REPORT
February 2022

EKSPERTGRUPPEN FOR EN
GRØN SKATTEREFORM

Green tax reform

First interim report from Ekspertgruppen for en Grøn skattereform (Expert Group for a Green Tax Reform)

Contents

Preface

The expert group for a Green tax reform was established in February 2021.

The members of the expert group are:

- Michael Svarer, Professor at the Department of Economics, Aarhus University, Chairman
- Peter Birch Sørensen, Professor at the Department of Economics, University of Copenhagen
- Claus Thustrup Kreiner, Professor at the Department of Economics, University of Copenhagen
- Mette Termansen, Professor at the Department of Food and Resource Economics, University of Copenhagen
- Joan Faurskov Cordtz, Partner at PwC
- Susanne Juhl, Chairman and member of the Board

In the Expert Group, we will draw up proposals on how to regulate greenhouse gases in Denmark based on a higher and more uniform CO_2e tax.

We have been given a complicated task. The road to a more uniform CO_2e tax means that we must tax CO_2 more uniformly in the future. This is in contrast to today, where CO_2 is taxed very differently depending on where the CO_2 is emitted and which fuels are used.

Our work shows how a higher and more uniform CO_2 tax can effectively reduce greenhouse gas emissions and thereby contribute significantly to meeting *klimaloven's* (Climate Act) target of reducing Denmark's greenhouse gas emissions by 70 per cent by 2030.

The starting point for our proposals and recommendations is that the green transition should not be unnecessarily costly for society. It must also take into account the Climate Act's guiding principles, such as social balance, social cohesion and a healthy business sector. Together, it forms an area of conflicting considerations to a certain extent, and in the end, it is a political choice as to which considerations should prevail. We present proposals that weigh the considerations differently. In other words, there are no easy or perfect solutions.

If we introduce a uniform CO_2 tax and create a more uniform regulation of greenhouse gases, it will affect citizens and businesses in all parts of society. The expert group's work shows a concrete step towards meeting the 70 per cent target by 2030.

Our work is divided into two reports, which together form a comprehensive analysis for all sectors. This first interim report initially introduces the rationale for a green tax reform (Chapter 1). This is followed by our recommendations and conclusions (Chapter 2 and Chapter 3). Finally, the report contains further models (Chapter 4), key features of current regulation and subsidies (Chapters 5 and 6), the future work (Chapter 7) and an appendix (Chapter 8).

In addition to the members of the Expert Group, department heads from the Danish Ministry of Taxation, the Ministry of Finance of Denmark, the Danish Ministry of Climate, Energy and Utilities, the Ministry of Industry, Business and Financial Affairs and the Minister for Food, Agriculture and Fisheries of Denmark participated in the discussions. We have been served by a secretariat consisting of officials from the ministries involved. They must be thanked for their great dedication and work.

We would also like to take this opportunity to thank the many stakeholders from the Danish business sector and key players in the expert monitoring group who have contributed to our work.

Michael Svarer/Expert group for a Green tax reform, 8 February 2022

The editing was completed on 6 February 2022.
The translation into English completed in May 2023.
Translation by Denker Media.

Executive summary

The expert group for green tax reform has been tasked with presenting proposals on how a uniform CO_2e tax can significantly contribute to Denmark's climate target of a 70 per cent reduction in domestic greenhouse gas emissions by 2030 compared to 1990. The proposals of the Expert Group must take into account the guiding principles of the Climate Act, including cost-effectiveness, sustainable economic development, social balance, employment and sound public finances, as well as the desire to avoid greenhouse gas leakage.

In this first interim report, the Expert Group proposes an architecture for a future uniform Danish CO_2 tax and a future level of tax rates on CO_2 emissions. The report describes how the Expert Group's proposals are expected to affect emissions from industry and other businesses, non-road transport and electricity production, and individual and collective heating. The final report of the Expert Group will address non-energy emissions of methane and nitrous oxide from agriculture as well as emissions from road transport.

The Expert Group recommends aiming for a level of taxation or a combination of taxation and subsidies that ensures a CO_2 reduction in 2030 of around 3.5 million tonnes in the sectors mentioned (industry, etc.). A reduction of this magnitude is estimated to be necessary to meet the targets of the Climate Act, taking into account the expected reduction contribution from agriculture and the effect of the expected higher emissions allowance price in the European Union Emissions Trading System (EU ETS). If a reduction contribution from industry etc. smaller than about 3.5 million tonnes is targeted, reductions would have to be implemented at a significantly higher socio-economic cost in other sectors.

The Expert Group's analyses show that it is impossible to design a CO_2 tax model that fully addresses all the objectives and guiding considerations of the Climate Act and the terms of reference. There is a fundamental dilemma between the desire for cost-effectiveness (lowest possible socio-economic cost to reach the 70 per cent target) and the desire to avoid significant changes in the size of different sectors and the resulting CO_2 leakage, where production and associated emissions move abroad.

Full cost-effectiveness requires a fully uniform CO_2 tax on all CO_2 emissions to ensure that CO_2 reductions are made where they are cheapest. However, as industrial emissions are highly concentrated in a few large emitters, these companies will be severely affected by a high uniform CO_2 tax with a consequent high risk of leakage. To reduce this risk through different forms of compensation, one must in turn give up the requirement of strict cost-effectiveness.

Against this background, the Expert Group presents three different tax models, all of which ensure a CO_2 reduction in industry etc. of about 3.5 million tonnes in 2030 and at the same time meet Denmark's reduction target for 2025, but which give different weight to the climate act's guiding considerations of cost-effectiveness and leakage risk. All three tax models involve a partial conversion of the current energy taxes into a CO_2 tax, a broadening of the tax base, a significant alignment of tax rates, and a reduction in the Danish CO_2 tax of 50 per cent of the emissions allowance price for companies covered by the EU ETS. All tax models also phase in the CO_2 tax gradually, giving companies time to adapt.

The Expert Group does not propose a full tax cut for the emissions allowance price because the emissions allowance price is an out-of-country payment that represents an additional cost to society of using fossil fuels in the ETS sector. Therefore, it is desirable that there is a higher CO_2 price and thereby a stronger incentive for CO_2 reductions within the ETS sector than outside the ETS sector since the Danish society saves the cost of the emissions allowance price when the reductions are made in the ETS sector. The fact that a large part of the emissions allowances is distributed free of charge to companies also means that there should not be a full discount for the emissions allowance price in the Danish CO_2 tax. On the other hand, companies covered by emissions allowances are typically very energy-intensive and exposed to international competition, with the resulting risk of leakage if their total CO_2 price becomes too high. As a compromise between these opposing considerations, the Expert Group proposes that a 50 per cent reduction be applied to the emissions allowance price.

In the Expert Group's **tax model 1**, the consideration of cost-effectiveness is given high priority. In this model, all companies outside the ETS sector are charged a CO_2 tax of DKK 750 per tonne in 2030, corresponding to the expected emissions allowance price in 2030. Companies covered by emissions allowances, which account for the vast majority of the industry's emissions, receive a tax reduction of 50 per cent of the emissions allowance price and thus pays a CO_2 fee of DKK 375 per ton, whereby their total CO_2 price (tax plus emissions allowance price) becomes DKK 1,125 per tonnes in 2030. In addition, subsidy is given for negative emissions. The tax is estimated to generate revenue of around DKK 0.8 billion in 2030 once the companies have adjusted. This revenue can be returned to the businesses, for example, via a reduction in corporate tax of approximately 0.6 percentage points.

Tax model 1 entails a relatively low socio-economic cost (loss of economic welfare in the form of e.g. lower real wages and adjustment costs) of DKK 250 per tonne of CO_2 reduction. At the same time, more than half of the reductions come from changes in the size of different sectors, i.e. from production cuts in the most CO_2-intensive companies, rather than from technical conversions that lower CO_2 emissions per unit produced. These changes in the size of different sectors entail a high risk of production and emissions moving abroad and, thus, a risk of leakage.

This risk of leakage is exceptionally high in mineralogical production processes, such as cement production and brickworks, which account for a large proportion of industrial emissions. In the Expert Group's **tax model 2**, the risk of leakage is countered via a reduced CO_2 tax rate of DKK 100 per tonne for mineralogical processes, etc., while the rates for other companies covered by emissions allowances are maintained at DKK 375 per tonne and DKK 750 per tonne in 2030 for companies not covered by emissions allowance.

To ensure the same total CO_2 reduction of about 3.5 million tonnes in 2030, the tax revenue in model 2 is used to finance subsidies for carbon capture and storage (CCS). Since technical reductions achieved via CCS technology are socio-economically more expensive than those achieved via the significant changes in the size of different sectors in model 1, the average socio-economic cost per tonne of CO_2 reduction increases to about DKK 500 in model 2. This is the cost of reducing the high leakage risk in mineralogical processes, etc.

However, tax model 2 still carries a significant risk of leakage in other industries such as refineries, fisheries and CO_2-intensive companies in the food sector. To reduce this risk, the Expert Group's analysis suggests that additional funding is needed.

In the Expert Group's **tax model 3**, it is assumed computationally that additional financing of DKK 0.5 billion is provided via a 0.05 percentage point increase in the state's lowest tax rate. Depending on political preferences, financing can also be provided by reprioritising public expenditure. The additional revenue is used in tax model 3 to finance additional subsidies for CCS, which ensure further technical CO_2 reductions. This will make it possible to lower the CO_2 tax for companies covered by emissions allowances to DKK 225 per tonne and DKK 600 per tonne for companies not covered by emissions allowances and still maintain a total CO_2 reduction of around 3.5 million tonnes in 2030. The lower CO_2 tax rates lead to fewer changes in the size of different sectors and, thus, a lower risk of leakage across the business sector. The price for this further reduction of the leakage risk is that, as mentioned above, additional financing must be provided, which is estimated to increase the average socio-economic cost per tonne of CO_2 reduction from around DKK 500 in tax model 2 to around DKK 525 in tax model 3.

The key figures for the three tax models are summarised in the table below. "Negative emissions" cover CO_2 reductions achieved by capturing and storing CO_2 from biogenic sources. The choice between the three models (or hybrids thereof) must primarily depend on a political trade-off between cost-effectiveness and the desire to avoid significant changes in the size of different sectors and high leakage risk.

Overview of the consequences of the tax models

	CO_2 reductions (million tonnes)			Tax rate in 2030 (DKK per tonne)		Costs and revenue (DKK billion)		Socio-economic costs (DKK per ton)	
	2025	2030	CSS, including negative emissions	Non-ETS/ ETS[1]	Rate mineralogy	Immediate load[2]	Revenue by behaviour	Avg. (after compensation)	Marginal
Model 1 (Cheapest reductions)	1.0	3.5	0.7	750/ 375	375	2.8	0.8	350 (250)	750
Model 2 – (Partial management of leakage)	0.7	3.5	1.7	750/ 375	100	2.3	0	500 (500)	850
Model 3 (Additional management of leakage)	0.6	3.5	2.0	600/ 225	100	1.6	-0.5	500 (525)	875

Note: Rates are rounded to the nearest DKK 25 per tonne of CO_2. Rates are shown in 2022 prices, and revenue effects are shown in 2022 levels. It is assumed that the taxes are continuously indexed with the general price level. The computation assumes that any shortfall is covered by an increase i½n the lowest tax rate, and any surplus in 2030 is used for a general reduction in corporate tax.

Note 1: For a number of tax bases, minimum energy taxes have been introduced in the EU's Energy Taxation Directive. In this context, a rate of DKK 750 per tonne of CO_2 should be interpreted as the sum of the CO_2 tax and the energy tax.

Note 2: Total tax burden on businesses before behavioural changes.

Source: Own calculations.

The starting point for a green tax reform

1

1.0 The starting point for a green tax reform

Climate change is a global issue. With *klimaloven* (the Climate Act), the ambition is for Denmark to be a pioneering country in international climate cooperation that can inspire and influence the rest of the world to step up efforts to meet the Paris Agreement's goal of limiting global temperature increase to 1.5 degrees Celsius. Under the Climate Act, Denmark has committed itself to reducing greenhouse gas emissions from Danish territory by 70 per cent by 2030 compared to 1990 levels.

According to the Climate Act, Denmark's climate targets must be met as cost-effectively as possible, taking into account the long-term green transition, sustainable business development, Danish competitiveness, sound public finances and employment. The climate action must enable the continued development of the Danish business sector, and Denmark must show that it is possible to carry out a green transition and, at the same time, preserve a strong welfare society where social cohesion and social balance are ensured.

Finally, the Climate Act states that national measures used to reduce greenhouse gas emissions must result in real, domestic reductions and not simply shift greenhouse gas emissions outside Denmark's borders.

In December 2020, a broad political majority (S, V, RV, SF and K) reached an agreement on a green tax reform in multiple phases. According to the agreement, a uniform greenhouse gas tax should be a key instrument for achieving the 70 per cent target by 2030, taking into account the guiding principles of the Climate Act. In this context, it was decided to set up an expert group for a green tax reform with the task of developing recommendations for a more uniform regulation of CO_2 emissions, including a more uniform CO_2e-tax.[1]

This chapter describes the tasks of the Expert Group, including the considerations that the terms of reference have given rise to.

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[1] CO_2e covers CO_2 equivalents, where the emission of other greenhouse gases such as methane and nitrous oxide is converted to an equivalent emission of CO_2, i.e. a CO_2 emission with the same climate effect.

1.1 Commission

After concluding *aftalen om en grøn skattereform* (the agreement on a green tax reform), the parties to the agreement agreed in February 2021 on terms of reference for the Expert Group's work*, see Section 8.2*. The terms of reference state that the Expert Group will:

- Prepare models for uniform CO_2e regulation, including the design of a more uniform CO_2e tax.
- Develop different scenarios that contribute significantly to the 70 per cent target, taking into account the guiding principles of the Climate Act. The starting point for the scenarios must be that they deliver the most cost-effective solution. If there is a deviation from the socio-economically least costly solution, reasons must be given.

The terms of reference state that the work of the Expert Group will be divided into two reports, which together will form a comprehensive analysis. This first report recommends a shift in energy taxation towards a more direct tax on CO_2 emissions and a broadening of the tax base to well-defined areas currently exempt from taxation, *see Chapter 2*.

The report thus focuses on a tax on emissions, capture and storage of CO_2 from industry, heat and electricity production and non-road transport, *see Section 2.1*. At the same time, a restructuring of the energy taxes to a more direct and uniform tax on CO_2 emissions must be described. It also entails a change in the energy tax to CO_2 tax in the area of space heating and for petrol and diesel*, see Chapter 3*.

With the final report, the Expert Group must highlight models for a more uniform CO_2e regulation across the entire economy, including road transport and non-energy-related emissions from agriculture, while also taking into account the guiding principles of the Climate Act, *see Chapter 7*. This includes a position on whether the tax levels should be aligned across application areas.

The second report will also assess the advantages and disadvantages of a regulatory solution for the agricultural sector, a subsidy solution for EU agricultural support and a CO_2e tax for this sector or a combination of these, as well as possible measures for cost-effective regulation of agriculture that address CO_2e emissions and other externalities, including, e.g. environment and health.

Contributions to meeting the reduction targets of the Climate Act can take the form of CO_2 emission reductions and negative CO_2 emissions, for example, by capturing and storing CO_2 from biomass and biogas, as negative emissions are counted towards the 70 per cent target on an equal footing with CO_2 reductions. In order to achieve cost-effective regulation, the incentive for greenhouse gas reduction must, as far as possible, be the same across the entire economy. This could be ensured, for example, by providing a subsidy – a so-called negative tax – for negative CO_2 emissions at a rate equivalent to the CO_2 tax rate.

In addition, the terms of reference state that, in addition to a uniform CO_2, appropriate compensation and feed-back mechanisms should be identified to support the guiding principles of the Climate Act. The report therefore highlights the consequences of a number of different initiatives, including subsidies, reductions in the tax rate for companies covered by emissions allowances, differentiated tax rates and basic deductions, *see Chapters 2 and 4*. Chapter 2 also presents the employment and income distribution effects of a CO_2 tax in the areas covered by this report.

1.2 The Expert Group's interpretation of the terms of reference and the guiding principles of the Climate Act

The Expert Group's analyses and recommendations, in accordance with the terms of reference, are based on the guiding principles of the Climate Act.

The 70 per cent target in the Climate Act relates to CO_2 emissions from Danish territory, which can be simplified to emissions from production in Denmark. Thus, the terms of reference propose that a Danish CO_2e tax be imposed at *the production stage* at the source of domestic CO_2 emissions. However, several analyses have shown that Denmark's *global climate footprint* is somewhat larger than the emissions from Danish production.[2] In the calculation of the global climate footprint, the emissions abroad that originate from the production and transport of the goods and services that are imported to Denmark are included. On the other hand, CO_2 emissions from the part of domestic production that is exported are deducted.

If the purpose of a climate tax is to lower the country's climate footprint, it is most targeted to impose the tax on the consumption side, where it burdens imported and domestically produced goods and services equally. The size of such a climate charge should reflect an estimate of how much greenhouse gas is emitted globally from the production and transport of the consumed product. In practice, this is often uncertain and administratively cumbersome, partly because domestic authorities have limited information on how production and transport abroad have taken place. Furthermore, a climate tax at the consumption stage provides little incentive for individual producers to reduce their emissions since the tax must reflect an estimate of the average amount of greenhouse gas emitted in the production of the product – an average over which the individual company typically has very little influence. A climate tax at the consumption stage therefore works primarily by encouraging consumers to switch their consumption to a climate-friendly direction.

The international climate cooperation under the auspices of the UN is based on the principle that the individual countries are responsible for the CO_2 emissions from their own territory, i.e. the emissions from domestic production, including the production of domestic transport services.[3] The principle reflects that the individual states have jurisdiction to regulate the CO_2 emissions from their own territory but do not have the powers to regulate the emissions from the territory of other countries.

The difficulties in implementing a climate tax in the consumption phase and the principles for climate cooperation in the UN are the background to the 70 per cent target of the Climate Act. For the same reason, the Expert Group focuses on a CO_2 tax at the production stage.

[2] See, for example, Statistics Denmark's: "Dansk forbrug sætter i høj grad sit klimaaftryk i udlandet" (Danish consumption largely leaves its climate footprint abroad). DST Analysis, 16 December 2021 (https://www.dst.dk/Site/Dst/Udgivelser/nyt/GetAnalyse.aspx?cid=47752).

[3] According to the UN's calculation method, emissions from the burning of wood-based biomass are attributed to the country where the trees are felled, and not to the country where the burning takes place.

