baseline will be changed again for the first phase. Like the EU ETS, CORSIA does not address non-CO_2 emissions. A set of criteria is used to assess the eligibility of offset units.

2.2 Main design options

As part of the Fit for 55 package, the Commission will also publish proposals for the reform of the aviation ETS. The crucial elements impacting the environmental effectiveness are the relationship with CORSIA/scope of the aviation ETS, the cap, the share of auctioning and the treatment of non-CO_2 emissions and aviation-induced cloud formation. The inception impact assessment includes six different policy options for the relationship between the EU ETS and CORSIA:

1. Return to full ETS scope without application of CORSIA,

2. Continuation of the reduced scope; CORSIA is not applied,

3. CORSIA replaces the EU ETS,

4. Continuation of the ETS in its current scope, CORSIA is applied on routes to/from third countries,

5. ETS remains in the current scope but is limited to emission below the CORSIA baseline; CORSIA is applied to emissions growth and routes to/from third countries, and

6. ETS remains in place for European operators in the reduced scope, CORSIA for external operators and routes to/from third countries.

These options have already been evaluated in the assessment pursuant to Art. 28b of the ETS Directive (ICF Consulting et al. 2020). Options 1 and 2 are not in line with the Council Decision to participate in CORSIA taken in June 2020. In terms of emissions from the sector, the impact assessment concludes that all six options lead essentially to identical emissions. The level of ambition of these options is mainly determined by the quantity of offset units/ETS allowances that need to be bought and the quality of these units. In terms of net emissions, options 3 scores the worst; options 4 to 6 would lead to a CO_2 emission decrease of 2.2 % compared to the CORSIA-only scenario and option 1 would be the most ambitious. These calculations assume that the CORSIA offset units lead to additional emission reductions, which is questionable – especially for the pilot phase. This is because eligible units can come from projects that were already in operation prior to the start of CORSIA and other weaknesses in the eligibility criteria, e.g. that permanence of forestry projects is only required for 20 years. The impact assessment concludes with regard to the level of ambition that CORSIA "is mis-aligned with, and weaker than, the global level of ambition required to keep within the temperature goals of the Paris Agreement" and also weaker than the level of ambition of the EU ETS. Replacing "coverage of aviation from the scope of the EU ETS with CORSIA therefore risks weakening EU climate targets".

Concerning the cap, if the current approach is continued, i.e. the cap for the aviation ETS declines in parallel with the stationary ETS, the resulting cap would be a reduction of approx. 48 % below the reference period 2004–2006. While this is a steep reduction compared to the historic growth rates, the impact on the overall supply and demand in the ETS would be very limited (Graichen and Graichen 2020). In terms of operational costs, the auctioning share has a much higher impact on airlines and ticket prices. For the stationary ETS, the approach to free allocation is based on the potential of carbon leakage: sectors which are deemed at risk due to an ambitious carbon price receive a share of the required allowances for free. In this way, the competitive disadvantage compared to installations in countries without a carbon pricing scheme is minimised. Sectors with a low risk of carbon leakage receive no free allocation. For aviation, demand is geographically fixed: passengers will want to depart/arrive close to their home; there is very limited potential to evade the EU ETS in aviation. Especially for intra-EU flights – which are covered by the ETS – there are no viable alternative routes with a stop-over outside the ETS.[1] Following the logic of the stationary ETS, there should, therefore, be no free allocation for airlines. However, on routes to third countries with a stop-over either within or outside the ETS, the situation is different (e.g. Rome – Paris – Bangkok versus Rome – Doha – Bangkok). In such cases,

1 With the departure of the United Kingdom from the EU, there is the theoretical but very unlikely possibility of evasion by flying through London, e.g. on a flight from Sweden to Spain. According to the EU-UK Trade and Cooperation Agreement, flights to the UK will remain in the ETS and the UK will implement a carbon pricing scheme which is at least as ambitious as the (current) EU ETS. In addition, the UK's climate target includes all domestic and international aviation, which provides a strong incentive to address aviation emissions.

the flight without a stop-over within the scope of the ETS would have an advantage compared to the route on which one leg is covered by the ETS. The assessment pursuant to Art. 28b modelled five different options for the future auctioning share, ranging from the status quo to direct full auctioning from 2023 onwards. The difference between these options is estimated to impact ticket prices by 0.6 % per one-way flight within the scheme, which amounts to less than 1 Euro. The assessment concludes that there is a low risk of carbon leakage even if full auctioning is applied but it could lead to reduced profits by airlines.

