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EMISSION POSSIBLE

How a consolidated emissions trading system would dramatically reduce costs in the EU

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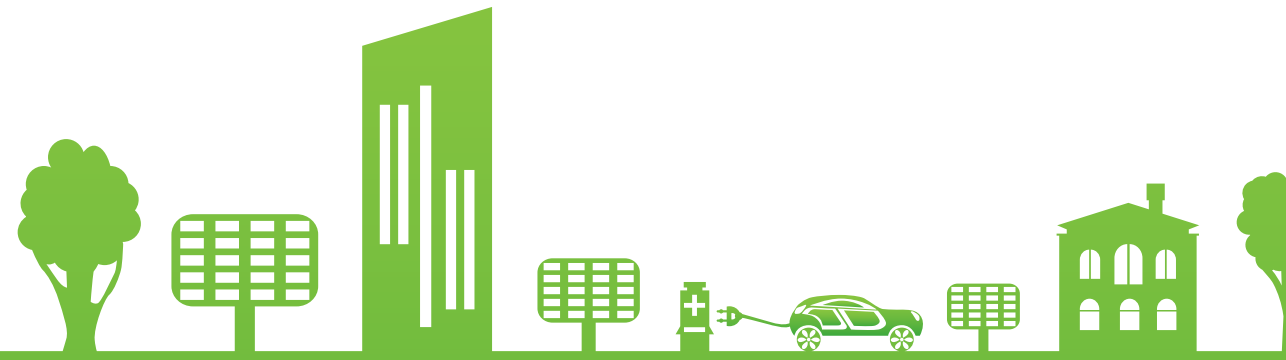

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Jonas Herby is a policy expert at the Center for Political Studies (CEPOS), a Copenhagen based public policy research institution and member of EPICENTER. Jonas is an expert in economic analysis focusing on the regulatory and welfare aspects of enabling economic growth. Jonas is good at relying on big data, web scrapping to formulate his analysis. Previously, he helped develop the Danish Transport Ministry's official models and unit prices.

Summary

- By consolidating the CO_2 emissions from land transport, buildings, and the existing EU emissions trading sector under a single, comprehensive emissions trading system (ETS), economic costs could be reduced by approximately 25 per cent compared to under the current climate policy.
- The Council and the European Parliament have reached a preliminary political agreement to establish a new special ETS for land transport and buildings (heating), resulting in two separate CO_2 ETS in the EU: the new ETS and the existing system covering electricity production, industry, and aviation.
- If national reduction targets for land transport and buildings are maintained, as is currently proposed, there are no significant benefits to incorporating these emissions into an ETS, but there may be additional costs.
- However, if a new ETS replaces national targets, it will reduce the economic costs of the EU's climate policy by approximately 7 per cent. The benefits will be much greater if the emissions are consolidated under the existing ETS instead of having a separate system. A consolidated ETS will reduce economic costs by 25 per cent.
- The benefits of a consolidated ETS will increase if demand in the emissions trading sector increases as the price difference between sectors increases. With parallel ETS, there is significant vulnerability to unforeseen shifts in demand, which can significantly increase economic costs.
- The full benefits of a consolidated ETS require that countries and the EU abolish double regulation in the form of taxes and efficiency requirements for emissions covered by the ETS.

Background

The EU's emissions trading system (ETS) covers the greenhouse gas emissions for which the EU has joint responsibility. Today, it primarily covers CO_2 emissions from electricity generation, industry, and aviation. The trading system sets a cap on the total CO_2 emissions in these sectors in the EU, and the strength of the trading system is that it encourages reducing greenhouse gas emissions where it is cheapest, across the countries and sectors covered. The system operates smoothly and transparently for consumers daily. This means that the total emissions from the covered sectors do not exceed a set limit.

The European Commission's proposal and the treatment of the proposal by the European Parliament and the Council

The Council and the European Parliament have reached a preliminary political agreement that land transport and buildings (heating) should be covered by a separate quota system, while maritime transport should be included in the existing quota system (European Council 2022). The political agreement has been made in connection with the EU's goal of reducing emissions in the Union by 55 per cent from 1990 to 2030 (also called 'Fit for 55').[1] The new system is expected to come into force in 2027.