A CO_2 tax gives individual companies and households a direct incentive to lower their emissions through, for example, energy efficiency, switching to renewable energy sources and developing new and more climate-friendly technologies. A key advantage of using the tax instrument is thus that it exploits the knowledge of companies and households themselves on how best and cheapest to reduce emissions. This mobilises valuable knowledge about reduction opportunities that authorities often do not have.

The requirement for *cost-effectiveness* in climate action is central to the Climate Act and the terms of reference and has therefore been given great weight in the work of the Expert Group. Cost-effectiveness means that greenhouse gas reductions are achieved at the lowest possible socio-economic cost, i.e. with the lowest possible loss of economic welfare in the form of, for example, lower real wages and conversion costs. Ultimately, the citizens bear the burden of a CO_2 tax in the form of lower consumption opportunities due to lower wages and higher prices.

As mentioned above, a fully cost-effective CO_2 tax requires that the tax is the same across all activities and that negative emissions are subsidised at a rate equal to the tax rate. Such a uniform CO_2 tax ensures the same incentive to lower emissions everywhere in the economy, whereby reduction efforts are concentrated in areas where it is cheapest.

However, the Climate Change Act and the terms of reference also mention other important considerations that are not necessarily compatible with the requirement of total cost-effectiveness, including limiting *CO_2 leakage* where production and associated emissions are shifted abroad and ensuring *social cohesion and social balance*. Both of these considerations can be challenged by the *changes in the size of different sectors* that a uniform CO_2 tax must be expected to bring about.

As the analyses in this report show, industrial CO_2 emissions are highly concentrated in a few large emitters. Large parts of their production will likely shut down or move abroad if a high tax is imposed on these CO_2-intensive companies without compensatory measures.

The labour and capital freed up by this will be used in other parts of the Danish economy over time, but the resulting shifts in business involve a significant risk of large-scale CO_2 leakage. At the same time, changes in the size of different sectors will mean that a large part of the adjustment costs of reducing emissions will be concentrated in a few firms and sectors. Although the adaptation costs will be small in relation to Denmark's total national product, they may be significant in some local areas, which may conflict with the Climate Act's considerations of social cohesion and social balance in a geographical perspective.

The analyses in this report thus reveal an unavoidable dilemma between the need for cost-effectiveness and the need to avoid significant changes in the size of different sectors with resulting CO_2 leakage and uneven distribution of adaptation costs. Against this background, the Expert Group has chosen in Chapter 2 to present three tax models that weigh these considerations differently to illustrate the policy trade-offs that necessarily have to be made.

The social balance considerations of the Climate Act and the terms of reference also imply that the costs of meeting the climate target must not be unevenly distributed across income groups. The analysis in Chapter 2 indicates that the Expert

Group's proposals will have very limited effects on income distribution and will not "turn the heavy end downwards". This reflects, among other things, that the burden of a tax on industrial emissions will be borne mainly by all employees in the form of a slightly lower rate of wage increase during an adjustment period.

According to the Climate Act, Denmark's climate action must be compatible with *sound public finances*, and the terms of reference require the Expert Group to present alternative scenarios, at least one of which involves no overall increase in taxes and duties.

Chapter 2 contains a scenario where taxes and charges do not increase overall, and a scenario where the revenue from the CO_2 tax is used for compensatory subsidies to counter leakage and large changes in the size of different sectors. Finally, Chapter 2 includes a scenario where the compensatory measures require additional financing beyond the tax revenue. This financing is computationally assumed to come from an increase in the state's lowest tax rate, but can alternatively be provided by reprioritising state expenditure.

To ensure full comparability between the three alternative tax and subsidy models in Chapter 2, the tax and subsidy rates are set so that a projected reduction of CO_2 emissions in 2030 of about 3.5 million tonnes is achieved in all scenarios. With the ambition of the agreed reduction target under *Aftale om grøn omstilling af dansk landbrug* (Agreement on Green Transformation of Danish Agriculture) from October 2021 and the estimated effect of the development in the price of CO_2 emissions allowances in the EU, it is estimated with some uncertainty that Denmark could meet the 70 per cent target by introducing one of the three tax models in Chapter 2. A less ambitious scale of reductions from the sectors covered by the first interim report would most likely require complementing with socially more costly measures to reach the 70 per cent target.

This first interim report covers relatively well-defined tax areas. The report describes how a more uniform CO_2 tax could be extended to areas that are currently exempt from CO_2 tax, including oil and gas extraction and refining, mineralogical processes, etc. and fossil fuels for electricity production. The majority of emissions are related to CO_2.

As a result, this report uses the terminology 'CO_2 tax' and 'CO_2 emissions', but the tax base also includes smaller CO_2e emissions of other greenhouse gases such as methane and nitrous oxide.

Recapitulation and recommendations

2

2.0 Summary and recommendations

Designing a CO_2 tax system that reconciles the many different considerations in the guiding principles of the Climate Act and the Expert Group's terms of reference is a significant challenge. As mentioned in Chapter 1, the Climate Act's target of a 70 per cent greenhouse gas reduction by 2030 relates to domestic emissions. According to the Climate Act, achieving this goal must be as cost-effective as possible, but taking into account several other factors, including the effect of Danish climate policy on global emissions, e.g. via greenhouse gas leakage.

It is a challenge to set up a tax system that combines all considerations

This chapter provides an overview of the Expert Group's analyses of a number of tax models that give different weight to the principles and objectives of the Climate Act and the terms of reference. The chapter begins with a status of the outstanding shortfall in reduction in relation to meeting the 70 per cent target. The Expert Group's recommendation for the level of ambition for CO_2 reductions in the parts of the Danish economy covered by this report is then presented. Finally, the Expert Group's analysis and discussion of different ways to meet this level of ambition follow.

This chapter covers the shortfall in reduction, ambition levels and analyses of pathways to meet it

2.1 Emissions and current CO_2 taxes

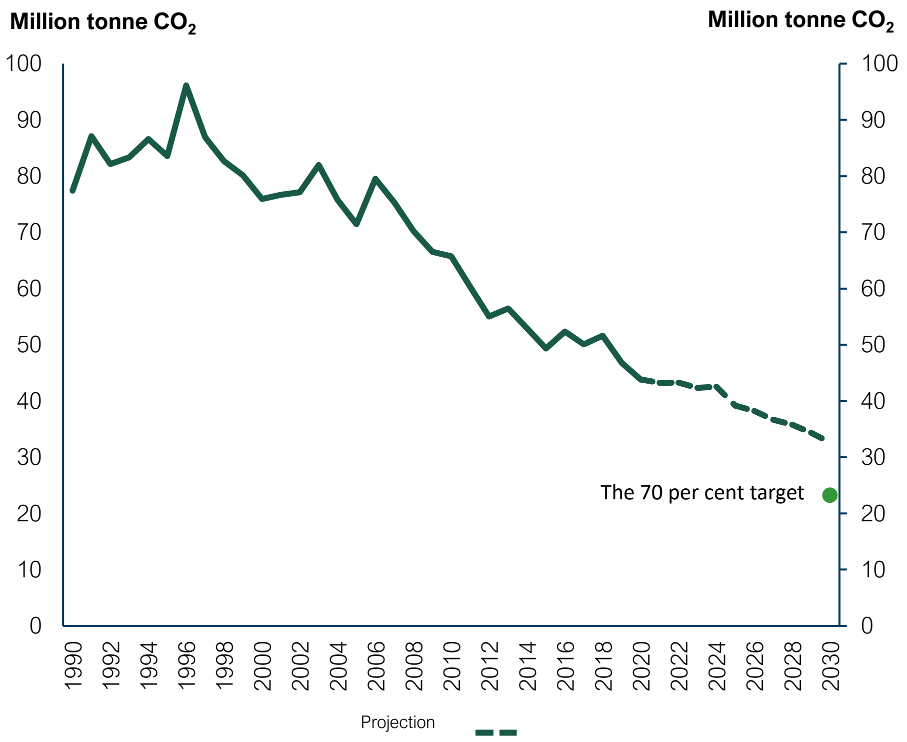
With the climate policy measures adopted so far, Denmark's total greenhouse gas emissions are estimated to be 32.6 million tonnes of CO_2 in 2030*, see Redegørelse for klimaeffekter 2021* (Report on Climate Impact 2021). Against this background, it is estimated that, with some uncertainty, reductions of around 9.4 million tonnes of CO_2 will be needed in 2030 to meet the 70 per cent target, *see Figure 2.1*. To meet the interim target of a 50-54 per cent reduction by 2025, there is a shortfall in reduction of 0.5-3.6 million tonnes of CO_2*, see Report on Climate Impact 2021*. In addition, Denmark has a target to be climate neutral by 2050.

A reduction of around 9.4 million tonnes of CO_2 is estimated to be needed to meet the 70 per cent target by 2030

Part of the shortfall in reduction in the emission of CO_2 towards 2030 is expected to be made up, all other things being equal, as a result of an expected increase in the price of CO_2 emissions allowances in the EU ETS, *see Section 4.3*. The reduction is linked to the fact that a significantly higher emissions allowance price is now estimated in 2030 than was assumed in *Klimastatus og -fremskrivning 2021* (Denmark's Climate Status and Outlook 2021). The estimated reduction due to a higher emissions allowance price amounts to just over 1 million tonnes of CO_2 in 2030, to be deducted from the 9.4 million tonnes.

A higher emissions allowance price is expected to reduce the shortfall by a further 1 million tonnes.

Figure 2.1. The total net emissions and 70 per cent – the target



Source: Denmark's Climate Status and Outlook 2021 incl. *Agreement on Green Transformation of Danish Agriculture* from October 2021 and partial agreement on the Finance Act 2022 *Investeringer i et fortsat grønnere Danmark* (Investment in a continued greener Denmark) from December 2021. The figure does not include the effect of the increase in the emissions allowance price.

The report covers emissions from industry and other sectors, non-road transport, electricity production and individual and collective heating.

This report considers emissions from industry and other business, excluding non-energy agricultural emissions of methane and nitrous oxide, non-road transport and electricity production, and individual and collective heat production, *see Figure 2.2.* Emissions are estimated to total around 9.2 million tonnes of CO_2 in 2030, adjusted for the higher emissions allowance price. Of this, around 7.3 million tonnes come from industry and other businesses, non-road transport and electricity production, while approximately 1.9 million tonnes come from individual and collective heat production.

The areas covered are estimated to cover almost 1/3 of Denmark's projected emissions in 2030

Emissions from agriculture and the transport sector are expected to make up the vast majority of Denmark's total emissions in 2030. Non-energy related emissions from agriculture are estimated at around 13 million tonnes of CO_2 in 2030, while emissions from road transport[4] and other transport4 are expected to be around 11.1 million tonnes. Waste for landfill and F-gases[5] and other sources are expected to emit about 1.1 million tonnes in 2030.[6] These areas are not addressed in this

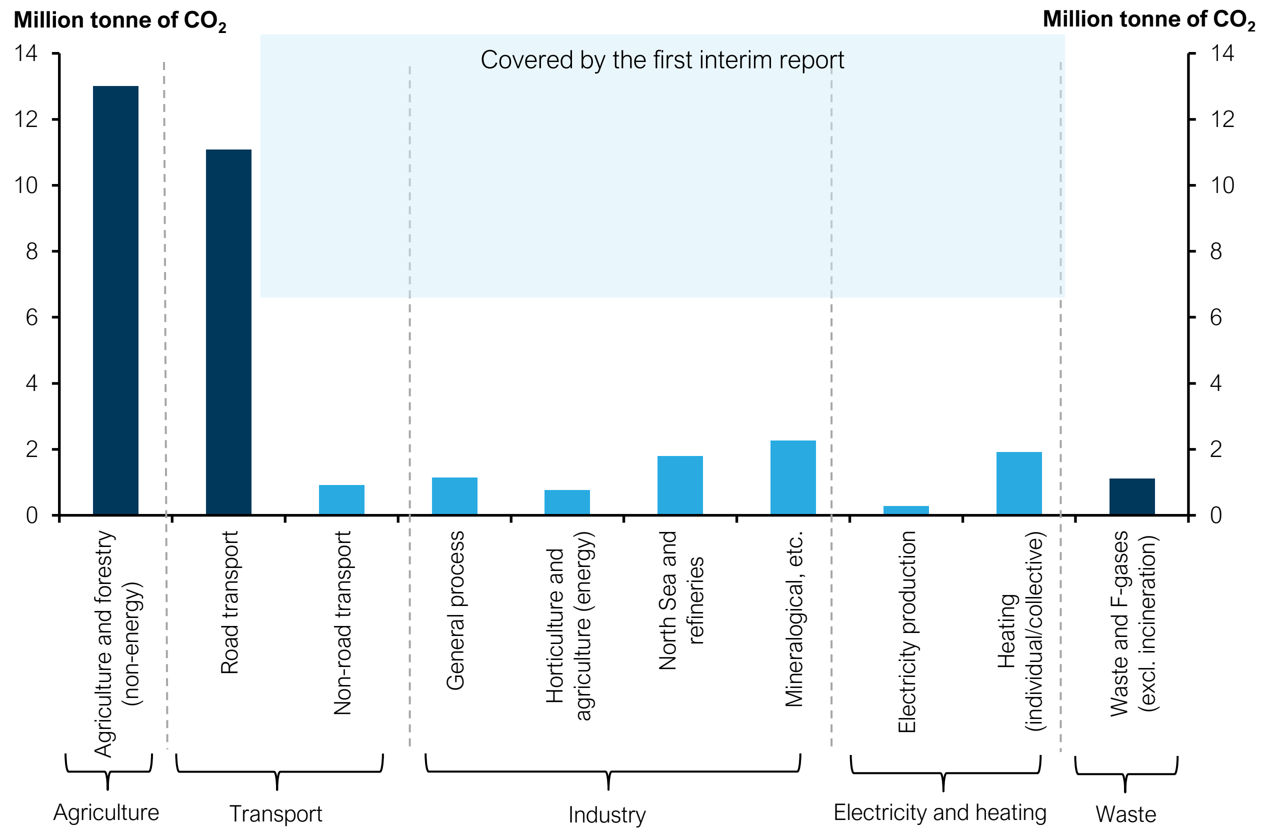
[4] Other transport covers internal transport in the manufacturing, construction and service industries as well as the defence and recreational vessels.

[5] F-gases are a group of powerful climate gases used in refrigerants in air-conditioning systems, refrigerators and heat pumps. In addition to waste for landfill, the figure also includes emissions from biogas leakage, composting and wastewater.

[6] Total emissions from Denmark's Climate Status and Outlook 2021, including new climate policy measures, amount to about 32.6 million tonnes in 2030. In this report, emissions are used according to how they are taxed. This leads to a larger expected base in 2030 than in Denmark's Climate Status and Outlook 2021, as pipeline gas is currently taxed as if it were 100 per cent fossil, independent of the actual amount of biogas in the pipeline gas.

report, but instead in the Expert Group's final report. The emissions from industry etc. discussed in this report correspond to almost 1/3 of the expected total emissions in 2030.

Figure 2.2. Projected emissions in 2030 covered by this report, million tonnes CO_2



Note: Agriculture (energy) under industry contains agriculture's energy-related emissions, while the non-energy-related emissions from agriculture are contained in Agriculture and forestry (non-energy). Non-road transport covers ferries, fisheries, railways and domestic flights. General process covers all other emissions in industry in connection with business processes. Mineralogical, etc. covers a number of specific processes in industry, including cement production and brickworks.
Source: Denmark's Climate Status and Outlook 2021 and own calculations

The calculation includes 1.4 million tonnes from CCS technology, which is not broken down by sector

In addition to the emissions indicated in Figure 2.2, CCS technology (carbon capture and storage) is expected to reduce total emissions by approximately 1.4 million tonnes in 2030.[7] These reductions are not allocated between sectors as they are based on subsidy pools not yet implemented. Therefore, they are not included in the individual categories in the figure but rather in the overall projection and calculation of the shortfall in reduction.

Negative emissions can expand the total reduction potential

In addition to the areas listed, this report focuses on so-called negative emissions. For example, they can come from the capture and storage of CO_2 by burning biogenic sources, such as biomass in CHP plants, in connection with the production of

[7] Carbon Capture and Storage (CCS) is a technology that captures and subsequently stores CO_2. The technology can contribute to negative emissions if CO_2 is captured from biogenic sources and stored. Emissions from burning biomass, for example, are not included, as according to the UN's climate accounting rules, they are attributed to the LULUCF sector in the country where the biomass is harvested. Capturing and subsequently storing CO_2 from biogenic sources reduces the concentration of CO_2 in the atmosphere.

biogas or biogenic waste (BECCS).[8] Thus, negative emissions could extend the overall reduction potential beyond the other emissions the report covers.

Industrial emissions are concentrated in a few companies

Large parts of industrial emissions are concentrated in a few large and very CO_2-intensive emitters. This is particularly the case in mineralogical processes, etc. (covering cement production and brickworks, among others) and other large ETS-coveredcompanies.

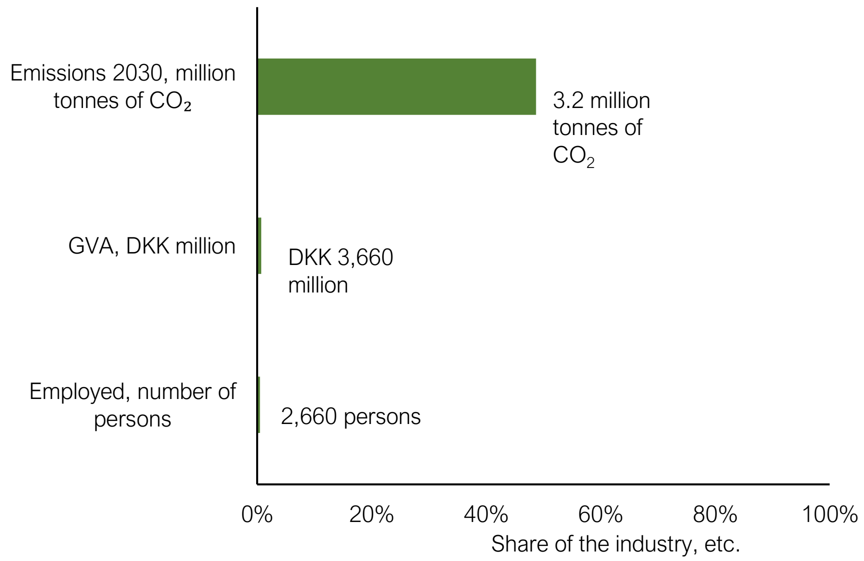
The five largest industrial emitters are expected to account for around 45 per cent of emissions in 2030

This is illustrated by the fact that around 45 per cent of industrial emissions, including non-road transport, in 2030 can be attributed to the five largest emitters in cement production, refineries, oil and gas production in the North Sea and ETS-coveredindustry, *see Figure 2.3.*[9] In addition, there are also several smaller emitters, which are however still very CO_2-intensive.