A parallel study assessed the options to reduce the impact of non-CO_2 emissions from aviation on the climate. The overall contribution of aviation to global heating is three times that of CO_2 alone, mainly through aviation-induced cloudiness and NO_x emissions (D.S. Lee et al. 2021). The policy options in the assessment include financial measures (NO_x-levy and inclusion of NO_x into the ETS), fuel-based measures and air traffic management (EC 2020a). Fuel-based measures focus on the quality of the fuel to reduce soot whereas the intention of traffic management is to avoid zones with a high likelihood for aviation-induced cloud formation. All these measures would need some time for implementation with most requiring 5 to 8 years according to the authors.

3 Maritime transport

3.1 Abatement options and costs

Operational and design/technical measures can be used to reduce GHG emissions from maritime transport. Operational measures like voyage optimisation or reduction of speed (called slow steaming) can have a significant impact, especially in the short term (Healy and Graichen 2019; IMO 2020). Technical measures can improve the energy efficiency of a ship by altering the design of the ship (e.g. hull, propeller) or by improving the engine (Bouman et al. 2017). The biggest lever for reducing emissions is, however, the switch to alternative fuel and energy sources (DNV GL 2019). Wind assistance or battery-electric propulsion of ships can contribute to a small degree and in niches; the switch to sustainable fuels based on renewable energy (so-called e-fuels) is the most promising option. In contrast to aviation (section 2), it is not yet clear which e-fuel (or which selection of fuels) will be dominant in maritime transport in the future. Among the carbon-free energy carriers, ammonia has received increased attention lately, partially for being among the cheaper options of e-fuels (LR; UMAS 2019). However, methanol is also a promising candidate fuel and less expensive than other carbon-based e-fuels (Korberg et al. 2021).

The most cost-effective abatement options are typically operational measures or smaller changes and maintenance of the hull or propeller – which might even have negative average marginal CO_2 reduction costs (Healy and Graichen 2019; Wan et al. 2018) Technical solutions like the use of onshore power have much higher CO_2 reduction costs. Eide et al. (2011) estimated these to be between 50 US$ and 200 US$ per ton of CO_2. Price estimations for e-fuels vary greatly as they depend on projections of future prices of renewable electricity and direct air capture (to provide CO_2 for carbon-based e-fuels). In 2030, fuel costs might range between 140 and 210 €/MWh (Perner et al. 2018). The switch to post-fossil fuels is the most important abatement option in shipping. It needs to be incentivised as soon as possible because the uptake of these fuels across the fleet takes time.

3.2 Existing regulation focussing on the European level

The potential inclusion of maritime transport is part of a stepwise approach of the EU to regulate emissions from maritime transport. The EU Monitoring, Reporting and Verification Regulation (EU 2015) requires the reporting of CO_2 emissions emitted:

- when ships are at berth,
- between the European Economic Area (EEA) ports (intra-EEA),
- between the last non-EEA ports and the next EEA ports (incoming voyages), and
- between the last EEA ports and the next non-EEA ports (outgoing voyages).

The EU MRV covers all ships calling at EU ports during the reporting period (one calendar year) above 5 000 gross tonnage (GT) except ships used for certain applications (e.g. dredging, ice-breaking, offshore installation activities, fishing, warships, government ships). The regulated entity is the shipping company defined as the shipowner or anyone who has assumed the responsibility to operate the ship like a manager or bareboat charterer.

3.3 Main design options for a maritime ETS

Geographical scope

According to EC (2020b), emissions from intra-EEA (including when ships are at berth), outgoing and incoming voyages account each a third of the CO_2 emissions covered by the EU MRV regulation. The highest environmental effectiveness would be achieved with the full scope including all emission of ships calling at EU ports (144 Mt CO_2 in 2019) (EMSA THETIS-MRV 2020). Considering the resistance from non-EU countries and drawing on the experience from aviation, a semi-full scope could be applied in the maritime ETS. This would cover 50 % of each outgoing and incoming voyage, totalling about 99 Mt CO_2 in 2019 (EMSA THETIS-MRV 2020).

Scope of emissions, ship type and size

A maritime ETS should cover all GHG emissions already monitored and reported under the EU MRV (currently only CO_2 emissions are covered). With the uptake of liquefied natural gas (LNG) and the potential introduction of biomethane as a fuel, methane (CH_4) emissions will become a relevant source in maritime transport. The EU should aim to include CH_4 emissions in the EU MRV and subsequently the EU ETS. In later reviews of the maritime ETS, black carbon and nitrous oxide (N_2O) emissions should be considered. Black carbon has a large global warming potential (GWP), especially in Arctic regions, and contributes to air pollution (Bryan Comer et al. 2017). Currently, there is an increasing interest of using ammonia as a marine fuel. There is a risk of emitting N_2O when combusting ammonia. N_2O emissions, with a GWP of 298 (Myhre et al. 2013), could, therefore, become more important in future. Following a proposal by the European Parliament, discussions are already ongoing to extend the maritime MRV system to other GHG emissions (EP 2020).