The quota system for land transport and buildings will thus come to resemble the current quota system of the EU, which sets a total ceiling on the joint CO_2 emissions from electricity production, industry, and aviation (and, in the future, maritime transport).

1 In 'Fit for 55', the European Commission proposes that maritime transport be included in the current quota system. This measure was later adopted by the European Parliament and Council, according to the European Council (2022). The economic consequences of this exercise are not included in the calculations in this study.

The agreement creates the conditions for the price of emitting 1 tonne of CO_2 to become more uniform across the sectors included in each of the two quota systems, which decreases the economic costs of reducing CO_2 emissions to a given level (see, e.g., Brøns-Petersen 2017; Danish Economic Councils 2019). However, the agreement of the Council and the European Parliament does not ensure that the price will be the same across *both* quota systems, and it will therefore not minimise the economic costs overall for the sectors covered. At the same time, member states levy emissions taxes to varying degrees, also on emissions from the quota sector, which means that the price of emissions is not entirely the same across countries and sub-sectors.[2]

Double regulation and potential revenues for the European Commission

If a quota system is introduced for land transport and buildings, other regulations should be scrapped or heavily adjusted to avoid double regulation. This applies, for example, to taxes on gas, as there will no longer be significant externalities associated with gas combustion that are not already regulated through other taxes (such as sulphur taxes). At the same time, national reduction targets should be adjusted so that they no longer include land transport and buildings, as these will be regulated through the quota system – just as in the current quota system, where there are no national reduction targets for electricity production, industry, and so on. In practice, this will mean that national reduction targets will almost exclusively apply to agricultural emissions of greenhouse gases other than CO_2.

The Council and the European Parliament have also agreed to establish a social climate fund. The fund will be established in 2026–2032, with eligible expenses from 1 January 2026 based on the auctioning of 50 million allowances in 2026 to provide support at the beginning of the fund, while the new ETS will allow for the financing of the fund from 2027. The fund will – after presentation to the Commission – be used to finance measures and investments to mitigate the impact of CO_2 pricing on vulnerable citizens and micro-enterprises.

If the new quota system merely supplements the existing national reduction requirements for the non-quota sector, the primary effect will be to displace

2 A part of the taxes is due to the EU's requirement for minimum taxes on energy. If there are national reduction targets, it can also lead to countries having to impose taxes on certain emissions, even though they are covered by a quota system.

some of the taxes that would otherwise be necessary to meet national goals. Thus, the primary effect is to shift revenue from taxes to quota sales. The Commission may have an interest in this, as in connection with the social climate fund, it may influence the use of this revenue, whereas tax revenue goes to the individual member states and the Commission has no influence over it. If national reduction requirements are maintained, the new quota system will not contribute to ensuring that reductions take place where they can be achieved most cheaply in the EU (unlike the existing quota system), but will simply be a complex method of increasing the Commission's political influence and centralisation in the EU.

Therefore, it is important to avoid double regulation in the form of both quotas and national reduction requirements for heating and transportation. The abolition of national requirements is a prerequisite for economic gains.

The Council's and the Commission's agreement suggests that there will still be national reduction requirements for land transport and buildings, which is why the current agreement does not result in a (significant)[3] reduction in the costs of the EU climate policy.

A better solution

This analysis estimates the consequences for emissions and emission prices (quotas or taxes), as well as the economic benefits, of including emissions from land transport and buildings (heating) under either a new standalone quota system or the current ETS. The entire analysis considers the effects at the EU level.[4] The national reduction targets for heating and transport are assumed to be eliminated, unlike in the current agreement between the Council and the European Parliament.

The analysis is based on four climate policies, which are described below.