But it only makes up a very small proportion of the value added and employment

This means that most of the emissions considered in this report are not widely distributed but concentrated in a small part of the economy that accounts for only a limited share of Denmark's total output and employment. Specifically, the five largest emitters account for 0.7 per cent of the added value in industry, etc. and for 0.2 per cent of Denmark's total value added, while they comprise 0.4 per cent of employment in industry etc. and 0.1 per cent of total employment, *see Figure 2.3.*

Figure 2.3. Top 5 emitters compared to total industry, etc.



Note: Emissions in 2030. The emissions for the 5 largest emitters are projected by maintaining their share of the 2020 emissions for their respective industry category in 2030. Accounting figures come from DST table NABP69 and are for 2019. Total industry, etc. covers industry, electricity production and non-road transport. See note to table 2.6 for description of assumptions regarding GVA and employment figures.

The current tax system is highly differentiated

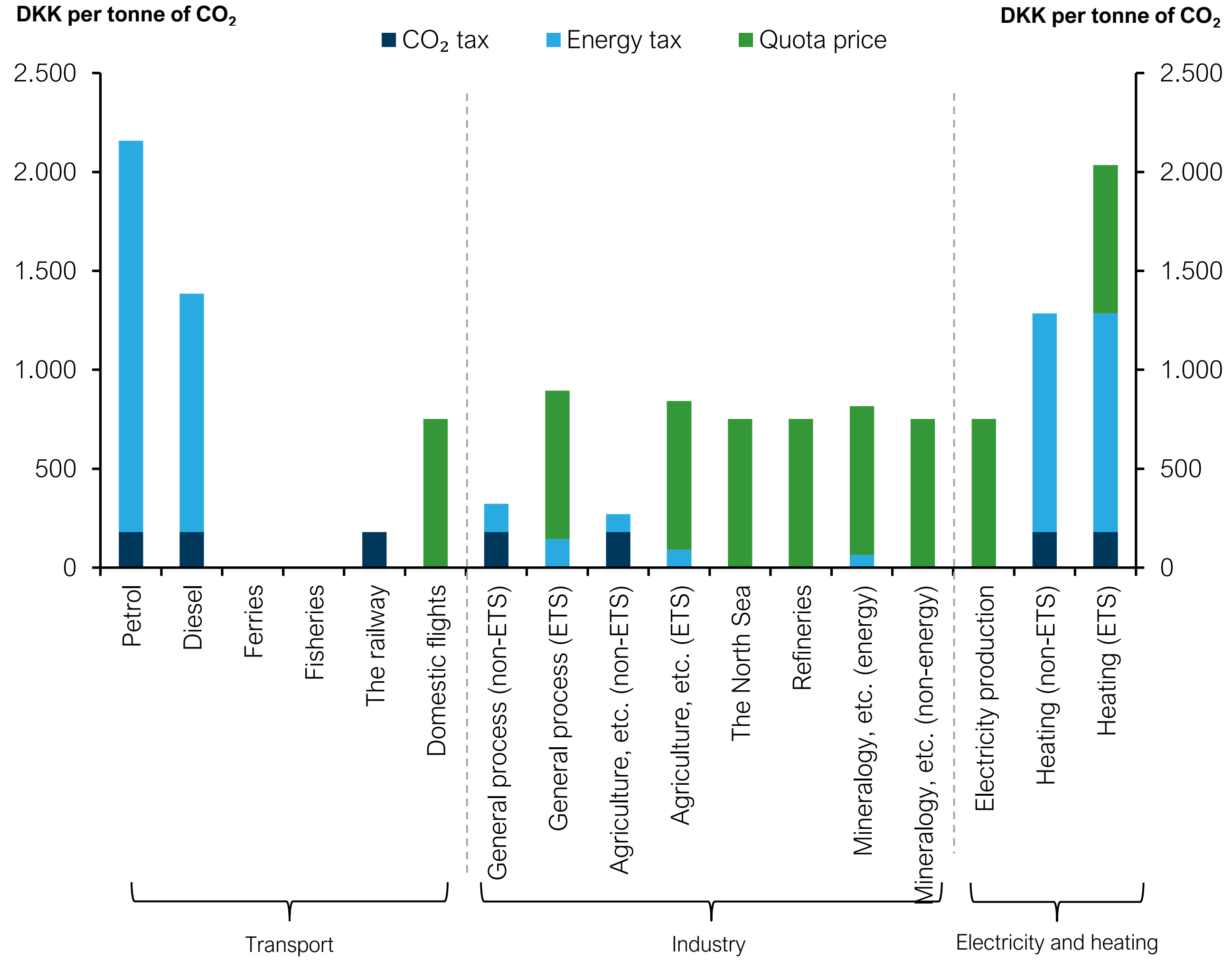
Under the current tax system, the price of CO_2 varies widely across sectors, *see Figure 2.4*.

[8] Bio Energy Carbon Capture and Storage (BECCS) covers the capture and storage of CO_2 from biogenic sources.

[9] North Sea production involves a number of players, although a few companies account for the majority of emissions.

For space heating fuels and road transport, the CO_2 tax is relatively high, while for industry and parts of the non-road transport sector, the CO_2 tax is relatively low. Some industrial emissions are not covered by energy or CO_2 taxes. However, many of these emissions are covered by the EU ETS and as a result pay the emissions allowance price for CO_2 emissions. However, in the ETS, there is a significant deduction in the form of free emissions allowances, so that companies do not bear the full burden of the emissions allowance price. The extent of free emissions allowances varies widely across industries, *see Section 5.3.1.*

Figure 2.4. Current tax system in 2030 – rates before restructuring



Note: Agriculture covers energy-related emissions from agriculture and energy consumption from horticulture. Current energy taxes are converted into CO_2 taxes, but will vary for different fuels within the tax categories. The latest projection of the emissions allowance price of DKK 750 per tonne of CO_2 in 2030 (2022 prices) has been used. The tax on mineralogical processes, etc. (energy) and part of the taxes on general processes and agriculture, etc. will not enter into force until 2023 and 2025 respectively. ETS stands for Emissions Trading System and covers companies and production processes covered by the EU Emissions Trading System.
Source: Own calculations.

Level of ambition in the first interim report

The expert group recommends an ambition level of around 3.5 million tonnes in 2030

The expert group has assumed that the recommendations of this interim report will meet the 2025 reduction target and make a significant contribution to reaching the

70 per cent target by 2030. The proposed solutions in all cases fulfil the lower part of the range for the 2025 target via a reduction of at least 0.5 million tonnes of CO_2 and contributes to the 2030 target via a reduction of approximately 3.5 million tonnes of CO_2.

The Expert Group considers that the sectors covered in the first interim report (industry and other business, non-road transport and electricity production, and individual and collective heating) need to contribute with reductions of this order of magnitude. This should be seen in the context of the following:

As with the agricultural reduction target and the higher emissions allowance price, the 70 per cent target is expected to be met

- In the *Agreement on Green Transformation of Danish Agriculture*, a reduction target has been set that corresponds to agriculture reducing by approximately 4-6 million tonnes of CO_2 in 2030, in addition to the specific reductions in the agreement.
- The expected increase in the emissions allowance price is estimated in isolation to contribute reductions of just over 1 million tonnes of CO_2 compared to what is assumed in the current calculation of the shortfall, *see Section 4.3*.
- The other sectors therefore need to deliver around 2.5-4.5 million tonnes to meet the reduction target of 9.4 million tonnes of CO_2 up to the 70 per cent target. A reduction ambition of around 3.5 million tonnes of CO_2 by 2030 would therefore provide a large part of the remaining shortfall.
- Reductions in other major sectors, such as transport, are more costly to society and it is therefore appropriate that the sectors covered contribute to the reductions instead.

Recommendations: Three models of the CO_2 tax system

The recommendations of the Expert Group are based on the conditions of the terms of reference. It is a central premise that the proposed models should be cost-effective, unless other circumstances justify departing from this.

The Expert Group's models are cost-effective in principle

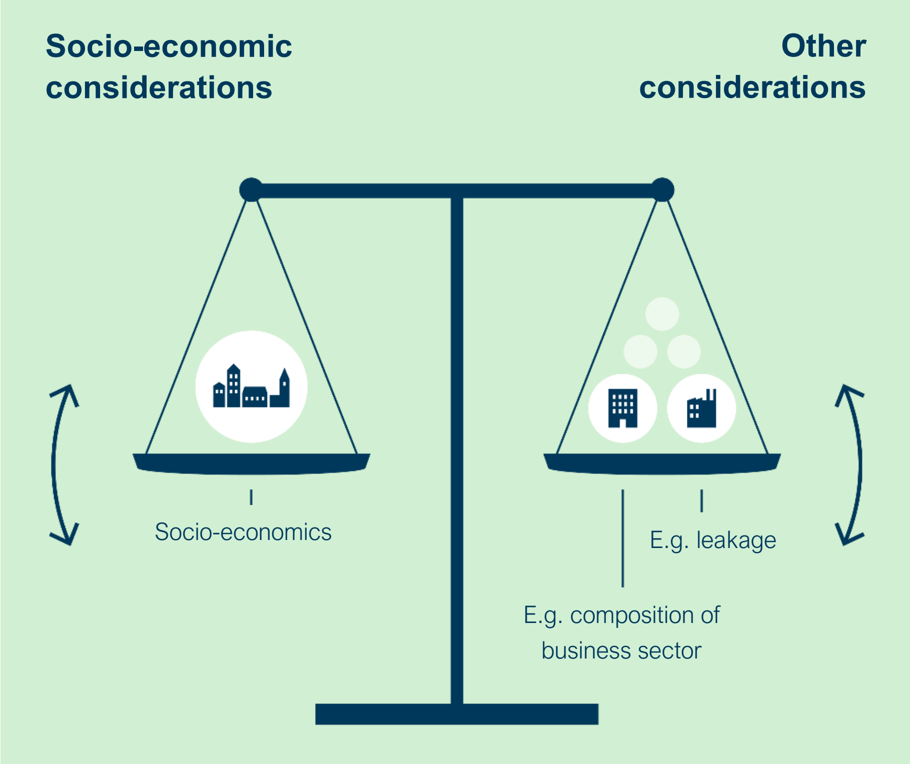
In addition, the Expert Group will include a tax model where total taxes do not increase, which is handled by returning the revenue from the CO_2 tax in the first of the Expert Group's models through reductions in existing taxes and duties. Here, the Expert Group has assessed reductions in corporate tax and electricity tax.

This includes a model where total taxes and duties do not increase

This section presents three different models for the tax system. Specifically, three models are presented that reflect different emphases on the guiding principles of the Climate Act (and the terms of reference). Finding one perfect model that satisfactorily meets all the principles is not considered possible. Instead, different pathways are presented to reach the 70 per cent target. Taken together, the tax models show a balancing of different and to some extent conflicting considerations, *see Figure 2.5*. In this way, it will ultimately be a political choice how the different considerations are weighted and how the architecture of a CO_2 tax system is arranged.

This chapter presents three approaches to the tax system, balancing different considerations

Figure 2.5 Balance between the Climate Act's guiding principles



In addition to the three models, the report highlights a number of additional models for the arrangement of the tax system, including models with both higher and lower levels of ambition, *see Chapter 4*.

The report also includes a number of supplementary models

2.3.1 Overview of the three tax models

The tax models show different weightings of climate law considerations

The three tax models, the design of which is detailed in *Box 2.1*, show the consequences of different weightings of the Climate Act's considerations.

In model 1, cost-effectiveness is highly weighted

The first tax model has a uniform CO_2 tax and thus emphasises low socio-economic costs, as the largest reductions for a given cost are achieved by uniform taxation of all CO_2 emissions. The revenue is used to ease corporate tax, further lowering society's costs.

Model 2 takes into account leakage within mineralogical processes, etc.

However, the first tax model also entails the risk of a significant decline in production and accompanying leakage in the CO_2-intensive industries. Therefore, tax model 2 seeks to reduce this by a lower tax for mineralogical processes, etc., which are considered particularly vulnerable to leakage. To achieve the same CO_2 reduction, the tax revenue is used for a subsidy pool for CCS. This increases the socio-economic costs and uses up the revenue, but leads, on the contrary, to a higher share of technical reductions.

In model 3, extra funding is used to take account of the business burden and leakage

The third tax model uses additional funding of DKK 0.5 billion to reduce the general CO_2 tax rate and increase the subsidy pool for CCS to achieve the same reduction despite the lower tax rate. The aim is to reduce the business burden and the risk of leakage in general.

Box 2.1

The Expert Group's models

Common to all three tax models is that they include a shift from energy taxation to a CO_2 tax, an extension of the tax base to areas currently exempt from energy and CO_2 taxation, a levelling of tax levels, a partial tax reduction for companies covered by allowances, an incentive for negative emissions and the abolition of the current basic deduction in the CO_2 tax. These commonalities in the models are elaborated in more detail in Section 2.3.2. In addition, the three tax models contain the following general elements:

- Model 1 – Cheapest reductions. A uniform CO_2 tax rate of DKK 750 per tonne of CO_2 for companies outside the ETS sector, corresponding to the expected emissions allowance price in 2030, and a tax rate of DKK 375 per tonne CO_2 for companies in the ETS sector. In addition, a subsidy is given for negative emissions, which can, at most, amount to the tax rate for the non-ETS sector. The tax revenue is returned broadly to the business sector, e.g. through a general relaxation of corporate tax.

- Model 2 – Partial management of leakage. A uniform CO_2 tax rate of DKK 750 per tonne of CO_2 for companies outside the ETS sector corresponding to the expected emissions allowance price in 2030, a tax rate of DKK 375 per tonne of CO_2 for companies in the ETS sector and a revised tax rate of DKK 100 per tonne CO_2 for mineralogical processes, etc. The tax revenue is used for a subsidy for CCS for reductions from fossil sources and for negative emissions from biogenic sources (BECCS), where the subsidy rate can exceed the tax rate in the non-ETS sector.

- Model 3 – Additional management of leakage. A uniform CO_2 tax rate of DKK 600 per tonne of CO_2 for companies outside the ETS sector, a tax rate of DKK 225 per tonne of CO_2 for companies in the ETS sector and a reduced rate of DKK 100 per tonne of CO_2 for mineralogical processes, etc. The tax revenue and additional financing of DKK 0.5 billion will be used for a subsidy for, e.g. CCS for reductions from fossil sources and for negative emissions from biogenic sources (BECCS), where the subsidy rate can exceed the tax rate in the non-ETS sector. The additional financing is provided in the calculations through a 0.05 percentage point increase in the lowest tax rate, but it can alternatively be provided through other taxes or reprioritisation of expenditure.

For the three models, the tax rates mean that, at the expected emissions allowance price of DKK 750 per tonne of CO_2, the ETS-coveredcompanies will have a total payment from the CO_2 tax and the emissions allowance price of DKK 975-1,125 per tonne of CO_2, depending on the model.

Table 2.1 shows the overall impact of the models

The overall overview of the impacts of the models is presented in *Table 2.1*, including the impacts of the models on CO_2 emissions in 2025 and 2030, emission rates, revenue impacts (immediate and behavioural) and socio-economic costs. The individual models and the results are further detailed in the separate sections. *Box 2.2* provides an overview of the main concepts for understanding the model results both in the table and in the review of the other chapters.

Table 2.1. Overview of the consequences of the models

	CO_2 reductions (million tonnes)			Tax rate in 2030 (DKK per tonne)		Costs and revenue (DKK billion)		Socio-economic costs (DKK per tonne)[4)]	
	2025	2030	CSS, including negative emissions	Non-ETS /ETS[1]	Rate mineralogy	Immediate load[2)]	Revenue by behaviour[3)]	Avg. (after compensation)	Marginal
Model 1 (Cheapest reductions)	1.0	3.5	0.7	750/ 375	375	2.8	0.8	350 (250)	750
Model 2 – (Partial management of leakage)	0.7	3.5	1.7	750/ 375	100	2.3	0	500 (500)	850
Model 3 (Additional management of leakage)	0.6	3.5	2.0	600/ 225	100	1.6	-0.5	500 (525)	875

Note: Rates and shadow prices are rounded to the nearest DKK 25 per tonne of CO_2. Totals may differ from the sum due to rounding. Rates are shown in 2022 prices, while revenue effects are shown in 2022 levels. It is assumed that the taxes are continuously indexed with the general price level. The return flow is calculated assuming a full spillover effect in wages*, see Section 2.4*. CCS is included as a technical reduction. The computation assumes that any shortfall is covered by an increase in the lowest tax rate, and any surplus in 2030 is used for a general reduction in corporate tax.
Note 1: For a number of tax bases, minimum energy taxes have been introduced in the EU's Energy Taxation Directive. In this context, a rate of DKK 750 per tonne of CO_2 should be interpreted as the sum of the CO_2 tax and the energy tax.
Note 2: Calculated excl. restructuring the space heating.
Note 3: Calculated after restructuring the space heating tax and subsidies for CCS.
Note 4: The socio-economic costs are measured in factor prices.
Source: Own calculations.

Impact calculations are made with uncertainty

There is fundamental uncertainty linked to the calculated effects in the table, including when they are broken down by sector. This is mainly due to uncertainty about behavioural effects and technological developments, as well as uncertainty about the projected tax bases.

Box 2.2

Key terms in connection with model calculations

The immediate burden is defined as the impact of a tax change on CO_2-emitting companies before the companies start to change their behaviour. It is calculated as the product of the company's CO_2 emissions and the tax increase.

Revenue after behavioural response is defined as the revenue effect of a tax change, taking into account changes in behaviour and the effect of the tax change on other government revenue and expenditure. It is this revenue that can be allocated to, for example, tax reductions and financing subsidies. In other contexts, revenue by behaviour is called the impact on government finances and immediate revenue effect after static effects and behavioural response.

The socio-economic cost indicates the value of the welfare loss experienced by society as a result of increased taxation and subsidies. The socio-economic cost per tonne of CO_2 is also called the shadow price. A distinction is made between the average shadow price, which covers the total socio-economic cost per tonne of reduced CO_2, and the marginal shadow price, which covers the socio-economic cost of reducing one more tonne of CO_2.

When a CO_2 tax is introduced, the CO_2 reductions can be calculated in two types of reductions: technical and structural effects.

Technical effects cover reductions that do not affect the scale of production but reduce emissions per unit produced, e.g. through energy efficiency improvements, electrification, fuel switching, etc.