To begin with, a maritime ETS could cover all ships types covered by the EU MRV, including all the exemptions (see above). However, any maritime EU policy should strive to include all ship types in accordance with the polluter-pays principle. A maritime ETS could therefore be extended to other ship types in a second phase. The EU MRV scope would need be extended accordingly beforehand.

A maritime ETS applied to ships larger than 5 000 GT benefits from data available on these ship types from the EU MRV. An ETS coverage of ships larger than 5 000 GT with the full geographical scope mentioned above would be able to cover 90 % of all maritime EU CO_2 emissions and 55 % of all ships calling at EEA ports (EC 2020b). The inclusion of smaller vessels has an additional benefit: because they typically operate near to shore, any reduction in GHG emissions and in corresponding air pollutants will be beneficial for the coastal population. An extension of the scope to ships larger than 400 GT could be reconsidered in the next review of the ETS. For now, an alignment with the EU MRV by covering ships larger than 5 000 GT is preferable.

Regulated entity

Ideally, the regulated entity should ensure compliance with the environmental requirements, be responsible for paying the fine in case of non-compliance and be able to influence the amount of emitted CO_2 (polluter-pays principle). Many factors influence the decision on CO_2 reduction or the uptake of alternative fuels. There is, for example, the problem of split incentives. The entity investing in a ship's environmental performance is not always the entity reaping the benefits of that investment. For a maritime ETS, a range of options for a regulated entity exist, e.g. the fuel supplier, ship owner, ship operator or charterer.

An upstream approach is to make the fuel supplier the responsible entity. However, it will likely decrease the effectiveness of the ETS because ship operators tend to bunker where fuel is cheapest and would thus bunker outside the scope of the scheme. The other options all have advantages and disadvantages. In the final analysis, a maritime ETS will likely be based on the EU MRV. The most practical approach might be to synchronise the choice of the regulated entity with whichever definition is used in the MRV regulation. Currently this regulated entity is the "shipping company"' (see above) which encompasses several of the above-mentioned options. The latest proposal of the European Parliament (EP 2020) to amend the EU MRV regulation suggests a refined definition of the regulated entity under an EU ETS by defining a 'commercial ship operator', which is the entity responsible for paying the fuel bill and operating the ship, and by adding the time charterer to the previously mentioned definition of a shipping company.

ETS type and cap

A cap that is at least semi-open would allow regulated entities to surrender allowances from other sectors and in this way mitigate the volatility of allowance prices. The cap, determined through the linear reduction factor, should not be weaker than that for other sectors. The baseline year for determining the cap could be based on the starting year of the EU MRV, i.e. 2018.

Allocation

For maritime transport, the auctioning of allowances provides a fast and advantageous way into a maritime ETS. Current discussions such as the proposal by the EP (2020) also suggest auctioning as the preferred allocation method. Drawing on the experience from the sectors in the existing EU ETS, in which allocation free of charge was used to avoid relocation of production beyond EU borders but might be replaced by a Carbon Border Adjustment Mechanism, auctioning seems to be preferable for the maritime ETS. A phase-in with gradual increase of the share of monitored emissions covered by the system could be an option for a limited period.

Use of revenues

If allowances are auctioned, revenues could be collected. A relevant part of these should be recycled back into the maritime sector to finance investments to decarbonise the sector, e.g. facilitating the uptake of sustainable alternative marine fuels. A dedicated fund for the maritime sector could be established that is similar to the Innovation Fund. The EP (2020) already suggested establishing such a fund, calling it the Ocean Fund. The auctioning of all allowances would generate € 3 960 million for a semi-full scope and € 5 760 million for a full scope (given a CO_2 price of 40 €/tCO_2).

Compatibility with IMO

Reviews of a maritime ETS should not necessarily be oriented at review timelines of other sectors, but rather be timed to coordinate with developments at the IMO. Most of the candidate measures (or rather policies) foreseen in IMO's Initial GHG Strategy (IMO 2018) would not interfere and would rather be compulsory to an EU policy. A maritime EU ETS will likely be implemented earlier than any similarly effective reduction policy at global level through the IMO. Discussion on market-based measures at the IMO have slowly re-started after a long break. A maritime EU ETS might add pressure and accelerate these discussions at the IMO. This occurred previously with the adoption of emission control areas and the EU MRV by the EU. The EU ETS can also be a role model for the design of such a policy under the IMO.