Baseline policy: In the baseline policy, CO_2 emissions are regulated largely as they are today. There is a quota system for electricity production, industry, aviation, and maritime transport, which corresponds to the current ETS expanded to include maritime transport, while emissions from land

3 There will only be a gain to the extent that the national reduction requirements are not binding for the countries.

4 The effects for Denmark will of course be smaller (according to the European Environment Agency (2021), Denmark accounts for about 1.2 per cent of the EU's total CO_2 emissions).

transport and buildings are still regulated through national CO_2 taxes on gasoline, diesel, and gas to meet national reduction targets.[5]

Climate policy 0: Two separate quota systems *with* national reduction targets (Council's and Parliament's agreement). In climate policy 0, a new quota system is established for land transport and buildings, which runs in parallel with the quota system in the baseline policy. The national reduction targets are maintained. Climate policy 0 thus corresponds to the principle in the Council's and Commission's agreement on separate quota systems.

Climate policy 1: Two separate quota systems *without* national reduction targets. This policy is similar to climate policy 0, but with the national reduction targets for land transport and buildings abolished.

Climate policy 2: One integrated quota system *without* national reduction targets. In climate policy 2, the quota system in the baseline policy is expanded to include land transport and buildings. National reduction targets for land transport and buildings are abolished.

5 In both climate policy 1 and climate policy 2, it is assumed that CO_2 taxes and energy taxes on gas will be replaced by quotas, as there are only a few externalities associated with the use of gas that have not already been addressed through, for example, sulphur taxes. Therefore, throughout the analysis, we consider the energy tax on gas as an actual CO_2 tax.

The reduction in the economic costs of climate policy is significantly greater with a single comprehensive quota system than with two separate quota systems

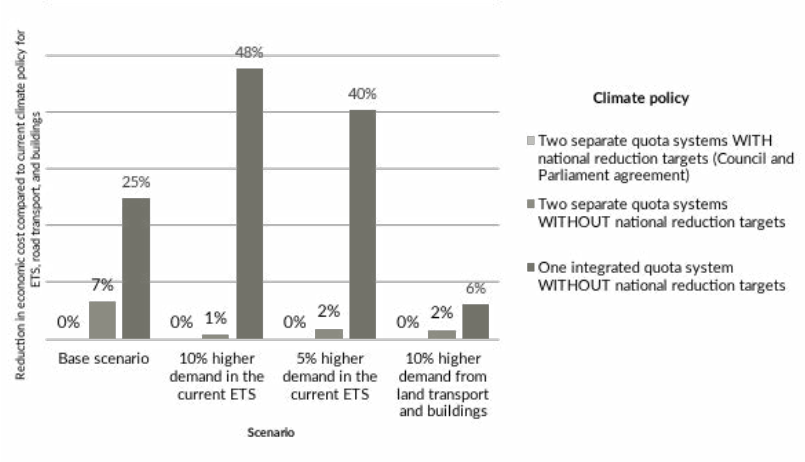
The analysis shows that there is a significant economic gain in transitioning from the current regulation (baseline policy) to a single, unified ETS (climate policy 2) compared to having two separate systems (climate policy 1). As described in the section 'Double regulation and potential revenues for the European Commission' above, there are no significant economic gains in climate policy 0 (Council's and Commission's deal).

In the central analysis, where the carbon price in the current trading system is 642 DKK/tonne in 2025 and where the reductions in total CO_2 emissions follow projections from the European Environment Agency (2022), the economic costs of climate policy are reduced by 7 per cent if a new independent trading system is established for land transport and buildings (climate policy 1), and by a whopping 25 per cent if land transport and buildings are included in a single, unified trading system together with the current trading system (climate policy 2); see Figure 1.

It is important to note that this is a minimum estimate, which only takes into account the benefits of having uniform prices across sectors. The benefits of having uniform prices across countries and within sectors in individual countries are thus not included.

Figure 1 also shows that a single unified ETS rather than two separate systems becomes more cost-effective as demand for emissions allowances in the current market increases. If demand for emissions allowances on the current market increases by 10 per cent, a single unified market would reduce the costs of climate policy by 48 per cent, whereas two separate markets would only reduce costs by 1 per cent.