Structural effects (alternatively changes in the size of different sectors) cover reductions from production decline or relocation and possible cross-border trade. This happens because a tax increase makes Danish companies less competitive relative to foreign companies and therefore forces them to reduce or relocate their production or because CO_2-intensive products become more expensive relative to CO_2-light products, causing consumers to shift their consumption towards CO_2-light products.

In calculating the CO_2 reduction effect of a tax increase, it is assumed that the greatest CO_2 reductions per kroner of tax burden are achieved with low tax increases, whereas with large tax increases it requires a larger tax increase to reduce by an additional one tonne of CO_2. It is thus assumed that each kroner of tax increase results in the same percentage reduction in CO_2 emissions.

Furthermore, it is assumed that in a given year, companies react partly to the actual tax increase in that year and partly to the expected final tax in 2030. For example, the reaction to the actual tax in the year is that companies will reduce emissions by measures such as saving energy and adjusting the scale of production. The reaction to the expected final tax will influence companies' investment decisions in e.g. energy efficient machinery, electrification, etc. The reaction to the final charge is expected to start already at the time of announcement.

The concept and calculation methods underlying the model calculations, including the potential of individual sectors to shift to less CO_2-intensive production, are further elaborated in the report's documentation note.

2.3.2 Common features of the three tax models

A number of elements are common to the three tax models presented

As mentioned, several common features are pervasive in all the Expert Group's models. These include: restructuring of energy taxation, broadening of the tax base, tax rebates for part of the expected emissions allowance price and subsidies for negative emissions, and other elements such as the abolition of the current CO_2-basic deduction, the gradual phasing in of taxes and the continuous indexation of tax rates. These elements thus do not distinguish the three models. The common features are discussed in the next sections.

Conversion of energy taxation to CO_2 taxation

Energy taxes are differentiated when calculated per tonne of CO_2 emitted

Fossil fuels are typically subject to energy taxation, and outside the ETS sector, fossil fuels are also subject to CO_2 taxation, *see Section 5.1*. The energy tax is currently paid on the basis of the energy content of the fuel and is therefore differentiated across the board when calculated per tonne of CO_2 emitted. This is because different energy products have different CO_2 contents.

Therefore, energy taxes are converted into CO_2 taxes, which in isolation results in a more uniform taxation

In the models, energy taxes are (partially) converted into a CO_2 tax. This means that energy products with a high CO_2 content will be taxed more heavily, while energy products with a low CO_2 content will be taxed more lightly compared to today. Coal and oil in particular have a higher CO_2 content than natural gas. In isolation, this change will result in a more uniform CO_2 taxation across fuels, as the taxes are targeted at CO_2 instead of energy content. Specifically, the following reorganisation is proposed in the relevant areas:

- For energy taxes on fuels used in industry and other sectors, as much as possible of the energy tax is converted into a CO_2 tax.[10] It will basically be an almost complete restructuring. This is done by gradually removing energy taxes while phasing in an increasing CO_2 tax.

Process taxes are converted as far as possible into CO_2 taxes

- For the space heating taxes, i.e. the energy taxes for collective and individual heating, part of the energy tax is converted to CO_2 tax corresponding to the size of the general CO_2 tax in the non-ETS sector.[11] The CO_2 tax will thus be the same across applications. Part of the energy tax on space heating is retained, as the current tax exceeds the proposed levels for the CO_2 tax. The restructuring implies that the relative prices of different fuels for space heating reflect differences in the emitted amount of CO_2. The restructuring and the consequences for the heating sector are detailed in Section 3.1.

The taxes on the production of collective and individual heat are partially restructured

- The restructuring of fuel taxes in the transport area (petrol and diesel) is similar to that for space heating taxes. There is thus no tax increase for petrol and diesel, but the change ensures that the general CO_2 tax applies across the areas of industry, commerce, etc., space heating and fuel taxes. The restructuring of fuel taxes for road transport is explained in Section 3.2.

Fuel taxes are also partially adjusted to ensure a general CO_2 tax across the board

It should be noted that it is currently not possible to estimate the effects of a restructuring of space heating taxes in the waste sector, including EU obligations for the waste sector, capacity adjustment, imports, sorting and recycling targets. This is due to the fact that a number of changes in the waste sector have taken place in recent years and have not yet entered into force. Thus, the concrete effects must be examined in more detail, including the interaction with other regulations. It is considered to be outside the scope of the Expert Group's investigation and the Expert Group recommends that this be further investigated separately from the work of the Expert Group, *see Section 3.1*.

It is not possible to estimate the effects of the restructuring on the waste area

Overall, the restructuring is expected to contribute to more uniform taxation and encourage CO_2 reductions. However, it is expected that the reductions from the restructuring itself will be relatively limited in isolation.

It contributes to a more uniform taxation, as well as limited reductions

Expansion to areas that are not currently taxed

CO_2 emissions in a number of well-defined areas within industry, non-road transport and power generation are currently not subject to energy or CO_2 taxes. This applies to ferries' and fisheries' fuel consumption, domestic flights, energy-related (until 2025) and non-energy-related emissions from mineralogical processes etc., North Sea energy consumption, emissions from refineries and use of fossil fuels for electricity production.

A number of well-defined areas are currently exempt from tax

Extensions to this would be a step towards a more uniform CO_2 tax, so in all models the tax base for the CO_2 tax is extended to these areas.

The CO_2 tax is extended to these areas

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[10] In this context, process covers energy use in production processes in industry and other sectors. It thus covers energy consumption in, for example, the food industry and horticulture, but not energy consumption for heating in, for example, households. In this context, industry and other sectors cover (i) ordinary process (ETS), (ii) ordinary process (non-ETS), (iii) agriculture, etc. (energy-related), (iv) horticulture (ETS), (v) horticulture (non-ETS), (vi) mineralogical processes, etc. (energy).

[11] The transition from energy taxes to CO_2 tax is arranged to ensure that it takes place in accordance with the minimum rates of the Energy Taxation Directive. Based on the existing Energy Taxation Directive, this implies that not all energy taxation can be reclassified, e.g. there must be a minimum rate.

The current Energy Taxation Directive contains a number of mandatory exemptions for several of these sectors. The proposed revision of the Energy Tax Directive envisages the abolition of some of the mandatory exemptions*, see Chapter 5*. For the extensions of the CO_2 tax, it is, therefore, a prerequisite that they can be arranged in a way that is acceptable to the EU and does not conflict with the Energy Taxation Directive, the mandatory tax exemptions or other legal obligations.

The extensions must be designed to be compatible with e.g. the Energy Taxation Directive

Alignment of tax levels

To ensure the most cost-effective reductions, the CO_2 tax should be uniform. After the restructuring and expansions, the tax levels are, therefore, generally aligned across application areas in all models. The specific levels and precise alignment vary in the *models presented, see Sections 2.3.3-2.3.5*.

The CO_2 tax is harmonised across the board, with the precise arrangement varying in the different models

A tax rebate is granted for part of the emissions allowance price

Companies covered by the EU ETS account for about 5 million tonnes of CO_2 emissions out of the total 7.3 million tonnes of CO_2 in 2030 from industry and other businesses, non-road transport and power generation.

ETS-coveredcompanies emit 5 out of 7.3 million tonnes of CO_2 in 2030.

Companies with production processes covered by the ETS also pay a emissions allowance price to the EU in addition to any national taxes. In the latest projection (beginning of 2022), it is estimated to be around DKK 750 per tonne of CO_2 in 2030. In addition, they are allocated a number of free emissions allowances to discourage leakage out of the EU. The share of free emissions allowances is currently around 40 per cent on average, but is expected to decrease in the future.

In addition to taxes, they will pay a emissions allowance price estimated at DKK 750 per tonne of CO_2 in 2030.

From a European perspective, the cheapest possible reductions would be achieved by a uniform marginal price on emissions in all EU countries, which would imply a deduction in the national tax for the ETS companies equal to the emissions allowance price.

From a European point of view, the marginal price should be the same for emissions in the EU

Equality for all companies may also require that companies inside and outside the ETS sector pay the same CO_2 price. This again means that companies covered by emissions allowances are awarded a full discount for the emissions allowance price in the domestic CO_2 tax. However, in the opposite direction, several large emitters in the ETS sector are allocated free emissions allowances and thus are not fully burdened by the emissions allowance payment.

Considerations for equalising companies can also dictate the same CO_2 price

In addition, with the 70 per cent target, Denmark has undertaken a greater reduction commitment than required by the EU. This may suggest that emphasis is placed on minimising Denmark's socio-economic cost by meeting the target. From a Danish socio-economic point of view, the emissions allowance price is an additional cost of using fossil fuels within the ETS sector. This is because the payment made by Danish companies for using an extra emissions allowance does not accrue to the Danish treasury, but rather to the foreign seller of the emissions allowance . This additional socio-economic cost in the ETS sector should, as a general rule, be reflected in the price of fuels faced by companies in the ETS sector. This implies that no discount must be given for the emissions allowance price in the domestic CO_2 tax.

However, from a Danish socio-economic perspective, the emissions allowance price should not be taken into account

However, companies in the ETS sector are among the most CO_2-intensive, and their costs will therefore typically increase relatively more with the introduction or increase of a CO_2 tax. They therefore risk losing market share or moving production

However, companies in the ETS sector are energy-intensive and prone to leakage, which may argue for a reduction.

abroad if a high CO_2 tax is imposed. In both cases, CO_2 leakage will occur, as falling production and emissions in Denmark will be fully or partially offset by increasing production and emissions abroad. Therefore, CO_2 leakage considerations argue in favour of lower taxation for companies covered by emissions allowances.

Consideration of a reduction in the emissions allowance price must therefore be based on a balance between the least costly solution in socio-economic terms, a consideration of the higher risk of leakage for ETS-covered companies, a consideration of the fairness of the same marginal price for companies inside and outside the ETS sector and a consideration of the scale of free emissions allowances.

A reduction in the emissions allowance price is a trade-off between all these considerations

As a balance of the conflicting considerations, the Expert Group assumes in the models presented that a partial discount of 50 per cent is given to the emissions allowance price. The compromise should be seen in the light of the fact that neither full nor no reduction is considered optimal. Section 4.4 also shows models with 0 and 100 per cent emissions allowance price reductions.

In view of these conflicting considerations, a 50 per cent reduction in the emissions allowance price is recommended.

The size of the ETS share should also be seen in light of the fact that most exports are concentrated in the ETS sector. For a given reduction target, a larger reduction in the emissions allowance price would imply that the tax would have to be significantly higher, *see Table 4.2 in Chapter 4*. This means that the ETS-covered companies would have to bear the burden of a higher reduction themselves to a very large extent.

With a higher emissions allowance reduction, the tax will also have to be set correspondingly higher

Incentive for negative emissions

A fully cost-effective CO_2 tax requires that the incentive for reductions be the same across all activities covered by the 70 per cent target. It also includes negative emissions, which are included on an equal footing with the reduction of positive emissions. As negative emissions are part of the 70 per cent target, they should be initially allocated a subsidy (a "negative tax") at a rate equivalent to the CO_2 tax. This ensures the same incentive to reduce emissions everywhere, so that reduction efforts are made where they are cheapest. The subsidy should in principle be available for all technologies that can ensure negative emissions. However, the calculations assume that negative emissions only occur via capture and storage of CO_2 from biogenic sources (BECCS).

A fully cost-effective CO_2 tax should have the same incentive for positive and negative emissions

From a socio-economic perspective, the tax on negative emissions should be paid through the tax system and without limitation, so that all negative emissions receive a subsidy equal to the tax rate. However, for the sake of the state's budget security, it may be necessary to put a cap on the total payment of negative taxes. In the Expert Group's tax models, the incentive for negative emissions is therefore a subsidy pool with a ceiling. A subsidy pool with a set ceiling can also support competition and reduce subsidy costs.

Taxing negative emissions should be done through pools

The pool will have both a cap on the total pool and a cap on the subsidy per tonne of CO_2 reduction. The total amount of the pool is determined on the basis of an estimate of the need of subsidy at a given subsidy rate per tonne of reduction.

With ceiling for total pool and subsidy per tonne

The maximum subsidy per tonne of reduction is set in the Expert Group's first tax model after the CO_2 tax in the non-ETS sector. This ensures two fundamental balances. First, the marginal incentive for reductions in the non-ETS sector is the same for positive and negative emissions. Second, the incentive for negative emissions in the ETS and non-ETS sectors is the same. This is consistent with the fact that

The subsidy per tonne should initially be equivalent to a maximum of the CO_2 tax rate in the non-ETS sector

negative emissions inside and outside the ETS sector count equally towards the 70 per cent target, while negative emissions are not included in the ETS. The subsidy rate means that the ETS sector will have a different incentive to reduce positive and negative emissions.

The pool is set up as a competition model

The subsidy pool is assumed to be designed as a competitive model, with the cheapest reductions per tonne of CO_2 receiving a subsidy first.

Other considerations may justify a higher subsidy rate as in model 2 and model 3

In balancing considerations other than cost-effectiveness, the subsidy rate for negative emissions may also be set higher than the level of taxation in the non-ETS sector. This would be the case in models 2 and 3, where the cost-effectiveness considerations are departed from precisely in order to limit the burden on business and the risk of leakage, because a higher subsidy makes it possible to achieve the same reduction with a lower tax rate.

Other common features: Abolition of the current CO_2-basic deduction, gradual phasing-in and continuous indexation

Certain companies currently have a basic deduction in the CO_2 tax

Companies with energy-intensive production processes, which in 2008 were not covered by the EU ETS, today receive a basic deduction in the CO_2 tax. It was introduced to put companies outside the EU ETS on an equal footing with those inside, who receive free emissions allowances. These are typically smaller, energy-intensive businesses in the horticultural and food industries.

This is recommended to be abolished in the models

The models assume that the basic deduction is abolished. The basic deduction provides a limited incentive for reductions for the covered companies, as it constitutes a very high proportion of the tax, and excess basic deductions cannot be paid for as a subsidy. Moreover, it reflects to a lesser extent the current compensation needs of companies, as the base deduction is based on companies' emissions back in either the period 2003-2007 or in 2007. Abolition would also contribute to a simpler and more uniform tax system.

Taxes phased in linearly from 2025 to 2030

The tax models analysed assume that the CO_2 tax will be phased in gradually from 2025 to 2030 to give companies time to adapt, including in those areas that will experience the largest tax increases.

The exact phasing in is shown in Table 2.2.

Specifically, the CO_2 tax for sectors covered by allowances will be increased to DKK 75 per tonne of CO_2 in 2025, while the tax for non-ETS sectors will be increased to DKK 350 per tonne of CO_2 in 2025. After this, all taxes will be increased linearly towards a uniform tax rate in 2030. For sectors already subject to a tax above DKK 75 per tonne of CO_2 in 2025 (horticulture and general processing), the tax will be maintained until the general tax for companies subject to the emissions allowance exceeds this. The exact phasing in, including the expected emissions allowance price, is outlined in *Table 2.2*.

Table 2.2. Phasing in of a uniform CO_2 tax in model 1-3

DKK/tonne CO2	2025	2026	2027	2028	2029	2030
Model 1						
Non-ETS	350	430	510	590	670	750
ETS (incl. expected emissions allowance price)	75 (730)	135 (805)	195 (885)	255 (965)	315 (1045)	375 (1125)
Model 2						
Non-ETS	350	430	510	590	670	750
ETS (incl. expected emissions allowance price)	75 (730)	135 (805)	195 (885)	255 (965)	315 (1045)	375 (1125)
Mineralogical processes, etc. (incl. expected emissions allowance price)	75 (730)	80 (750)	85 (775)	90 (800)	95 (825)	100 (850)
Model 3						
Non-ETS	350	400	450	500	550	600
ETS (incl. expected emissions allowance price)	75 (730)	105 (775)	135 (825)	165 (875)	195 (925)	225 (975)
Mineralogical processes, etc. (incl. expected emissions allowance price)	75 (730)	80 (750)	85 (775)	90 (800)	95 (825)	100 (850)

Source: Own calculations.

However, there will still be a reduction in 2025

In the models, there is a reduction effect in 2025, although the taxes will only be increased from then on. As explained in Box 2.2, this is because, in addition to the actual tax, companies are also estimated to react to the expected future tax through, for example, their investment decisions.

Political wishes may dictate a faster phase-in than assumed

The tax phase-in in the models is computed linearly from 2025, but if there is a political will, the phase-in can also be faster. This will affect the scale of reductions in 2025, but not in 2030.

The taxes are continuously indexed

Taxes are also indexed to price developments on an ongoing basis so that they are not affected by inflation. In the models, tax rates and the expected emissions allowance price are calculated in 2022 prices.