3.4 Impact on emissions from sector

The impact of a maritime ETS depends on the chosen scope and the ETS allowance price. An ETS covering intra-EEA voyages will do little to reduce GHG emissions of the sector as it only includes a small amount of emissions (55 Mt CO_2). Even though current ETS prices are far too low to incentivise the uptake of e-fuels in maritime transport, carbon pricing can help leverage low-cost abatement options like slow steaming. The partial use of revenues from auctioning allowances can be used to further lower the price gap between fossil and post-fossil fuels. If maritime transport is subject to at least a semi-cap and a linear reduction factor like other sectors in phase 4 of the ETS, it is expected that the maritime transport sector will draw on the stationary ETS allowances in the foreseeable future. The impact on the emissions might, therefore, be limited after low-cost abatement options have been implemented. Other regulatory measures will be necessary to set the maritime transport sector on a course towards full decarbonisation by 2050 (e.g. the Fuel EU Maritime Initiative).

4 Integration of road transport into the EU ETS

4.1 Abatement options

A carbon price raises the price of transport fuels such as gasoline and diesel and hence provides incentives for private households and road freight transport companies to adjust their fuel consumption.

For example, in the short term, households or individuals can drive more economically or switch to public transport as well as non-motorised modes of transport, such as walking or cycling. In the medium term, there is also the option of buying a more efficient combustion engine, reducing the carbon-intensity of fuels (e.g. by blending it with low-carbon fuels such as biofuels or synthetic fuels taking into account sustainability implications). In addition, people may reduce the distance travelled, e.g. by working from home or via integrated urban planning. In the long term, a change of residence or workplace to avoid trips and the associated mobility costs is conceivable.

In freight road transport, possible short-term adaptation consists of a higher utilisation of vehicle capacity. In the medium term, the use of low-emission vehicles (such as battery-electric or hydrogen-powered trucks) is conceivable. In the long term, routes can be avoided through shorter value chains and changed consumer behaviour, and a shift to the more climate-friendly option of rail can be achieved.

4.2 Existing regulation focussing on the European level

Currently, the Effort Sharing Regulation sets national targets, which include emissions from road transport. Member States have substantial freedom regarding the measures they want to use to achieve these targets. If the emission targets are missed, there is an obligation to buy annual emission allocations (AEA) from other Member States that have exceeded their reduction targets. In the period up to 2020, during which a very limited amount of trade occurred, prices were low due to a significant surplus (Gores and Graichen 2021). During the period up to 2030 such offsets – whose cost per ton of CO_2 could be significantly higher than those in the EU ETS,– would impose substantial burdens on government budgets, thus creating a direct financial incentive to implement measures to achieve national emissions targets.

The European Commission has announced that it will consider including road transport in the EU ETS for the climate package expected in July 2021. Among other things, this would help avoid fuel tourism between individual Member States. An EU-wide emissions trading system for road transport would have the advantage of establishing a uniform price signal throughout Europe. Despite this, fuel prices would still differ due to the different fuel taxes across countries.

4.3 Main design options for integrating road transport into the EU ETS

Road transport might be included in the existing EU ETS or a novel trading scheme (possibly jointly with the buildings sector). In both cases, the most straight-forward point of regulation will be mid-stream at the distributors of transport fuels or up-stream where fuels are produced/imported. The covered entity would need to surrender emissions allowances for fuels sold and/or decrease the fossil carbon content of the fuel. The permit price would then be passed on to the final consumers who would adjust their behaviour accordingly. Granting exemptions for particular activities (such as transport in the agricultural or construction sectors) could be achieved by means of special purpose distributors that only sell fuel for those targeted activities without the obligation to surrender emission permits.

A crucial issue is the size of the sector: road transport emissions are about 50 % of those already covered by the ETS (EEA 2020a). This means that the assumptions and data of this sector need to be robust enough to avoid unintended consequences for the overall ETS. It will also be necessary to ensure that there is no double counting (or omission) of fuels which are supplied to stationary installations already covered by the EU ETS. Thus, setting up an ETS for road transport would most likely require a data gathering exercise and several years of planning. It will also be necessary to ensure that there is no double counting (or omission) of fuels. This would most likely require a data gathering exercise.