Fig 1: Reduction in economic costs compared to current climate policy for ETS, road transport, and buildings in different scenarios



Source: Author's calculations.

Uniform prices for CO_2 emissions ensure economic gains

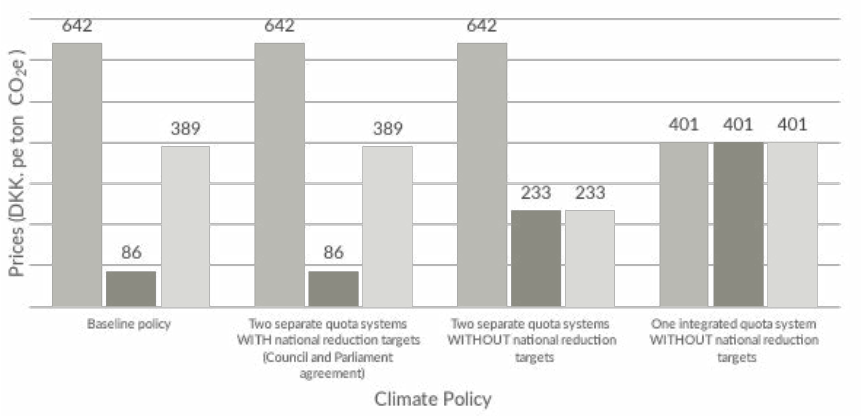
The reduction in economic costs is a result of uniform prices on CO_2 emissions across sectors. Companies implement measures to reduce CO_2 emissions – such as investing in new equipment – as long as the cost of the measures is lower than the cost of buying additional quotas. If the price of quotas is 642 DKK/tonne, it reflects that the price (the so-called shadow price) of implementing further reductions within the quota sector is 642 DKK/tonne. The same principle applies to land transport and buildings, where reductions will be made as long as the cost of reducing CO_2 emissions is lower than the price of emitting CO_2. Therefore, the price of CO_2 emissions reflects the marginal economic cost of reducing CO_2 emissions.

When prices are different in the three sectors (current quota sector, land transport, and buildings), the economic costs of reducing total CO_2 emissions to a given level will be higher than necessary because one sector pays to remove CO_2 emissions that could be removed more cheaply in other sectors. Therefore, if prices are not the same, there is potential for economic gain by creating uniform prices.

It is this potential that is presumably partially realised by including land transport and buildings under a new quota system, as the quota system can ensure that prices in the two sectors become uniform. However, this only happens if there are no national reduction requirements, as national reduction requirements would otherwise have to be achieved through emission taxes. If the national reduction requirements are binding, the tax on buildings will be so high that demand in the new quota system is pushed down, so the total price – including quotas and taxes – will be approximately the same as under the current climate policy without a new quota market.

But even without national reduction requirements, as Figure 2 shows, there will still be a price difference if there are two separate quota systems, so there will still be a potential for economic gains. This potential is fully realised only if all sectors are included under one overall quota system.