2.3.3 Model 1: Cheapest reductions

Model 1 is based on a cost-effective tax system

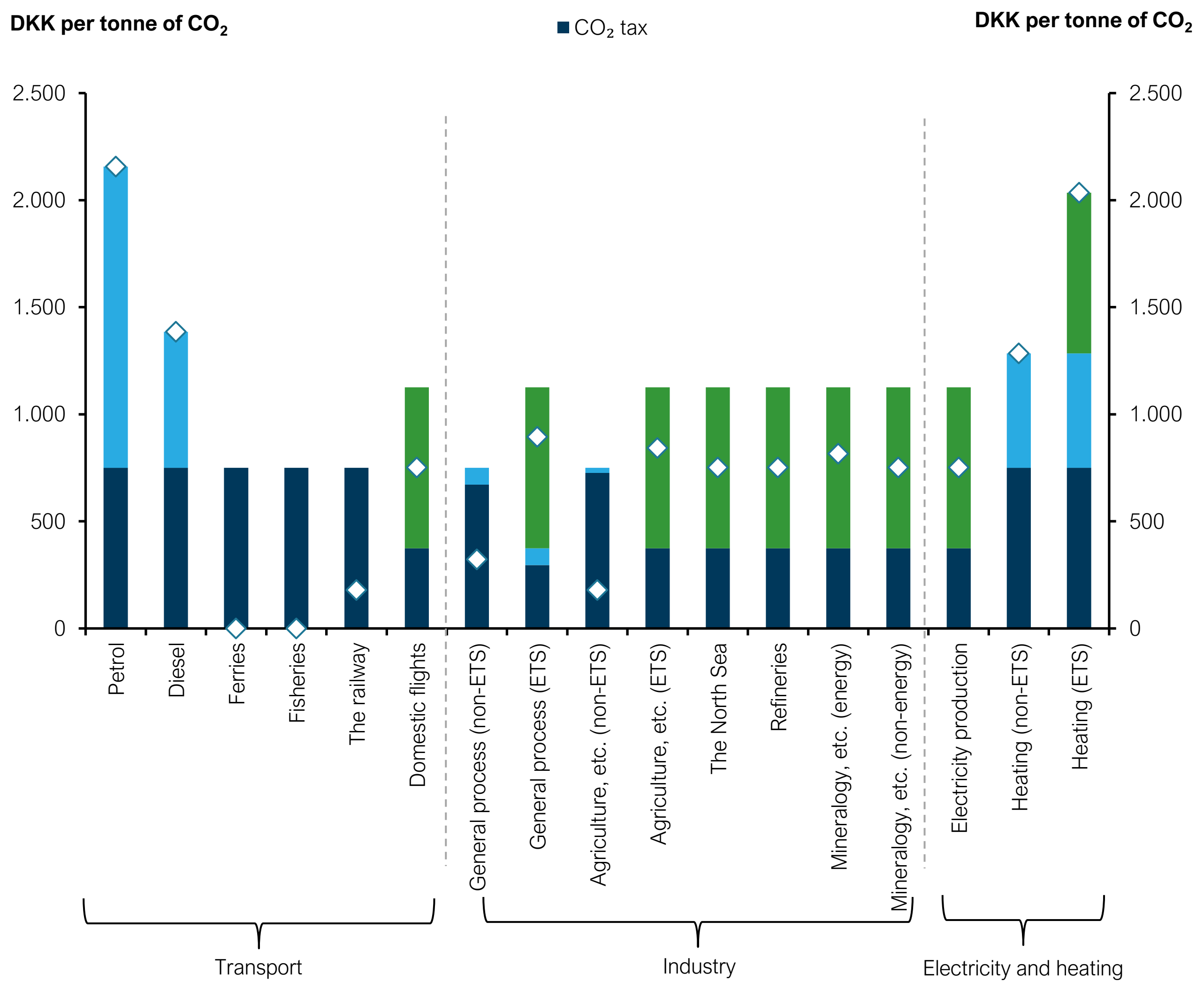
Model 1 is based on a cost-effective system where - in addition to the common features mentioned - there are uniform CO_2 tax rates of DKK 750 per tonne of CO_2 for companies outside the ETS sector, DKK 375 for companies within the ETS sector and a subsidy of a maximum of DKK 750 per tonne of CO_2 for negative emissions.

Where the rate outside the ETS sector corresponds to the expected emissions allowance price in 2030

The rate of DKK 750 per tonne of CO_2 outside the ETS sector is also the same as the expected emissions allowance price in 2030. This means that ETS-covered companies at the expected emissions allowance price of DKK 750 per tonne of CO_2 has a total payment from the tax and the emissions allowance price of DKK 1,125 per tonnes of CO_2.

The model's rates from the taxes and the emissions allowance are illustrated in *Figure 2.6*.

Figure 2.6. Model 1 - rates after restructuring



Note: Agriculture covers energy-related emissions from agriculture and energy consumption from horticulture. The current energy taxes have been converted to CO_2 taxes. However, for many tax bases, there are minimum energy taxes in the EU's Energy Taxation Directive, so the rates must be interpreted as the sum of the CO_2 and the energy tax. The industry's energy tax after restructuring reflects the EU's Energy Taxation Directive's minimum taxes. "Total tax before restructuring (incl. emissions allowance price)" covers the sum of the emissions allowance price (for ETS-coveredcompanies) and the domestic tax rates that will apply in 2030 pursuant to the political agreement of December 2020 on a green tax reform. Free emissions allowances and basic deductions are not included. The latest projection of the emissions allowance price of DKK 750 per tonne of CO_2 in 2030 (2022 prices) has been used.
Source: Own calculations.

The additional revenue is recovered through corporate tax

The model's taxes give rise to additional revenue, which in the calculations is returned broadly to the business sector via a general reduction in corporate tax.

The main results for model 1 are shown in *Table 2.3*.

Table 2.3. Main results of model 1

Model 1 Cheapest reductions: DKK 750 / 375 per tonne (non-ETS/ETS)					
CO_2 reductions		Costs and revenues, 2030		Economy, 2030	
2025	1.0 million tonnes	Immediate tax burden	DKK 2.8 billion	Cost	DKK 1.3 billion
2030	3.5 million tonnes	Revenue after behavioural response	DKK 1.2 billion	Cost (after compensation)	DKK 0.9 billion
- of which negative emissions[1]	0.7 million tonnes	Subsidy (negative tax)	DKK -0.4 billion	Avg. shadow price	DKK 350 per tonne
Share of technical reductions	47 per cent	Revenue for compensation (via corporate tax)	DKK 0.8 billion	Avg. shadow price (after compensation)	DKK 250 per tonne

Note: See Table 2.1. The main results after compensation are after the return of the revenue via a general reduction in corporate tax.
Note 1: Indicates the estimated negative emissions from capture and storage of biogenic sources at a subsidy rate of DKK 750 per tonne CO_2.
Source: Own calculations

The model has low socio-economic costs

Model 1 is the one of the three models shown that results in the economically cheapest reductions in industry, etc., as the tax, in addition to the discount for the emissions allowance price, is uniform.

Especially compared to other areas, e.g. transport, these are socio-economically 'cheap' reductions

The fact that the reductions are the cheapest in socio-economic terms means that the costs in terms of lost economic welfare (e.g. loss of wealth or reduced real wages) for a given level of reduction are minimised, which is reflected in a low shadow price (socio-economic cost per tonne of CO_2 reduced). The total socio-economic cost is DKK 1.3 billion, corresponding to an average shadow price of DKK 350 per tonne of CO_2, before taking into account possible gains from the use of the revenue, and DKK 250 per tonne of CO_2 after the reduction in corporate tax. Compared to other areas, e.g. transport, where the fiscal shadow price for private car use is in the order of DKK 2,000 per tonne of CO_2, these are very cheap reductions in terms of socio-economic cost.

Partly because current taxes are low

It is also connected with the fact that a large part of the industry currently has low or no taxes, so even relatively cheap reduction measures are not currently profitable but will be with higher taxes.

0.7 million tonnes are estimated to come from negative emissions

The model is estimated to deliver 0.7 million tonnes of CO_2 reduction from negative emissions, which are expected to come from the capture and storage of CO_2 (CCS) from biogas plants and biomass and waste plants in the heating sector.

The model will imply domestic production cuts for CO_2-intensive companies

In addition to the fact that the model gives rise to cost-effective reductions, it is also assessed to have major consequences for companies with very CO_2-intensive production. This can be illustrated by the fact that only about 47 per cent of the reductions achieved are estimated to come from technical effects, part of which is secured through subsidies for negative emissions (negative tax). This means that more than half (53 per cent) of the reductions come from structural effects, covering reductions from production downsizing or relocation.

Structural effects and changes in the size of different sectors may not necessarily result directly in leakage if, for example, consumption also changes as a result of the tax. This may be the case for parts of non-road transport, which are eliminated by rising prices and replaced by other consumption. However, large structural effects will usually indicate a significant risk of leakage.

The reductions from these structural effects will often involve risk of leakage

Leakage can also occur through a variety of channels other than production moving abroad or market share being lost. Leakage can also occur, for example, through the ETS or through price effects on the fossil fuel market. Considerations about leakage are elaborated in Section 8.2.

However, leakage can come from other channels than the relocation of production

The large structural effects in model 1 are related to the fact that industrial CO_2 emissions are highly concentrated in a few large emitters. When these companies have very large emissions relative to their size, their profits, turnover, gross value added (GVA) and number of employees are relatively small compared to the scale of their CO_2 emissions.[12]

The structural effects are a result of highly concentrated emissions

As a result, these emitters do not necessarily have a large surplus to cover the tax burden in the case of a general, uniform CO_2 tax. The tax will also constitute a relatively significant increase in their costs, which, if passed on to the price, will result in a substantial price increase. The price increase will typically lead to a fall in demand for their products. Therefore, they will have to reduce domestic production because they will lose market share to foreign competitors and have to close down or move production abroad. A larger part of the domestic consumption of the produced goods will thus be covered by imports, which will result in leakage.

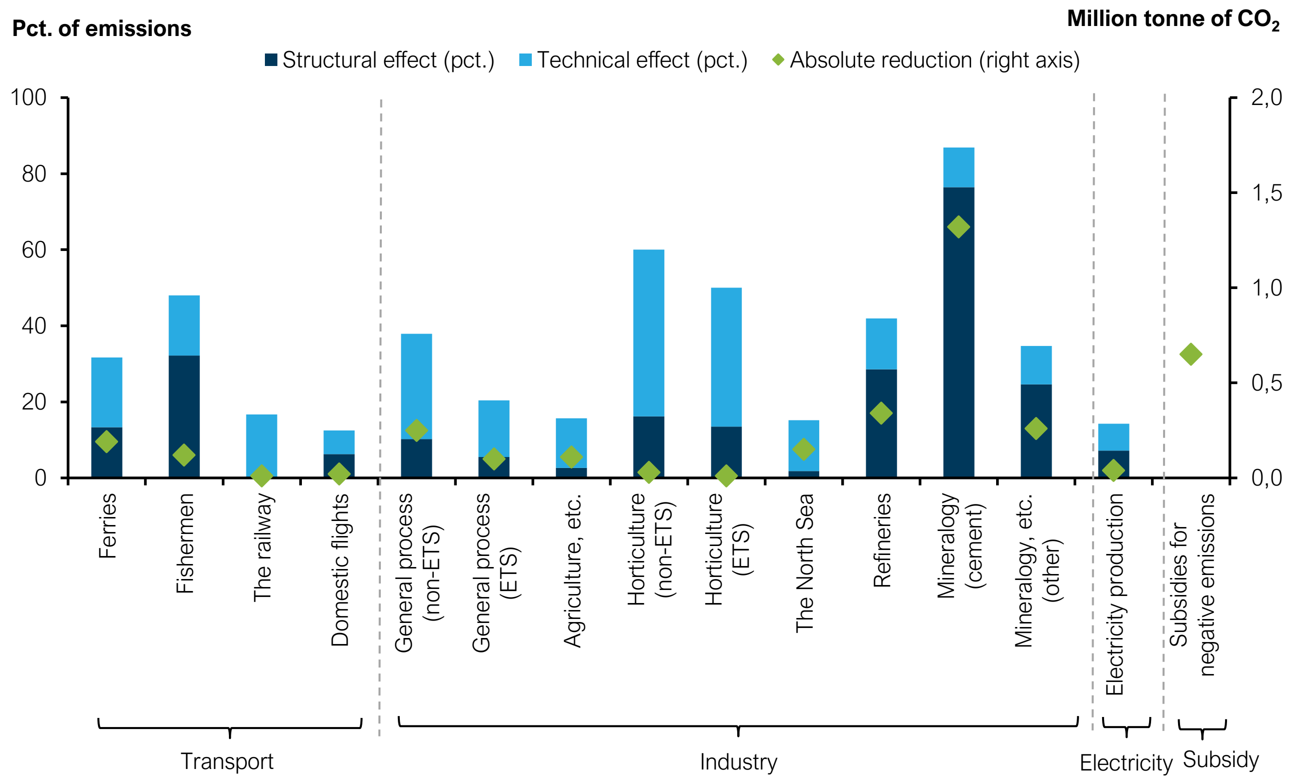
Where large emitters typically represent a small share of the total economy

Figure 2.7 illustrates the reductions from the model at industry level, broken down by technology and structural effects. In the figure, the dark part of the bars indicates the percentage decrease in CO_2 emissions from a decrease in production, while the lighter part indicates the percentage decrease from technical reductions, i.e. decrease in emissions per produced unit. In addition, the absolute reduction for the industry is illustrated on the right axis.

Figure 2.7 shows the distribution between structural and technical effects

[12] Gross value added (GVA) is a measure of value added (the increase in the value of goods or services) in society or in an industry, including taxes on production, but before any taxes on products.

Figure 2.7. Model 1 - share of structural and technical effects in relation to the base



Note: The green diamonds are the reduction in emissions in million tonnes (right axis). The bars cover the proportion of the tax category's basis that is reduced (left axis). Technical effects cover reductions that do not affect the scale of production but reduce emissions per unit produced, e.g. through energy efficiency improvements, electrification, fuel switching, etc. Structural effects cover reductions from production downsizing or relocation. This can happen because Danish companies are now less competitive relative to foreign companies and therefore have to reduce their production, or because CO_2-intensive products become more expensive relative to CO_2-light products, which causes consumers to shift their consumption.
Source: Own calculations.

The majority of the reductions in the model can be attributed to a few CO_2-intensive industries – especially cement production

It is estimated that emissions from cement production will decrease by over 85 per cent, of which almost all can be attributed to structural effects. As cement production is expected to cover a good 20 per cent of the industry's emissions after taking into account a higher emissions allowance price, it constitutes a large proportion of the total reductions. The same situation applies to several other of the industry's major emitters, including the refineries. It is estimated that almost 2/3 of the reductions can be attributed to a few very CO_2-intensive companies within precisely mineralogical processes etc., the refineries and a few larger industrial companies covered by emissions allowances.

It is both the model's strength and weakness that CO_2-intensive production is replaced by less CO_2-intensive production

In a way, this fact is the strength of the uniform tax model, since the purpose of the CO_2 tax is precisely also to ensure that CO_2-intensive production is replaced by less CO_2-intensive production. However, this is also the model's challenge, as it entails a high risk of leakage, where CO_2-intensive production (with associated jobs) and emissions are simply shifted abroad, leaving global emissions unchanged.

Ancillary industries may also be affected

Ancillary industries and companies that supply inputs or purchase goods from the CO_2-intensive sectors may also be significantly affected by the CO_2 tax through lower demand for their products or higher prices for their inputs.

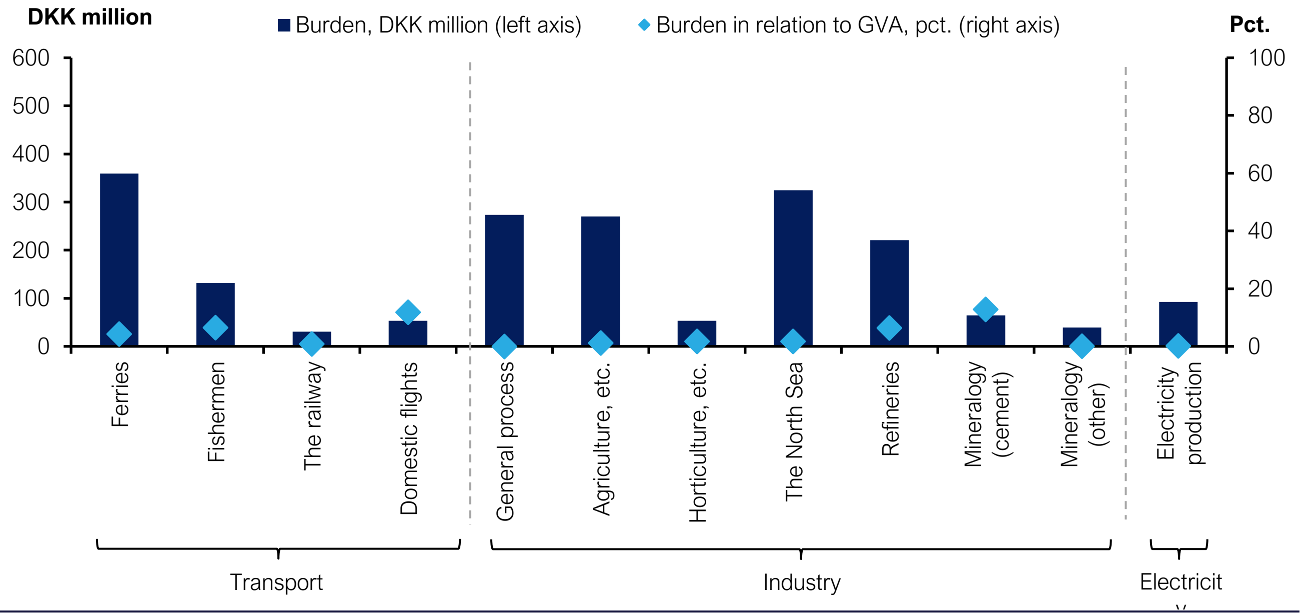
The burden on business and the resulting structural effects depend to a large extent on the level of emissions relative to the value added. *Figure 2.8* thus illustrates both the absolute load by sector and the load in relation to GVA. It can be seen that it is particularly ferries, the fishing industry, mineralogical processes, etc. (primarily cement production) and the refineries that are burdened by the CO_2 tax in model 1. Cement production in particular is considerably more stressed than all the other sectors.

The burden as a share of GVA also shows that some areas are hit hard.

The burden on business is shown here after adjustment. For industries where a large part of the adjustment and reductions can be attributed to production reductions, the immediate burden will be significantly higher. This is the case, for example, for cement production, refineries and fisheries, where the pre-adjustment burden is significantly higher relative to industries with smaller output reductions.

Even when the burden is calculated after adjustment

Figure 2.8. Model 1 - Burden on business after adjustment in DKK million and in relation to GVA



Note: The burden is calculated after adjustment, as explained in Box 2.4, and in 2022 prices.
Source: Own calculations.

The model's overall impact on CO_2-intensive industries in particular may challenge the desire to be a pioneering country that inspires the rest of the world, if climate targets are achieved primarily by moving production away from Denmark. It can be particularly difficult to imagine that the model will inspire countries with a large CO_2-intensive industry. Conversely, an unnecessarily costly transition in socio-economic terms would also be incompatible with the desire to be a pioneering country.

Thus, model 1 can also challenge the desire for Denmark to be a pioneering country

Use of revenue

Model 1 leads to additional revenue of about DKK 0.8 billion (after subsidies for negative emissions), which can be used to compensate the industry, for example in the form of general tax relief.

Model 1 leads to additional revenue of DKK 0.8 billion.

It is fundamentally difficult within the existing tax system to target the revenue back to the companies most affected by the CO_2 tax. These companies will typically not

However, it is difficult to direct it back to the affected companies

have a correspondingly large tax payment (from e.g. corporate tax) compared to the burden from the CO_2 tax.

It is therefore assumed that the revenue will be returned via a reduced corporate income tax

The model assumes that the revenue of DKK 0.8 billion will be used to reduce the general corporate tax rate. To a very limited extent, this will be the case for CO_2-intensive companies, but particularly for industries with high corporate tax payments, e.g. the financial sector and the pharmaceutical industry, *see Section 4.6*. However, a corporate tax cut means that the revenue from the CO_2 tax is returned to the industries as a whole.

A corporate tax will increase productivity and lower socio-economic costs

A corporate tax cut would also lead to generally higher productivity, which increases real wages. Therefore, there is a socio-economic gain from this use of the revenue. This has to be seen because the CO_2 tax in isolation implies socio-economic costs. For model 1, the total socio-economic costs are reduced from DKK 1.3 billion to about DKK 0.9 billion by using the revenue for a corporate tax relief.