Integration into the existing EU ETS

If emissions from road transport are integrated into the existing EU ETS, it can be assumed that the resulting prices will be dominated by the abatement options in the stationary sector. Estimated prices in 2030 are comparatively low with limited impacts on emissions in the transport sector. Prices currently prevailing in the EU ETS – approx. € 40-50 per ton of CO_2 – would raise prices for gasoline by about 10–12 ct/l, which seems unlikely to result in large-scale changes in mobility choices. This is especially important if abatement targets are further tightened under the EU Green Deal. In this case, if transport were integrated into the EU ETS without accompanying regulation, emission reductions would take place primarily in the electricity sector, with only limited impact on road transport.

A significantly higher CO_2 price, which also provides substantial incentives for road transport, could be achieved within the EU ETS by introducing a corresponding minimum price or reducing the supply of available emission allowances. In this case, however, there would be adverse effects on energy-intensive industries in the EU ETS and the risk of relocation to regions with less stringent climate policies. Therefore, a significant CO_2 price for transport in the EU ETS only seems plausible if measures are in place to effectively prevent carbon leakage in the industrial sector. Currently, this is ensured by the free allocation of emission permits for energy-intensive industries. However, in the medium term, as we move toward net-zero emissions, there will not be sufficient allowances to provide effective leakage protection. As part of the Green Deal, the Commission is also assessing a Carbon Border Adjustment Mechanism (CBAM), which would impose a CO_2 price on energy-intensive imports to create a level playing field between EU and non-EU producers.[2]

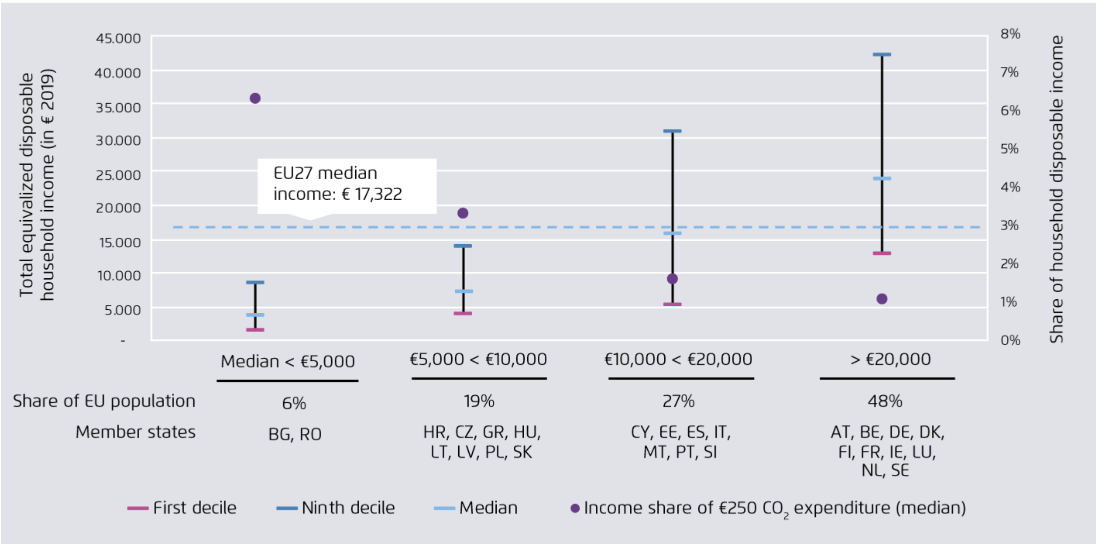
A separate ETS for transport

An alternative to achieving a uniform EU-wide CO_2 price in transport is to create a separate ETS for transport (and possibly the building sector) in parallel to the existing EU ETS. This approach could achieve an effective EU-wide CO_2 price in transport if it were the main measure: Without strong additional regulation (e.g. via CO_2 standards), a relatively high price would be expected to achieve an emissions target in line with the increased ambition. While effective this could lead to significant additional

[2] The concrete design is to be detailed in the Fit for 55 package.

burdens and distributional effects both within a country and between countries (Pollitt and Dolphin 2020). This is even more the case if the building sector is also included in the ETS as heating costs often account for a substantial share of expenses for low-income earners. Figure 1 illustrates this by providing the example of an additional cost of € 250 per person and year due to the introduction of a uniform carbon price across Europe. While the impact would be around 1 % of the disposable income for households in the wealthier Member States, for Bulgaria and Romania the impact would be over 6 %. To cushion social consequences, an EU-wide price should, therefore, be accompanied by measures to compensate poorer Member States, e.g. through direct payments or increased support through cohesion and structural funds. Revenues from auctioning emission allowances could be used to fund these measures. In this way, poorer Member States would receive a net positive revenue. However, it would be necessary to ensure that these funds actually benefit those most in need to prevent a regressive policy.