Figure 2: Prices of CO2 emissions in each sector for different climate policies

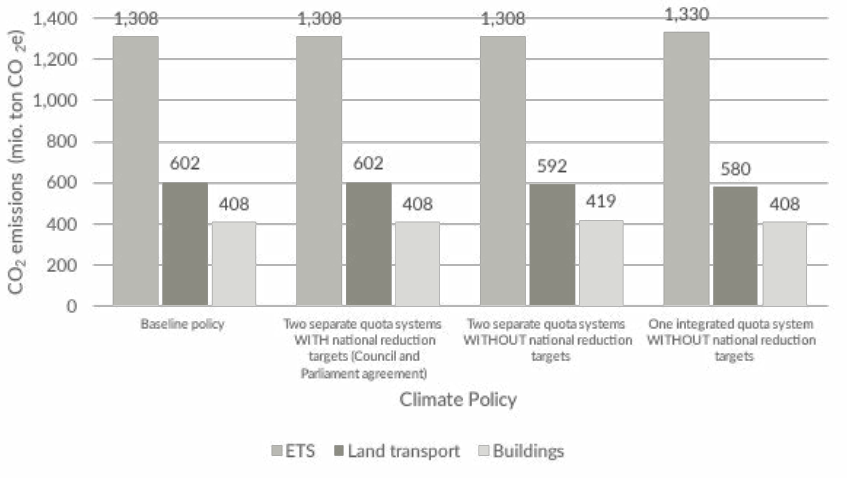


Source: Prices given the current climate policy is from Danish Energy Agency (2022), European Environment Agency (2019b), and OECD (2019), while prices for the new climate policies are based on the author's calculations.

Note: In climate policy 0, the prices correspond to the current climate policy because the national reduction targets – as with the current climate policy – are binding.

The size of the economic benefits also depends on how strongly the consumption of fossil energy responds to changes in the price of CO_2 emissions. Since the CO_2 price only constitutes a small part of the total energy price, even large changes in the CO_2 price have only a relatively modest effect on demand. For example, the price of a litre of gasoline only increases by 6–7 per cent when the price of CO_2 nearly quintuples from 85 DKK in the base policy to 401 DKK in climate policy 2. Therefore, the reduction in emissions from land transport is also modest, as shown in Figure 3.

Figure 3: CO2 emissions in each sector for different climate policies



Note: Emissions under the current climate policy are from the European Commission (2021a) and European Environment Agency (2022) (see Appendix A), while emissions for the new climate policies are based on the author's own calculations.

In climate policy 0, the prices (and, hence, the emissions) correspond to the current climate policy because the national reduction targets – as with the current climate policy – are binding.

The economic benefit depends on the demand for CO_2 emissions

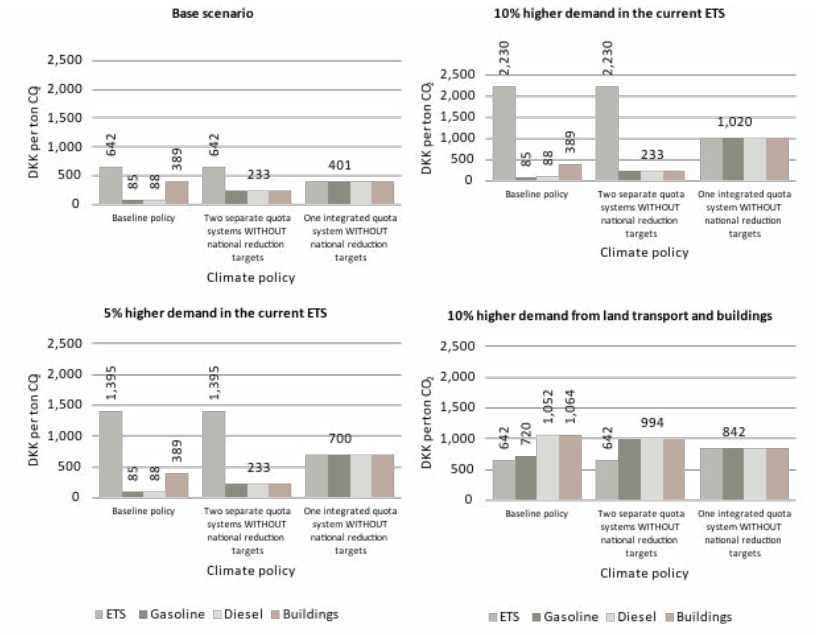
The prices of quotas under various climate policies depend on the demand for the quotas. If, for example, due to changing geopolitical conditions, there is a greater underlying demand for quotas at a given price in the current quota system, the price will rise until the total demand is kept within the quota sector.

This means that the price difference between emissions in different sectors – and thus the economic benefits of having a single quota system – depends on future demand. To illustrate the effect of changing demand, we have conducted three sensitivity analyses:

- 10 per cent higher demand for quotas at a given price from sectors covered by the current quota system;
- 5 per cent higher demand for quotas at a given price from sectors covered by the current quota system; and
- 10 per cent higher demand from land transport and buildings at a given price.