Not estimated to have distributional effects

The overall changes are not estimated to have a significant distributional impact, *see Section 2.4.*

Revenue can alternatively be recovered via reduced electricity tax

Alternatively, it could be considered to use the revenue for reliefs targeted at households, e.g. the general charge levied on electricity, which is high and not targeted at CO_2 reduction. Households will be the main beneficiaries of a lower electricity tax, while non-VAT-registered businesses (e.g. the financial sector) will also benefit. The proposal should be seen in the context that a CO_2 tax is ultimately borne by households, *see Section 2.4*, and that the Expert Group's proposal introduces a tax on electricity production that precisely targets CO_2 emissions.

Which will reduce real income disparities

In isolation, a reduction in the general electricity tax would reduce real income disparities, as lower income groups spend a relatively larger share of their disposable income on electricity consumption.

Conclusion regarding model 1

A uniform CO_2 tax is a highly effective instrument, but carries a risk of leakage

In summary, the above analysis of model 1 shows that a uniform CO_2 tax is a highly efficient instrument from a socio-economic point of view, but also that a large part of the CO_2 reductions in industry under this tax model results from a decrease in production in sectors with a high risk of leakage.

Therefore, the other models differ from a completely uniform taxation

The analysis also shows that the leakage problem cannot be solved by using the tax revenue for general tax relief, e.g. in the form of a reduction in corporate tax, as it will not be targeted at the hardest hit companies. Therefore, the following models deviate from the principle of completely uniform taxation and involve other elements than the tax system. The models include instruments that better respond to the desire to consider CO_2 leakage and the existing business structure.

2.3.4 Model 2: Partial management of leakage

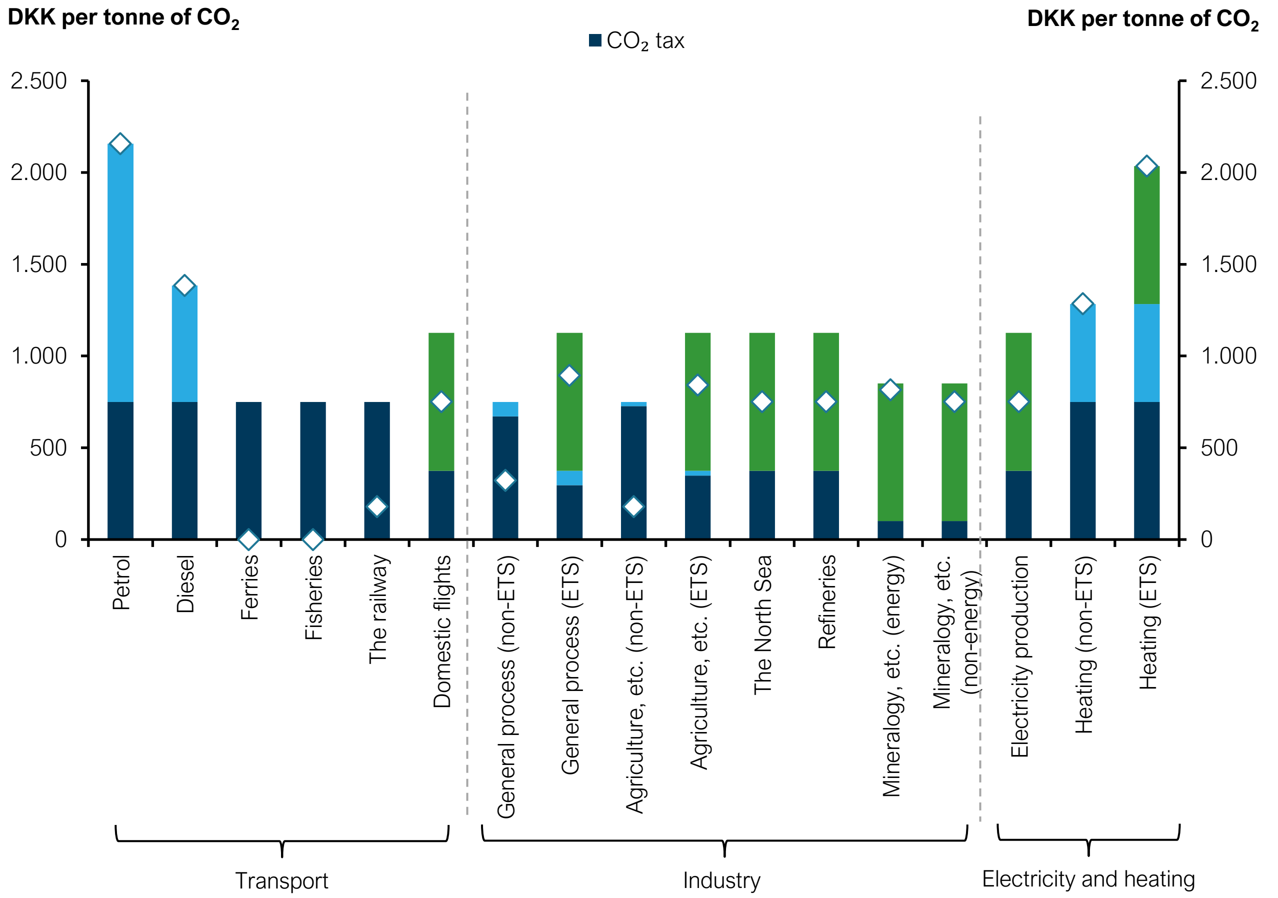
In model 2, the rate for mineralogical processes etc. is reduced, and the tax revenue is used for a subsidy for CCS

Model 1 only takes leakage into account via the partial tax reduction for ETS-coveredcompanies, which are typically exposed to leakage risk. Model 2 goes a step further to reduce the risk of leakage. In addition to the common features of all models mentioned above, there remains a uniform CO_2 tax of DKK 750 per tonne of CO_2 for companies outside the ETS sector and DKK 375 for companies within the ETS sector. In addition, mineralogical processes etc. have a reduced tax rate of DKK 100 per tonne of CO_2, as they are assessed as particularly vulnerable to leakage, *See Box 2.3*. At the same time, the full tax revenue is used to finance subsidies for CCS to ensure the same CO_2 reduction in 2030 as in model 1.

Figure 2.9 shows the model's tax rates and Table 2.4 the main results

At the expected emissions allowance price of DKK 750 per tonne of CO_2, most companies covered by the ETS have a total payment from the tax and the emissions allowance price of DKK 1,125 per tonne of CO_2. The model's tax rates including the emissions allowance price are illustrated in *Figure 2.9*, and the model's main results are shown in *Table 2.4*.

Figure 2.9. Model 2 – rates after restructuring



Note: See Figure 2.6.
Source: Own calculations.

Table 2.4. Main results of model 2

Model 2 - Partial leakage management: DKK 750 / 375 /100 per tonne (non-ETS/ETS/mineralogical processes etc.), subsidy for CCS					
CO_2 reductions		Costs and revenues, 2030		Economy, 2030	
2025	0.7 million tonnes	Immediate burden on business	DKK 2.3 billion	Cost	DKK 1.8 billion
2030	3.5 million tonnes	Revenue after behavioural response	DKK 1.1 billion	Cost (after compensation)	DKK 1.8 billion
Of which negative emissions and CCS subsidies	1.7 million tonnes	Subsidy	DKK 1.1 billion	Avg. shadow price	DKK 500 per tonne
Technical reductions	70 per cent	Revenue for additional compensation (via corporate tax)	DKK 0 billion	Avg. shadow price (after compensation)	DKK 500 per tonne

Note: See Table 2.1.
Source: Own calculations.

The model is less cost-effective

As mineralogical processes, etc. receive a reduced tax rate, the model differs from the socio-economically cheapest one.

The rate reduction results in a lower level of reduction seen in isolation

The price for the rate reduction is, seen in isolation, fewer CO_2 reductions. Lowering the rate for mineralogical processes, etc. from DKK 375 to DKK 100 per tonne of CO_2 will reduce CO_2 emissions by about 1 million tonnes. To ensure the same overall CO_2 reduction as in model 1, additional reduction measures are therefore needed. The reductions from this will be more costly and therefore result in higher socio-economic costs, which is the price of reducing the risk of leakage.

To ensure the reductions, the revenue is used for subsidies for CCS

Therefore, model 2 assumes that the tax revenue is used for an additional subsidy to CCS and BECCS (in addition to the negative tax) in order to provide further technical reductions and not impose a higher tax burden on the other sectors.

Which can be set up as a global pool with subsidies for negative emissions

In principle, the negative tax and the subsidy pool for CCS can be designed as two separate pools, but since it is only expected that the CCS technology can ensure negative emissions in the covered sectors, the pool can also be one combined pool that includes both CCS from biogenic sources and from fossil sources. The computation is based on such a design.

With a pool of DKK 1.1 billion.

The size of the pool is therefore increased from approximately DKK 0.4 billion in model 1 to approximately DKK 1.1 billion in model 2, corresponding to the entire tax revenue being used for this purpose. This also means that the highest subsidy rate per tonne of CO_2 is higher.

The model increases the technical share of reductions from 47 per cent in model 1 to 70 per cent in model 2

Compared to the model with uniform rates (model 1), the share of technical reductions increases from about 47 per cent to about 70 per cent and the structural effects are reduced accordingly. This is because technical effects from CCS for biogenic and fossil sources totalling around 1.7 million tonnes of CO_2 replace equivalent reductions from mineralogical processes etc., which are largely due to structural effects.

Subsidies for CCS likely to accrue to large point sources

It is to be expected that the subsidy for CCS may accrue to large industrial point sources. The subsidy thus contributes to ensuring more reductions in the industry than expected via the tax alone.

The subsidy increases the socio-economic costs but limits the risk of leakage

When part of the reductions is provided through a subsidy for CCS, the socio-economic costs are significantly higher than in model 1. Conversely, the subsidy and reduced tax for mineralogical processes, etc. take into account CO_2 leakage and the existing business structure.

For the other sectors, however, the burden remains unchanged

The reductions and the burden to business from all other sectors are unchanged compared to model 1*, see Figure 2.10 and Figure 2.11*, as these sectors pay the same tax as in model 1 and are not expected to use CCS. Therefore, in model 2, the same high pressures remain on fisheries and refineries, among others.

The breakdown into business categories can cover up large differences within sectors

In addition, it is noted that the breakdown into business categories can, in certain cases, cover up a large variation between the companies covered. Thus, there may be very CO_2-intensive companies among ETS-coveredgeneral process in particular, which also have a high tax burden, even though the sector as a whole has a lower average burden.

At the same time there is no revenue for other reversals

Thus, the key difference compared to model 1 is that the tax revenue is used to secure reductions from subsidies for CCS to counter the lower rate for mineralogical processes, etc., rather than to compensate other companies or relax general taxes that could give rise to socio-economic gains.

Box 2.3

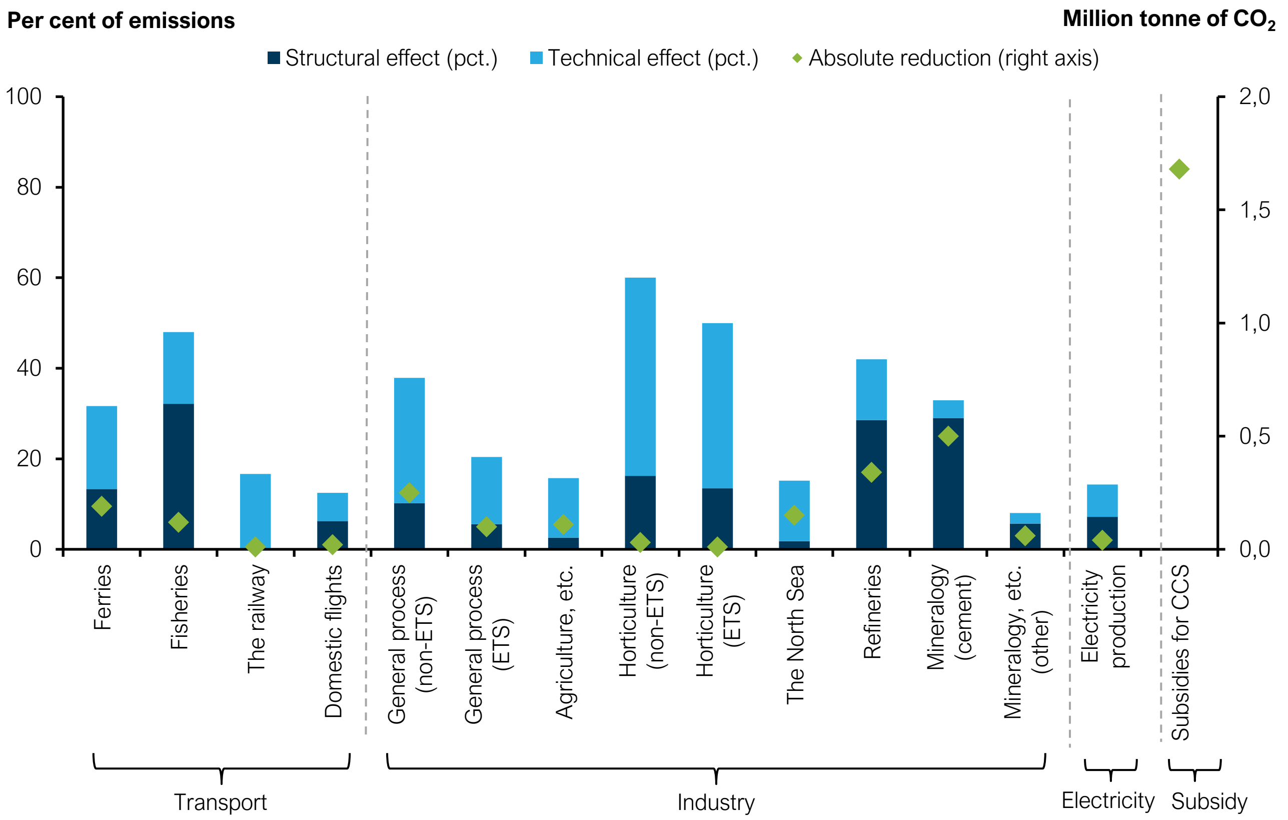
Consideration of a tax rate of DKK 100 per tonne of CO_2 for mineralogical processes, etc.

In mineralogical processes, etc., there are forms of production where both the energy consumption and the processes themselves emit large amounts of CO_2. In this sector, for example, lime is heated to high temperatures, which releases CO_2. Production at very high temperatures requires high energy consumption, which today is largely met by fossil fuels. The sector thus faces a particular challenge in reducing CO_2 because even with a switch to renewable energy sources, there will still be process emissions that can only be reduced to a small extent. Reducing these companies' CO_2 emissions therefore requires both a shift in fuel consumption and the development of new product types.

Mineralogical processes, etc. are also part of the ETS-coveredsector and must therefore purchase additional emissions allowances based on emissions. Companies within mineralogical processes, etc. receive a significant number of free emissions allowances, whereby they do not fully bear the emissions allowance costs. Free emissions allowances are allocated to the energy-intensive part of the industry, which is assessed by the EU to be particularly exposed to leakage in connection with production outside the EU. In addition, the sector is highly competitive and will be at a disadvantage compared to competitors from other EU countries that are not subject to both CO_2 tax and emissions allowance costs.

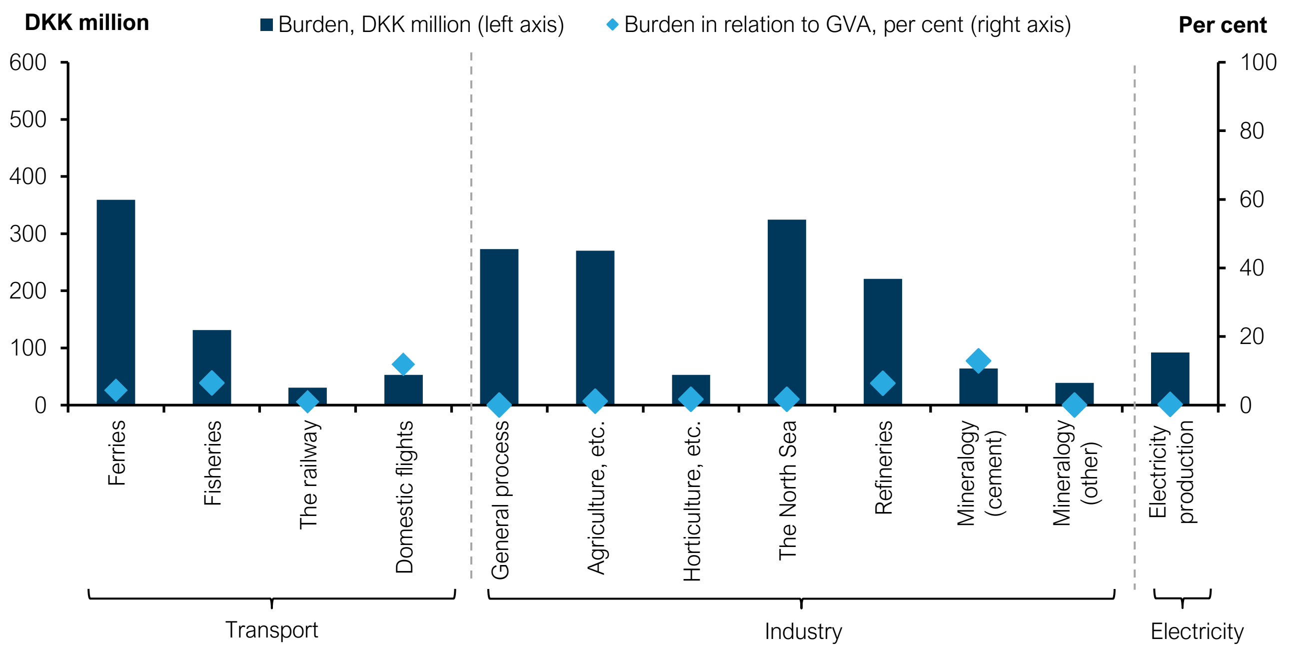
The Expert Group noted that a number of separate initiatives have been launched in the sector to reduce emissions, such as energy efficiency and the development of less climate-damaging productions. However, it is estimated that a significant reduction of emissions from e.g. cement production would require the introduction of CCS. This releases CO_2 emissions allowances that can be sold to companies in other EU countries, which lowers the socio-economic cost of introducing CCS in the ETS sector.

Figure 2.10. Model 2 - structural and technical effects on emissions



Note: See Figure 2.7
Source: Own calculations.