Figure 1: Disposable income distribution and impact of CO_2 expenditure on median income (in different EU Member State groups)



Own calculations based on Eurostat (2021b)

Source: Graf et al. (2021)

Another problem could be that, even with two separate emissions trading systems, market players could speculate that these could be merged into a single system in the future. The prospect of the associated increase in the price of CO_2 in the EU ETS could lead to increased demand for allowances. This shortage would result in a price increase - and thus the undesirable effects on energy-intensive industries which have already been discussed.

4.4 Impacts on emissions from road transport

EU-wide pricing of transport emissions, whether in a separate emissions trading scheme or in the existing EU ETS, could mitigate the importance of national emissions targets or relieve Member States of the obligation to meet national emission targets. For example, national emissions targets which also cover the transport sector were introduced under the Effort Sharing Regulation primarily to ensure that EU climate targets could be met with fair burden-sharing among Member States. With an emissions cap that effectively limits transport emissions at the EU level, such national targets would at least no longer be necessary to limit EU emissions in sectors included in a cap-and-trade scheme.

One option to prevent excessive cost burdens especially for Member States with low per-capita incomes would be a cap on the CO_2 price while maintaining the Effort Sharing Regulation targets, even though this might generate additional complexities (e.g. whether such a measure would be regarded as a tax and require adoption by unanimity vote). If the CO_2 price set via such a cap is not sufficient to meet emission targets, further (national) instruments must be implemented. This is particularly relevant for the transport sector since a broad bundle of measures in addition to the CO_2 price is required in this sector to bring about effective emission reductions. Hence, carbon prices need to be complemented instruments that, for example, target the purchase of low-emission vehicles, the expansion of infrastructure for e-mobility, public transport and bicycle traffic, as well as the reform of environmentally harmful subsidies in the transport sector.

4.5 Social impacts, especially between Member States

National targets, the non-achievement of which is sanctioned, can be an important motivation to introduce additional instruments for a climate-friendly transport policy or to strengthen existing ones. However, an EU-wide pricing system makes it more difficult to rely on national targets, as CO_2 prices in an integrated system depend on economic developments as well as ambition levels in other Member States. Furthermore, an EU-wide emissions trading system means that additional emission reductions by individual Member States have no effect on EU emissions. Accordingly, a cap on the CO_2 price combined with maintaining national targets under the Effort Sharing Regulation could provide an appropriate policy mix for the transport sector.

At the same time, a price cap would have the advantage of reducing distributional effects between Member States; it prevents low-income countries from assuming an excessive cost burden. Perhaps even more importantly, this approach would shield low-income households from the additional costs resulting from higher prices for transport (and possibly heating) fuels.

5 Impact of the inclusion of transport in the ETS on stationary installations

5.1 Demand for stationary ETS allowances from transport sectors

If further sectors are included in the ETS, this will impact the stationary installations, too, depending on design choices. The impact on the supply of allowances for stationary ETS depends largely on i) whether the new sectors can use EUAs for compliance and ii) the net supply/demand of these sectors.

There are different options for designing the interaction of the sectors:

- Following the example of aviation, a separate cap for the other transport sectors is defined. Units are fully fungible, meaning that operators can use EUAs to cover their surrender obligation and vice versa. There is no limit on the use of EUAs. This option results in uniform prices across all sectors.

- Systems could also be linked by one-way trade only (as was the case for aviation up to 2020). If the sector permitted to use allowances from the other sector has too few, prices will align. If it has too many, then prices are expected to differ with lower prices in the sector being long.

- Another variant would be to allow only a certain share of units from other sectors for compliance. Demand from other sectors would be limited, leading to lower impacts on stationary installations. At the same time, sectors with higher abatement costs would be required to contribute to the decarbonisation effort through in-sector reduction. In this case, differing prices are to be expected.

If sectors were not allowed to use EUAs for compliance, separate systems will evolve and different CO_2-prices are to be expected. There would be no impact on supply to the stationary sector. The first option, unlimited trade and use for compliance, will have the largest impact on the stationary sector and thus forms the basis of analysis in this chapter.

The demand for allowances depends on how abatement costs in the sectors compare to allowance prices. If abatement is cheaper than in the stationary sector, transport emissions are reduced. If abatement is more costly, operators will opt to purchase EU allowances (EUAs) rather than undertaking reduction efforts. The aviation sector is a buyer of allowances from the stationary sector to cover its emissions that exceed the aviation cap.

The demand of transport sectors for allowances from the stationary sector depends on:

1. abatement costs compared to EUA prices,
2. the size of the sector, and
3. the allowance shortage in the sector and the year of inclusion.