Figure 4 shows how the changed assumptions affect prices under different climate policies. The figure shows that the price of CO_2 emissions in the current quota sector can become very high if demand increases more than expected. If demand increases by 10 per cent, the price in the model becomes 2,230 DKK/tonne.

Figure 4: Prices of CO2 emissions in each sector, in each scenario for different climate policies



Source: Author's calculations

Note: In climate policy 0, the prices (and, hence, the emissions) correspond to the current climate policy because the national reduction targets – as with the current climate policy – are binding. For illustration purposes, this climate policy is not shown.

If there are two separate quota systems and demand increases by 5 per cent in the current quota system, the prices for reductions in the current quota system will be 1,395 DKK/tonne CO_2, but only 233 DKK/tonne CO_2 in the quota system for land transport and buildings; see Figure 4 bottom left.

This means that there is an economic potential that is not being realised. With one unified quota market, the price of CO_2 emissions is always the same across sectors, as shown in Figure 4, and thus the full economic potential is always realised regardless of demand in individual sectors.

Conclusion

There are significant benefits to changing the EU agreement to establish a carbon trading system for land transport and buildings. Firstly, a prerequisite for economic gain is that national reduction targets are eliminated when emissions are included in the carbon trading system – similar to what applies to emissions that are already covered. Secondly, a separate carbon trading system for heat and transport should not be established. Instead, heat and transport should be included in the existing ETS, which currently covers industry, energy production, and aviation.

The economic gain is related to the fact that the price of emitting CO_2 becomes more uniform across countries and sectors. In the central scenario, the total economic cost of climate policy is reduced by 25 per cent with a single carbon trading system, and the gain could be significantly greater with certain changes in assumptions. The agreed model with two carbon trading systems is therefore not robust against, for example, changes in demand.

In addition to the benefits resulting from the price of CO_2 emissions becoming uniform across sectors, there will be significant economic benefits associated with the prices of CO_2 emissions becoming uniform across EU countries, as carbon trading systems in both cases help ensure that resources are not used to reduce CO_2 emissions in one sector/country if the same reduction could be achieved at lower costs in other sectors/countries. The carbon trading system thus helps ensure that climate targets are achieved using the least possible resources.

Appendix A: Description of the model used and assumptions for the economic calculations

Overall method

A demand model is established and calibrated for the base scenario in the analysis year 2025. Then, the two different policies, scenarios 1 and 2, are implemented and the model is run again for each scenario to read off prices and quantities from the model.

Background for model calibration

Putin's attack on Ukraine

The war in Ukraine creates some uncertainty about the results, as it affects future energy prices, especially gas prices. A higher gas price will, all else being equal, lead to less gas consumption, which in isolation reduces quota prices. On the other hand, a higher gas price will also lead to substitution towards coal, which all else being equal increases quota prices. As there are two opposing effects, the overall effect on quota prices is uncertain. In the calculations, it is assumed that things have normalised by 2025, but this is obviously an uncertainty factor in relation to the results. However, it is found in the assessment that the uncertainty only affects the orders of magnitude of the results, not the relative relationships and overall conclusions.

The market and elasticities

We establish a simple demand model for fossil energy (quotas), where the price of quotas depends on the total quantity of quotas available and the underlying demand function. The energy demand is determined by a function with constant price elasticity:

$$\mathrm{D}(p) = kp - \varepsilon,$$

where the central estimates for price elasticity, e, according to Brøns-Petersen (2014) are as follows:

- -0.22 for (fossil) energy subject to the quota sector;
- -0.75 for gasoline in the transport sector;
- -0.41 for diesel in the transport sector; and
- -0.30 for (natural gas in) buildings.