Figure 2.11. Model 2 - Burden on business after adjustment in DKK million and in relation to GVA



Note: See Figure 2.8.
Source: Own calculations

There are various alternatives to reduce leakage and achieve the reductions anyway

There are different alternatives to reduce leakage and achieve the same level of reduction. Instead of using subsidies for CCS as an additional reduction measure, the other tax rates could simply be increased. Alternatively, a basic deduction could be introduced to reduce the risk of leakage, thereby preserving the higher taxes on mineralogical processes as well. However, these routes have been rejected. The following section first discusses subsidies for CCS and then elaborates on the rejected alternatives.

Subsidy for CCS

In model 1, for example, biogas plants are expected to use CCS

In model 1, it is expected that the subsidy for negative emissions ("negative tax") may provide sufficient incentive for e.g. a number of biogas plants to adopt CCS technology, as CO_2 is already emitted by upgrading raw biogas to natural gas quality, reducing the costs of capture and storage in this area.

However, it requires additional subsidies for large fossil sources

However, for large fossil point sources within the industry, it is estimated that the CO_2 tax in question is not in itself sufficient to ensure the introduction of CCS, as the costs of CCS technology are higher than the tax savings. Even if the tax is set sufficiently high, companies exposed to competition will not be able to bear the cost. Therefore, subsidies for CCS are deemed necessary to bring the technology into play in this area.

Companies in mineralogical processes, etc. are expected to benefit from the subsidy

CCS can achieve significant reductions from CO_2-intensive industries with less risk of production downtime because emissions are captured and stored. As CCS technology is mainly applied to larger point sources and with the higher emissions allowance price, mineralogical processes etc., including cement production, are expected to benefit from the subsidy.

A potential disadvantage of a targeted subsidy for CCS is that other competitive and cheaper technologies in the industry are less likely to be deployed. In industry, however, CCS is expected to be used mainly in areas where a high tax would simply limit production. Furthermore, it must be expected that a very large part of the subsidy pool goes to individual companies. This will have to be taken into account in the pool design, for example, through a so-called *open book negotiation*, where the winner presents their financial prerequisites for the project to reduce the risk of overcompensation.

A potential disadvantage is that other technologies are brought less into play

And that large parts of the pool go to a few companies

In addition, CCS is still an untested technology on a large scale in Denmark. The allocation of any funds for CCS will need to be considered in relation to existing funds for CCS in terms of impacts and cost developments, etc., and may need to ensure some risk sharing between the state and beneficiaries. In calculating the impact of the CCS subsidy, it is assumed that the subsidy pool is added to the pool already allocated to this technology.

At the same time, CCS remains an untested technology on a large scale

It should be noted that under state aid law there may be restrictions on the maximum proportion of aid for construction costs, which is not taken into account in the model. The combination of subsidies for CCS and rebates for mineralogical processes, etc. would have to be designed in accordance with the state aid rules.

The subsidy must be designed in accordance with the state aid rules

An alternative: higher CO_2 taxes for some sectors

The tax relief for mineralogical processes etc. leads to lower CO_2 reductions in 2030, all other things being equal. As an alternative instrument to increase reductions, the Expert Group examined the impact of increasing CO_2 tax rates for the remaining sectors to achieve similar reductions as in model 1.

As an alternative to the subsidy, tax rates in other areas can be increased

Since mineralogical processes, etc. account for such a large share of the reductions in model 1, this requires significant increases in the CO_2 tax for the other sectors or further reductions from the negative tax. The exact level depends on whether the rate of the subsidy for negative emissions follows the rate in the non-ETS sector, as in model 1. Raising the subsidy rate accordingly is estimated to require a tax of DKK 825 per tonne of CO_2 in the non-ETS sector and a tax of DKK 450 per tonne of CO_2 in the ETS sector. A large part of the additional reductions will come from the subsidy for negative emissions.

If the subsidy rate is increased accordingly, the tax must be increased by DKK 75 per tonne

If, on the other hand, the maximum subsidy rate is maintained at DKK 750 per tonne of CO_2, the taxes would have to be raised to DKK 975 per tonne of CO_2 in the non-ETS sector and DKK 600 per tonne of CO_2 in the ETS sector, corresponding to a total CO_2 price (tax plus emissions allowance price) of DKK 1,350 per tonne in the ETS sector. The higher taxes will increase the immediate burden on businesses to DKK 3.3 billion.

With a fixed subsidy rate, the charges must be increased by DKK 225 per tonne

The disadvantage of raising CO_2 tax rates is that a larger share of the total CO_2 reduction comes from changes in the size of different sectors with the resulting risk of leakage rather than through technical reductions. This reflects the fact that subsidies for CCS are a very targeted instrument to ensure technical reductions. In addition, it may ensure reductions in mineralogical processes, etc., which may be cheaper than the additional reductions achieved by a higher tax rate.

Higher rates will therefore lead to greater changes in the size of different sectors in relation to the subsidy

Another alternative: Basic deduction

A possible alternative is an activity-based basic deduction and higher rates

Another possible alternative to a subsidy for CCS to reduce leakage is to return the tax revenue to companies via an activity-based floor deduction in the CO_2 tax, while the tax rate can be set higher to ensure the same CO_2 reduction.

A basic deduction increases incentives at the margin while keeping the average tax low

An activity-based basic deduction will mean that the incentive for CO_2 reduction is high at the margin (as a result of the CO_2 tax), while the average CO_2 tax burden remains low (as a result of the basic deduction). By linking the deduction with the companies' activity, a lowering of the companies' marginal costs is achieved, which counteracts the cost-driving effect of the CO_2 tax.

This can provide greater incentive for technical reductions

A tax system with a CO_2 tax and an activity-dependent basic deduction will provide a greater incentive for (technical) CO_2 reductions than a similarly simpler system with a lower CO_2 tax and no basic deduction, if the immediate tax payment is the same. This is because the marginal tax in the system with basic deductions will be higher, which gives a greater incentive to lower CO_2 emissions per produced unit. Therefore, there are arguments that a system with a high marginal CO_2 tax and a basic deduction provides greater CO_2 reductions for a given impact on the business structure than a simple system without a basic deduction.

In practice, however, it is difficult to set up and can create inappropriate distortions and implementation challenges

However, setting up an activity-based basic deduction to work entirely according to the theoretical principles is challenging in practice. If a basic deduction is to have an effect on relocation and business structure, it must be conditional on business activity being maintained in Denmark. The deduction can, for example, be linked to companies' physical production or added value. Depending on the target of production on which the basic deduction is based, it will create incentives to increase this activity. This is partly intentional, as the purpose of an activity-based basic deduction is precisely to increase activity and thus counteract structural reductions in the economy. In addition, it will also, however, provide an incentive to distort production so that a given company obtains additional payment of basic deductions. These inappropriate distortions of companies' behaviour will, among other things, increase the socio-economic costs, *see Section 4.5.2*.

In addition, there are administrative challenges in introducing an activity-based basic deduction. A calculation of the basic deduction linked to the physical production of the good(s) produced by the companies (measured e.g. in number, kg, litres) would in practice be costly and difficult to implement administratively, especially if the deduction is granted to more than a few companies. A manageable system would therefore need to be designed so that the subsidy is given on a more easily observable basis, e.g. the value added of businesses as measured by the VAT accounts. However, the cost of such a simpler measurable concept is that there is no one-to-one relationship between marginal cost and value added.

In Chapter 4, models with a basic deduction show that the gains are limited, even without taking into account possible distortions and administration

In Section 4.5.3 of the report, tax models with activity-based basic deductions and reduced tax rates have been calculated. These calculations confirm the theoretical result that a bottom-up model lowers structural business effects and increases technical reductions. However, the calculations also indicate that the quantitative gains are limited compared to reduced tax rates and subsidies for CCS. To this should be added the administrative difficulties and distortions in business behaviour by introducing a basic deduction in practice, which are not captured in the model results.

Therefore, the Expert Group does not recommend a model with basic deduction either

The calculations thus indicate that a basic deduction is not necessarily a more socio-economically optimal and effective method of reducing leakage risk for the most

CO_2 intensive and competitive companies than relaxed tax rates and subsidies for CCS. The Expert Group has therefore considered that this argues in favour of not introducing a system of activity-based basic deductions.

Conclusion regarding model 2

Combination of lower rate and subsidy pool reduces leakage risk for large emitters

The Expert Group's analysis shows that combining a reduced CO_2 tax rate for mineralogical processes, etc., and subsidies for CCS can significantly substitute CO_2 reductions from changes in the size of different sectors with technical reductions. Since changes in the size of different sectors will often result in leakage, such an arrangement of the tax system will limit the risk of leakage considerably. Tax models where the subsidy for CCS is replaced by a higher CO_2 tax on areas other than mineralogical processes, etc., or by activity-based basic deductions, will not ensure a significantly larger shift from changes in the size of different sectors to technical CO_2 reductions. In addition, they risk entailing a number of inadequacies and implementation challenges.

However, this results in higher socio-economic costs

However, model 2 has a significantly higher socio-economic cost than model 1, and there is no revenue to relieve general taxes. This is the price of lowering the risk of leakage for selected industries.

Other industries will also continue to face a high CO_2 tax

There will also still be industries and companies that cannot use CCS technology and therefore do not benefit from the subsidy or the reduced tax rate. They will continue to face such a high cost of the CO_2 tax that in some cases they will be at high risk of production cuts or relocation. To compensate these companies, additional funding is needed, for example to allow tax rates to be reduced either for selected sectors or across the board.

2.3.5 Model 3: Additional management of leakage

Additional subsidies and lower rates can mitigate the effects on the business sector

If significant reductions from covered areas are desired while avoiding large changes in the size of different sectors business with the risk of leakage, additional emphasis on subsidies may be an option. This will ensure more technical reductions, so that a lower CO_2 tax rate can be set with the same level of reductions.

However, it increases the socio-economic costs and requires financing beyond the tax revenue.

Such a solution leads to lower business costs and fewer changes in the size of different sectors, but when reductions are found in a more costly technology, the socio-economic costs increase. In addition, there is the socio-economic cost of securing funding for additional subsidies through higher taxes (which may lead to increased tax distortions) or lower public spending in other areas, which reduces the scope for addressing other societal concerns.

Model 3 uses an additional revenue of DKK 0.5 billion.

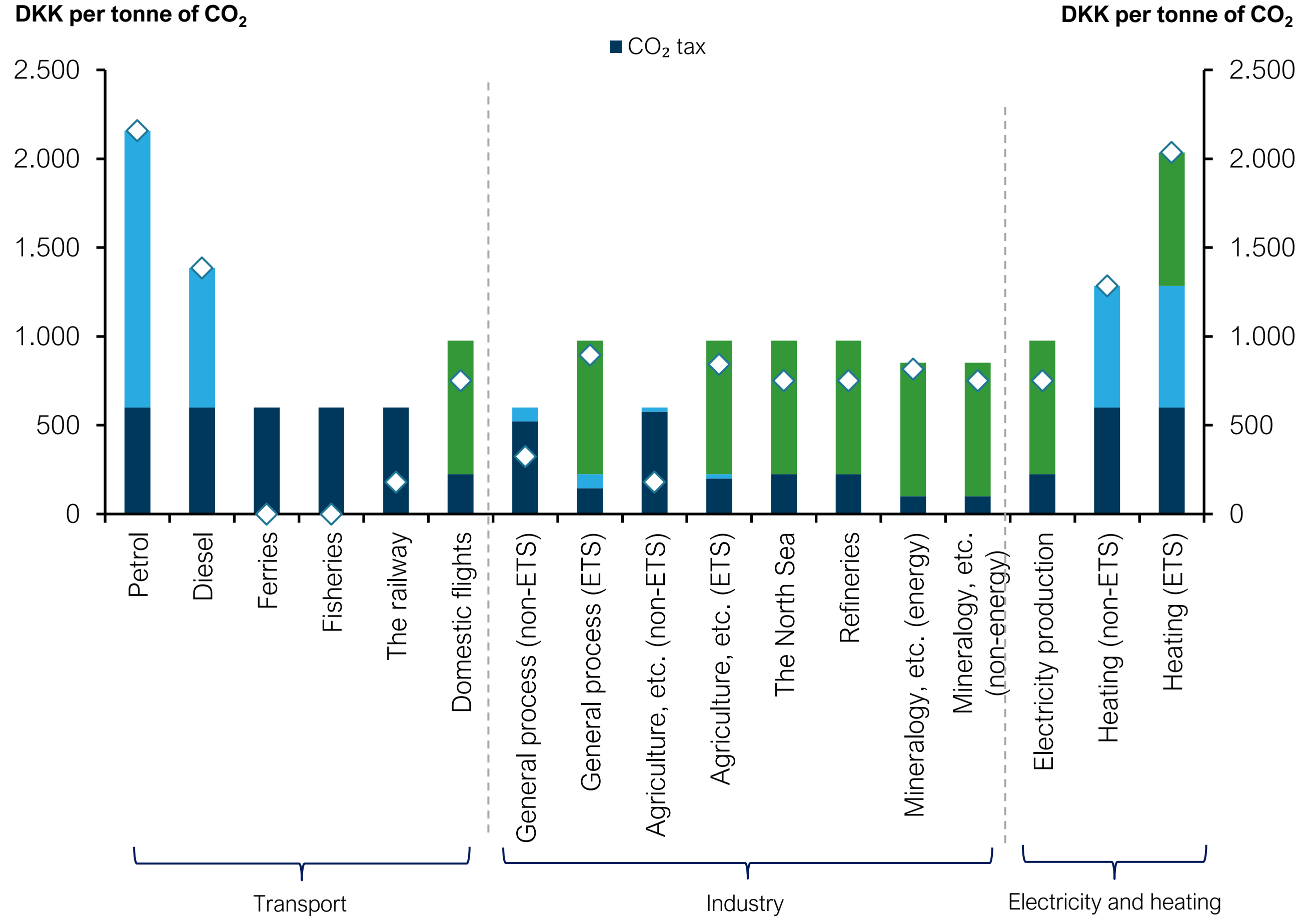
In the following, a model 3 is shown, where in addition to the tax revenue, an additional revenue of DKK 0.5 billion is used for subsidies, which makes it possible to lower the tax rates and still achieve a CO_2 reduction in 2030 of about 3.5 million tonnes. It is assumed for computational purposes that the revenue is raised by an increase of 0.05 percentage points in the state's lowest tax rate.

So, the CO_2 tax can be broadly reduced by DKK 150.

The model is constructed with uniform CO_2 tax rates of DKK 600 per tonne CO_2 for companies outside the ETS sector, DKK 225 for companies within the ETS sector and DKK 100 per tonne CO_2 for mineralogical processes etc.*, see Figure 2.12*. Compared to model 2, the CO_2 tax is broadly reduced by DKK 150 per tonne of CO_2. This means that at the expected emissions allowance price of DKK 750 per tonne of CO_2, most ETS-coveredcompanies will have a total payment from the tax and the emissions allowance price of DKK 975 per tonne of CO_2 in 2030.

The main results for model 3 are shown in *Table 2.5.*

Figure 2.12. Model 3 – rates after restructuring



Note: See Figure 2.6.
Source: Own calculations.

Table 2.5 Main results of model 3

Model 3 - Additional leakage management: DKK 600 / 225 / 100 per tonne (non-ETS/ETS/mineralogical processes etc.), subsidy for CCS

CO_2 reductions		Costs		Macroeconomics	
2025	0.6 million tonnes	Immediate burden on business	DKK 1.6 billion	Cost	DKK 1.8 billion
2030	3.5 million tonnes	Revenue after behavioural response	DKK 1.0 billion	Cost (after financing)	DKK 1.8 billion
Of which negative emissions and CCS subsidies	2.0 million tonnes	Subsidy	DKK 1.4 billion	Avg. shadow price	DKK 500 per tonne
Technical reductions	75 per cent	Revenue after subsidy (before financing via the lowest tax rate)	DKK -0.5 billion	Average shadow price (after financing)	DKK 525 per tonne

Note: See Table 2.1.
Source: Own calculations.

The additional funding is used for higher subsidies and lower taxes

The additional funding is used in the calculations to increase the subsidy for CCS from DKK 1.1 billion in model 2 to DKK 1.4 billion in model 3. The pool increases by only DKK 0.3 billion, as the lower tax rates reduce tax revenues, resulting in a total burden on public finances of DKK 0.5 billion.

The model thus lowers the burden on business and increases the technical share of the reductions

Since an even larger proportion of the reductions are provided via subsidies, the general tax rate can be set lower. The lower rate results in the burden on business falling by approximately DKK 0.7 billion DKK to DKK 1.6 billion, and thus a number of the other very CO_2-intensive companies must be expected to have less risk of a significant decline in production. The technical share of the reductions also increases from 70 per cent to 75 per cent.

The model entails a higher shadow price

The model, on the other hand, implies a further, albeit smaller, increase in the shadow price to DKK 500 per tonne of CO_2 (DKK 525 including financing via the lowest tax rate). The increase in socio-economic costs is thus a result of cheaper reductions from the tax being replaced by more expensive reductions from the subsidy for CCS.

This is the result of the CO_2 taxes being less uniform

The similar incentives from model 1 are now even more distorted in model 3, where the subsidy rate is estimated to be DKK 875 per tonne of CO_2, while the tax rate is DKK 600 per tonne of CO_2. There will therefore be other reduction measures than CCS with costs of between DKK 600 and 875 per tonnes of CO_2 that are not carried out, even if they are cheaper, because the tax is lower than the subsidy. This increases the socio-economic costs, which is the price of avoiding the higher burden on business and structural effects. As it is expected that the cheapest CCS reductions will be secured first, the additional reductions from increasing the pool will also be relatively more expensive.

A large part of the reductions comes from the subsidy

It can also be seen that a very large share of the total reductions is from the subsidy. 2 million tonnes of CO_2 reductions can be attributed to this, part of which can be attributed to the negative tax. In contrast, only about 1.5 million tonnes can be attributed to the tax itself.