Abatement costs

The EUA price for one ton of CO_2 was only € 6 on average in the years 2013-2017, a price too low to trigger significant abatement measures (see table below). Since 2018 the price has risen, from € 15 in 2018 to around € 25 in 2019 / 2020. Prices increased even more since then, hitting an all-time high of € 50 beginning of May 2021. Projections on future prices levels vary. In the modelling supporting the climate target plan CO_2 prices in the ETS sector range from $€_{2015}$ 32 to 65 in 2030 depending on the scenario (EC 2020c). Policy scenarios that assume carbon pricing in transport sectors expect prices ranging from $€_{2015}$ 44 to 65.

Table 1 Allowance prices in the stationary sector: primary auctions of EUAs

Year	2013	2014	2015	2016	2017	2018	2019	2020
Price in €	4	6	8	5	6	15	25	24

Sources: Nissen et al. (2020) for 2013-2019, (EEX 2020) for 2020.

All three transport sectors assessed are expected to face higher marginal abatement costs than in the stationary sector and higher than projected CO_2 prices in the climate target plan. While part of the GHG reductions are expected to take place in the transport sectors (e.g. operational measures), it will be more economical to purchase emission allowances when larger investments are required or e-fuels come into play.

Size of the sectors

In 2021, the EU ETS covers emissions from installations of the energy sector and industry as well as from flights in and between EEA countries. Emissions from the stationary ETS have declined in recent years mainly due to emission reductions in the power sector. In 2020, the stationary sector emitted 1 354 Mt CO_2eq (EEA 2020c). Aviation emissions were exceptionally low in 2020 (25 Mt CO_2), which is even below free allocation levels. In the years preceding the COVID-19 pandemic, aviation emissions were increasing year by year, reaching 68 Mt CO_2 in 2019. Emissions are expected to increase again to similar levels when travel restrictions are lifted and the industry has recovered. In the pre-pandemic years of 2013-2019, the aviation sector covered a third of its emissions by allowances bought from the stationary sector. The demand from the aviation sector is expected to increase in future years as the aviation cap will be reduced by 2.2 % per year from 2021 onwards following the example of the stationary sector.

Table 2 Emissions in the EU ETS, maritime and road transport (Mt CO_2eq.)

Year	2013	2014	2015	2016	2017	2018	2019	2020
Stationary ETS	1 908	1 814	1 803	1 750	1 755	1 682	1 530	1 354
Aviation ETS	53	55	57	61	64	67	68	25
Maritime transport (50% of voyages to/from non-EEA ports)						95	99	
Road transport (EU 27)	728	725	733	747	764	777		

Source: Emissions from ETS include all 30 EU ETS countries and are based on (Nissen et al. 2020) for the ETS emissions years 2013-2019 (all 30 EU ETS countries) and (EEA 2020c) for 2020. Maritime emissions include emissions from voyages between EEA ports and when at berth (EC 2020b; EMSA THETIS-MRV 2020). Road transport emissions are based on GHG inventory for the EU 27, CRF category 1.A.3.b road transport (EEA 2020b).

Total emissions from maritime transport amounted to 144 Mt CO_2 in 2019 if intra-EU voyages as well as voyages to and from non-EEA ports were included in the EU ETS and 99 Mt CO_2 if only half of voyages to/from non-EEA ports were covered and only intra-EEA voyages fully (EMSA THETIS-MRV 2020). If maritime emissions were added to the current EU ETS, it would still be dominated by stationary emissions. This would change if road transport emissions were included as the sector would add substantial emissions: in 2018, EU 27 reported 777 Mt CO_2 from road transport in the inventory.

Allowance shortage in the sector and year of inclusion

The demand for allowances from the stationary sector depends on the extent to which the transport sectors face a shortage and on the year in which they are included. The cap of the stationary ETS reflecting the increased climate ambition is not published yet. Based on the modelling of the climate target plan, stationary ETS emissions are expected to amount to approx. 720 Mt CO_2e in 2030 (scenario MIX).

The aviation sector is already included in the EU ETS; therefore, adjustments can happen more quickly for this sector than for others, e.g. in 2024. The aviation cap declines yearly by the same linear reduction factor as applied to the stationary sector whereas emissions are increasing (outside the crisis years); therefore, net demand from the aviation sector is expected to increase once the effect of the COVID-19 crisis diminishes. In the impact assessment on CORSIA, a constant scope for aviation ETS is assumed; demand for EUAs from the stationary installations is estimated to amount to approx. 23 Mt CO_2 in 2030 (with a range of 12 to 32 million tons) (ICF Consulting et al. 2020). The scenario assumed the currently valid LRF of 2.2 % and a price of $€_{2018}$ 30.8 per t of CO_2. Knowing that the stationary ETS cap will be tightened, a more stringent LRF, the aviation cap is also expected to decline more steeply than in the modelling, resulting in a higher demand for allowances from the stationary sector. If a stationary cap of about 720 Mt CO_2 is assumed, aviation demand would represent up to 5% of the stationary cap.