For example, the price elasticity for gasoline in the transportation sector means that a 1 per cent increase in gasoline price reduces the demand for gasoline by 0.75 per cent. In all cases, these are long-term price elasticities, and it has been taken into account that higher prices for fossil fuels increase the demand for renewable energy (the share of renewable energy increases by 0.4 per cent when the energy price increases by 1 per cent).[6]

CO_2 emissions and quota prices

The annual emissions in the original quota system are initially 1.3 billion tonnes of CO_2 in the analysis year 2025, according to European Commission (2021a),[7] while emissions are 0.6 billion tonnes of CO_2 from transport and 0.4 billion tonnes of CO_2 from buildings, according to the European

6 In the building sector, the energy elasticity is -0.30 and the renewable energy (RE) share is 39.9 per cent, according to Brøns-Petersen (2014). With a 1 per cent price increase, the RE share increases by 0.16 percentage points because 0.4 per cent (the elasticity for the RE share) of 39.9 per cent is 0.16 percentage points, while energy demand falls by 0.30 per cent. The total demand for fossil fuels (and thus quotas) therefore decreases by 0.41 per cent, corresponding to (1 - 0.3%) ´ (1 - 0.16%) - 1 = -0.41%.

7 In 2021, there were 1,571,583,007 quotas available, according to the European Commission (2021b), which are reduced linearly by 4.2 per cent per year, as stated by the European Commission (2021a): 'The Union-wide cap for 2021 from stationary installations is fixed at. The annual reduction corresponding to the linear reduction factor is 43,003,515 allowances.'

Environment Agency (2022).[8] Overall, the emissions from the affected sectors are initially – with current policies – 2.3 billion tonnes, of which more than half are within the current quota system.

The quota system is assumed to clear, so the total quota ceiling is utilised every year. Compared to the quota surplus in recent years, this may seem like a relatively strict assumption, but with declining quota issuance in the future, the quota surplus will also become smaller or disappear altogether. Therefore, with respect to calculating the long-term consequences of having different versions of the quota system, the assumption is considered unproblematic.

In 2025, CO_2 quotas cost 642 DKK/tonne initially, according to the Danish Energy Agency (2022).[9]

Fuel consumption and prices

The average fuel prices in the EU including taxes are initially set at 11.22 DKK/litre for gasoline and 10.10 DKK/litre for diesel, corresponding to the average price in 2020, according to the European Environment Agency (2019b).[10] Of these, CO_2 taxes account for 43.2 øre (gasoline)[11] and 48.3 øre (diesel) based on OECD (2018), corresponding to a CO_2 price of 88 DKK/tonne and 85 DKK/tonne, respectively.

Gasoline accounts for 27 per cent of fuel consumption (in terajoules (TJ)), while diesel accounts for 73 per cent, according to the European Environment Agency (2019a).[12] Biofuels, which account for less than 5 per cent of total energy consumption in the transport sector, are disregarded.

Natural gas consumption and prices

The gas price is initially set at 143 DKK/GJ, corresponding to the average price in 2019, according to Eurostat (2022). The CO_2 tax in the EU is – including energy taxes – on average €2.90/TJ, corresponding to 389 DKK/

8 We have used the 'with existing measures' alternative in the European Environment Agency (2022).
9 We have used the value in 2025 from DTU Transport (2022) in 2022 prices.
10 Therefore, we assume that the price in 2025 corresponds to the price in 2021. Prior to the war in Ukraine, prices had been relatively constant since 2015, according to the European Environment Agency (2019b).
11 One DDK is subdivided into 100 øre.
12 The distribution between gasoline and diesel consumption in the transport sector is assumed to be unchanged in 2025.

tonne of CO_2.[13] It is assumed that other taxes on gas are cancelled, as there are no longer significant externalities associated with gas combustion that are not already regulated by other taxes (e.g., sulphur taxes), and therefore, the total tax in the calculation is considered as CO_2 tax.[14]

Calculation of the economic consequences

Assumptions

The calculations of the economic consequences are based on an assumption that the CO_2 tax on gasoline, diesel, and buildings (including energy taxes) will be replaced by quotas when the sectors are included in the quota system. At the same time, it is assumed that other taxes are economically optimal. This is not a realistic assumption, as, among other things, Danish cars are overtaxed, as reported by the Center for Transport Analytics (2021) and the Danish Commission for the Green Transformation of Passenger Cars (2020).[15] Nevertheless, we conduct the analysis based on an assumption that other taxes are economically optimal because the over-taxation of cars and other 'non-optimal policies' is not related to CO_2 emissions and the quota system, but to other policy errors that should ideally be resolved by easing (or, if the tax is too low, raising) taxes other than the CO_2 tax.[16] The results should, therefore, be interpreted as the benefits of expanding the quota system in a situation where the policy error of over- and under-taxation of other externalities has been resolved.

Minimum estimate of the benefits

It is important to note that the estimated benefits to society of including land transport and buildings in the emissions trading scheme are minimum estimates. This applies to both the creation of a new emissions trading scheme and the inclusion of the two sectors in the current system. This is because the economic calculations are based on average prices for

13 The CO_2 tax is from OECD (2019), and the emission factor used is from the Danish Energy Agency (2022a).

14 The taxes on diesel and gasoline are maintained as, on average, they correspond to the economic externalities (note that Danish cars are overtaxed, according to, among others, the Center for Transport Analytics (2021) and Danish Economic Councils (2014)).

15 The Commission for Green Conversion of Passenger Cars (2020) states, among other things, 'Based on the external costs that form the basis of the Commission's tax models, conventional cars are currently estimated to be overtaxed compared to their external costs.'

16 There will also be cases where expanding the road network is the best way to address externalities.

emissions from land transport and buildings and therefore do not capture three important benefits.

The first is the benefit of having consistent CO_2 prices across countries, and the second is the benefit of having consistent prices across sectors within individual countries. These benefits arise because the national reduction targets are removed when land transport and buildings are included in an emissions trading scheme. Having national reduction targets implies that the price of emitting CO_2 from land transport and buildings varies across countries and often also across sectors within individual countries. The emissions trading scheme ensures that prices are consistent across countries and sectors, resulting in an economic benefit because emissions reductions occur where it is cheapest for Europeans.

The third benefit is the replacement of technical regulation – which aims to reduce CO_2 emissions through requirements for emissions from cars – with quotas, which are a much more economically efficient means of reducing emissions. However, this benefit assumes that this technical regulation is removed when land transport and buildings are included in an emissions trading scheme.

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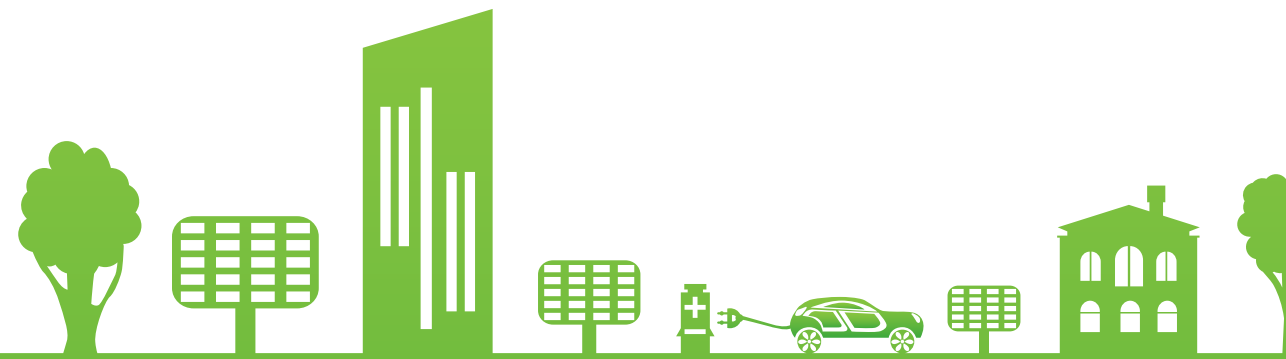

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