The maritime sector is currently not covered by the EU ETS and its inclusion would require some preparation. The EU MRV system is a good starting point and in many elements the scheme could be oriented to the aviation sector. Considering legal timelines as well as technical implementation, starting in the middle of the trading period seems both ambitious and feasible. If only intra-EEA voyages are included, the climate target plan expects maritime emissions of about 75 Mt CO_2 in 2030. If additionally, 50 % of the emissions of voyages to extra-EEA ports are covered, emissions are estimated to amount to about 165 Mt in 2030. There is little information on the cap to be expected for the maritime sector; it can be estimated to be roughly in the order of magnitude of demand from the aviation sector.

The longest preparation time of all is expected for the inclusion of road transport. The ownership structure of vehicles in the sector is very different to aviation and maritime transport, therefore many design elements will need to be newly developed and the point of regulation is likely to be upstream. While it can build upon experiences from the German fuel ETS, it will mean that many new entities will be subject to emissions trading and new MRV guidelines will need to be developed. Therefore, its inclusion is expected towards the end of the fourth trading period, only.

In summary, it can be expected that all three transport sectors will purchase allowances from the stationary sector and thus contribute to higher EUA prices. In the scope currently discussed, aviation and maritime transport are small emission sectors compared to stationary installations and even though they are expected to cover a substantial part of their emissions by EUAs, the impact on the stationary ETS is manageable. If they were to cover 50 % of their pre-pandemic emissions with EUAs, demand would be around 80 Mt annually.

If the road transport sector is included in the ETS, it may generate substantial demand for allowances both due to its sheer size and the obstacles which cannot be overcome by CO_2-pricing alone (e.g. infrastructure requirements). The road transport sector would add to demand towards end of the fourth trading period, when allowance supply in the stationary sector is also expected to have declined substantially. Therefore, it would impact prices more strongly than the other two transport sectors.

5.2 Interactions with the market stability reserve in the stationary ETS

The stationary ETS currently has an oversupply of allowances, which has accumulated since the start of the second trading period. More emission allowances (including international carbon credits) were put into circulation than were needed to cover the emissions of stationary installations. To reduce the imbalance in the market, the market stability reserve was introduced. If the total number of allowances in circulation (TNAC) exceeds a pre-defined threshold, auctioning volumes are reduced. If it falls below the lower threshold, allowances from the MSR are added to auctioning volumes. From 2023 onwards, allowances in the MSR exceeding the auctioning volume of the previous year are invalidated. The MSR is set to be reviewed together with the Fit for 55 package.

Currently, aviation demand is not included when the TNAC is calculated. This approach should also be followed if further transport sectors are included, otherwise the ability of the MSR to reduce the surplus accumulated in the stationary sector would be dampened and affect the environmental effectiveness of the scheme (Zaklan et al. forthcoming).

5.3 Impact on prices

CO_2 prices of the different sectors will align if units from different sectors are fully fungible. Assuming that abatement costs in transport sectors are higher, the inclusion of further sectors will lead to higher prices in the stationary ETS. This leads to emission reductions in the stationary sector instead of the more costly options in the transport sectors.

Stenning et al. (2020) expect the EU ETS price to increase substantially if road transport and buildings are included in the EU ETS. Whereas they model very moderate prices in a stand-alone ETS in the stationary sector (below € 20 in 2030), if those sectors are fully included in the ETS prices of about € 80 are modelled. The modelling underlying the climate target plan determines EUA prices of € 32 in the base case and € 60 in the carbon price scenario.

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Annex

List of Abbreviations

AEA	annual emission allocations
CBAM	Carbon Border Adjustment Mechanism
CO_2eq	Carbon dioxide equivalents
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
COVID-19	Corona virus SARS-CoV-2
EEA	European Economic Area
EP	European Parliament
ESR	Effort Sharing Regulation
ETS	Emission Trading System
EU	European Union
EUA	European Union Allowance
GHG	Greenhouse gas
GT	Gross tonnage
GWP	global warming potential
ICAO	International Civil Aviation Organisation
LNG	liquefied natural gas
MRV	Monitoring, Reporting and Verification
Mt	Million tons
NDC	Nationally Determined Contribution
TNAC	total number of allowances in circulation