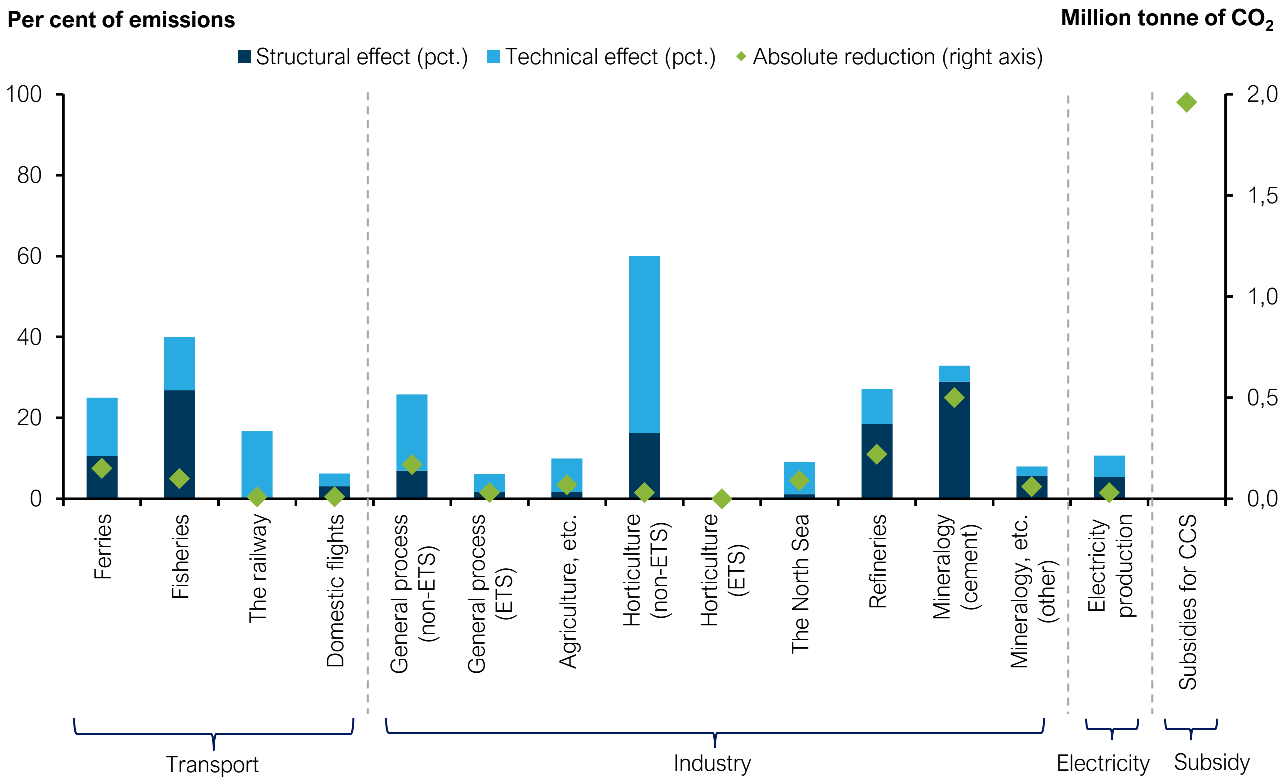
As the subsidy rate in models 2 and 3 is set higher than the tax level, it provides an incentive for CO_2 to be stored (where the incentive is the subsidy) instead of being recycled (where the incentive is the CO_2 tax). The difference between tax and subsidy rates makes the use of CO_2 less attractive, which may have implications for the production of carbon-based Power-to-X fuels, for example. Carbon-containing PtX fuels are considered immediately most relevant in shipping and aviation. They are therefore expected to deliver only limited reductions under the 70 per cent target, as emissions from international shipping and aviation, which make up the bulk, are not covered by the 70 per cent target.

The higher subsidy rate may affect the production of Power-to-X fuels, which are however expected to contribute only marginally to the 70 per cent target

Figure 2.13 illustrates structural and technical effects from each area. It can also be seen that reductions broadly decrease relative to models 1 and 2, while reductions from the CCS subsidy increase.

Figure 2.13 shows the structural and technical effects of the model

Figure 2.13. Model 3 - structural and technical effects on emissions



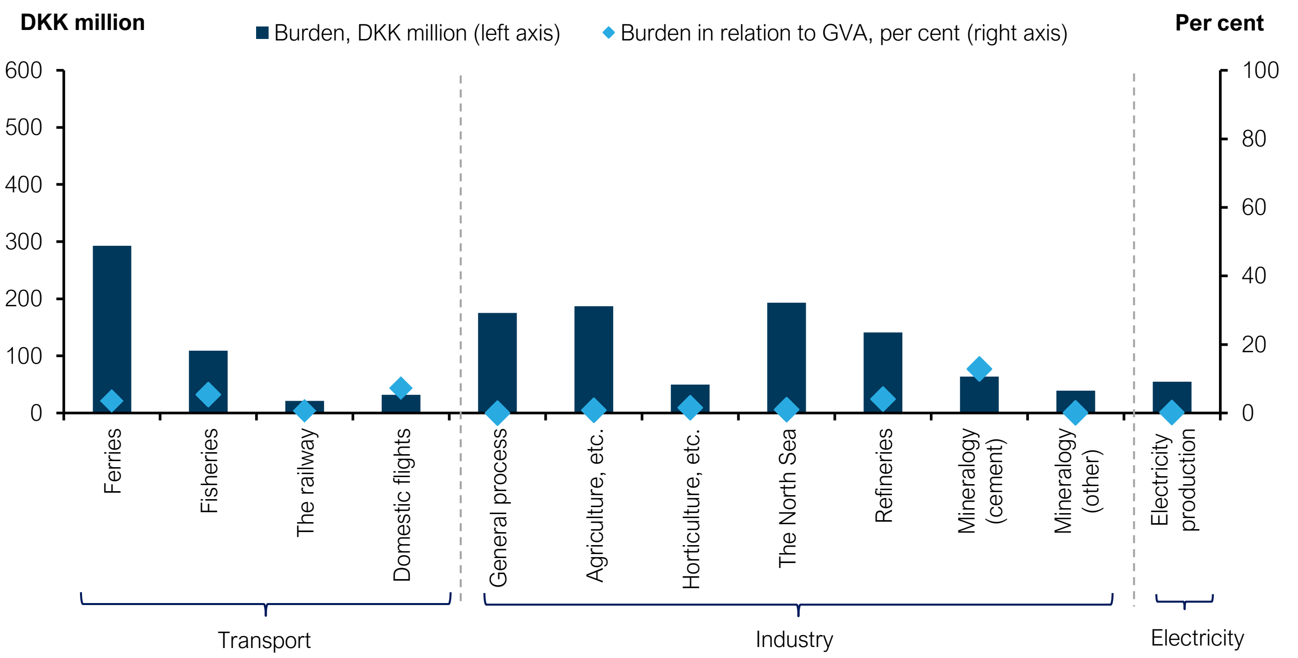
Note: See Figure 2.7.

Source: Own calculations.

The burden on industry is lowered broadly in the model, but some areas are still affected

Figure 2.14 shows that the burden decreases for all sectors except for mineralogical processes, etc., which maintains the CO_2 tax rate of DKK 100 per tonne. There is still a significant load, especially for ferries, fisheries and refineries, but it is lower than in the other models. The burden is also a result of the fact that these industries are completely exempt from taxation today. The breakdown into business categories can continue to cover up the fact that individual companies are hit relatively harder by the tax than what the average figures indicate. These companies will also be less burdened in model 3 than in the other models.

Figure 2.14. Model 3 – Burden on business after adjustment in DKK million and in relation to GVA



Note: See Figure 2.8.
Source: Own calculations.

The additional subsidy is expected to go to biomass and waste plants

CCS is considered relevant for relatively few companies in the industrial sector, so the increase in the CCS pool is expected to be mainly for biomass and waste plants in the heating sector. While other sectors of industry are not estimated to benefit from the subsidy itself, they are significantly less burdened by the lower CO_2 tax rate.

Subsidies can, however, be seen as indirect compensation, as everyone obtains a lower tax

Thus, the provision of a subsidy can indirectly become a broad compensation, as the CO_2 tax rate and thus the burden on business is reduced for all the companies by a given amount of CO_2 reductions.

A model with a basic deduction is not considered to solve the challenge better

The Expert Group has also examined the impact of using the additional approximately DKK 0.5 billion to finance an activity-based basic deduction rather than financing increased subsidies for CCS. Calculations in Section 4.5 of the report indicate that both the structural effects and thus the risk of CO_2 leakage as well as the socio-economic costs will not be significantly lower. This reflects the fact that, with the assumptions made about the costs of this technology, subsidies for CCS ensure a high targeting of technical CO_2 reductions.

However, there is a risk with CCS, which is still an immature technology, but a general pool is considered less appropriate

A risk of model 3 is that it assumes even more extensive reductions via an as-yet immature technology such as CCS. The Expert Group has therefore considered an alternative subsidy model, where part of the funding is paid out from a technology-neutral subsidy pool, where all companies can apply for subsidies for all technologies that are deemed to reduce CO_2 emissions per unit produced. However, it is estimated that a very large part of the subsidy from such a pool would go to CO_2 reductions that would be undertaken anyway to avoid the proposed CO_2 tax, thereby ensuring only limited additional reductions, *see Section 6.2.1.* Due to the risk of subsidy waste and the administrative costs of identifying eligible technologies, the Expert Group has opted out of a general subsidy model.

Conclusion regarding model 3

Model 3 thus reduces the burden on business and structural effects

Model 3 with reduced rates and additional funding of subsidies for CCS results in a lower burden on business and thus less leakage risk more broadly in the business sector compared to models 1 and 2. The additional funding allows the same CO_2 reductions to be achieved with lower tax rates and a higher subsidy, and ensures that a larger share of the reductions comes from technical measures that do not reduce domestic production.

However, offers higher shadow price and requires external funding

The cost of this is a higher shadow price on CO_2 reductions, as the additional subsidies must be assumed to finance reductions that are on average more expensive than the marginal reductions in model 2. In addition, the model is no longer revenue neutral, and just like in model 2, there is no revenue to compensate in general. At the same time, a large part of the reductions will depend on a still immature technology whose future costs are uncertain.

2.3.6 A closer comparison of the three tax models

The three models show the central dilemmas

The three tax models illustrate the clear dilemmas for the design of the tax system, including the changes that occur by moving from a uniform tax in model 1 to models 2 and 3, where a larger share of reductions is provided through subsidies.

The socio-economic costs increase from model 1 to 3

Firstly, the socio-economic costs increase. Model 1 has an average shadow price before compensation of DKK 350 per tonne of CO_2 (DKK 250 per tonne after compensation), which increases to DKK 500 per tonne of CO_2 and DKK 525 per tonne (after financing) in models 2 and 3, respectively. This reflects the fact that a more uniform CO_2 tax ensures the cheapest reductions in socio-economic terms, while subsidies are instead given to some less cost-effective reductions.

Conversely, the burden on business decreases

Secondly, the burden on business decreases from model 1 to model 3. When a larger share of the reductions is achieved through subsidies, a lower tax burden on industry is possible, which is reflected in the immediate burden on business. While it is DKK 2.8 billion in model 1, it is reduced to DKK 1.6 billion in model 3.

And the technical part of the reductions increases

Thirdly, the share of technical reductions increases. It is also a direct result of the fact that the subsidy (which in itself provides technical reductions) contributes a larger share, thus crowding out part of the structural effects of the CO_2 tax.

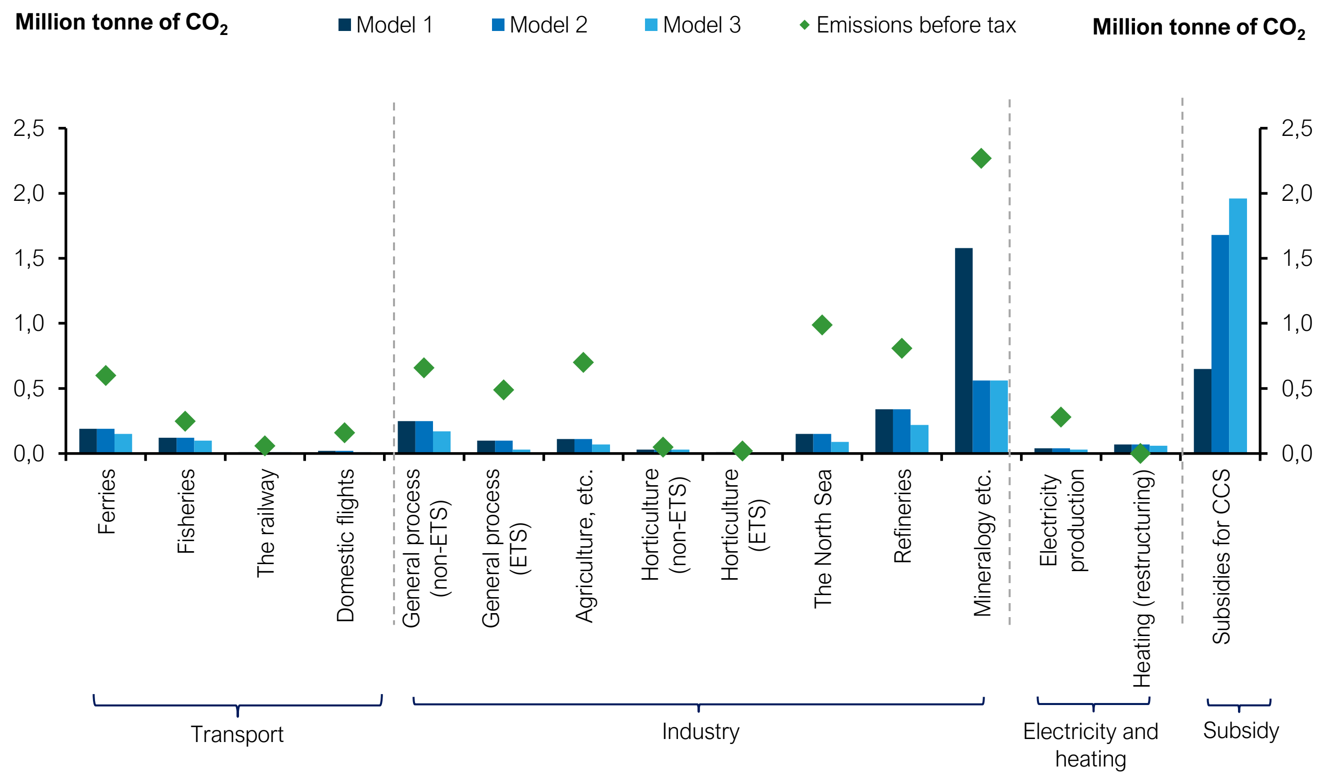
However, the revenue decreases and creates a need for financing in model 3

Fourthly, the tax revenue decreases. While the revenue for reversal in model 1 is DKK 0.8 billion, it is instead turned into a need for financing in model 3 of about DKK 0.5 billion.

Effects at sector level illustrate the same points

The comparison of CO_2 impacts at sector level in *Figure 2.15* also illustrates these points. For mineralogical processes, etc., it is particularly clear that the contribution decreases from model 1 to 2 when possible CCS reductions from this sector are not taken into account. There is no further decrease in emissions from mineralogical processes when moving to model 3, as the rate is maintained. For the other sectors, the burden and thus the reductions are unchanged from model 1 to 2, but generally decrease in model 3.

Figure 2.15. Comparison of the three models – CO_2 reductions and initial emissions



Note: The green diamonds cover the tax category base, i.e. the initial emissions in 2030 before the introduction of the new taxes and subsidies, while the bars cover the reductions in the different models.
Source: Own calculations.

Table 2.6 shows more detailed economic consequences of the three tax models. Common to all models is that the economic consequences are greatest on the North Sea, refineries, cement production, fisheries and ferries. *Box 2.4* describes how the burden on business is calculated.

In all models, the areas with the highest burden on business are the same

Table 2.6. Comparison of the three models – burden of business excluding compensation

2030	Model 1 / model 2			Model 3		
	Burden	*Burden per person employed*	*Burden in relation to GVA*	*Burden*	*Burden per person employed*	*Burden in relation to GVA*
	DKK million	*DKK per person employed*	*Percentage*	*DKK million*	*DKK per person employed*	*Percentage*
Transportation						
Ferries	350	123,800	4.3	300	100,900	3.5
Fisheries	150	53,700	6.5	100	44,500	5.4
Railway	50	4,400	0.9	0	3,000	0.6
Domestic flights	50	141,000	11.8	50	86,000	7.2
Industry						
General process						
- Food, beverage and tobacco industry	*50*	*1,200*	*0.2*	*50*	*500*	*0.1*
- Chemical industry	*50*	*3,200*	*0.2*	*0*	*1,800*	*0.1*
- Plastics, paper and metal industry	*50*	*400*	*0.1*	*0*	*200*	*0.0*
- Construction	*150*	*700*	*0.1*	*100*	*600*	*0.1*
- Other industry	*0*	*0*	*0.0*	*0*	*0*	*0.0*
Agriculture, etc.	250	4,200	1.2	200	2,900	0.8
Horticulture	50	14,600	1.7	50	13,600	1.6
North Sea	300	71,400	1.7	200	42,500	1.0
Refineries	200	452,500	6.4	150	289,700	4.1
Mineralogical processes, etc.	350 (100)	24,800 (7,300)	3.1 (0.9)	100	7,300	0.9
- of which cement	*150 (50)*	*487,100 (188,700)*	*33.3 (12.9)*	*50*	*188,700*	*12.9*
Electricity and heating						
Electricity production	100	4,400	0.3	50	2,600	0.2
Total	2,150 (1,900)	1,100 (1,000)	0.2 (0.1)	1,350	700	0.1

Note: The business economic costs are calculated after adjustment, i.e. after industries have adapted their production to the new tax levels. Thus, the burden will consist of the tax burden on industries for their new production and the conversion costs that industries have incurred to switch their production. The burden is rounded to the nearest DKK 50 million and the burden per employee to the nearest DKK 100 per employee. Totals may differ from the sum of individual sectors due to rounding. The consequences of model 2 are shown in brackets for mineralogical processes, etc. For the other sectors, the economic consequences are the same between models 1 and 2. Number of employees and GVA are 2019 figures and based on Statistics Denmark's (DST) national accounts. For the transport industries (excluding fishing), it has not been possible to base the number of employees and GVA directly on the national accounts, and the figures for these industries must therefore be interpreted with extra caution. For "Railway", this is due to the fact that the national accounts include trains as a part of the larger industry "Land transport". Employment in "Railway" is therefore based on table RAS309 from DST, where employment is equal to the sum of industries "491000 Passenger rail transport, interurban", "492000 Freight rail transport" and "493120 S-train services, metro and other short-distance railway services". The GVA in "Railway" is calculated as the total GVA in "Land transport" multiplied by the employment share of the three above-mentioned railway industries in the total employment of the land transport industries in RAS309 (industry codes 491000-495000). For "Ferries" and "Domestic flights", it is not possible to distinguish between domestic and international transport in the national accounts and in RAS309. In order to calculate employment for domestic maritime and aviation, tables SKIB31, SKIB32, FLYV32 and FLYV41 have therefore been used to calculate the share of domestic maritime and aviation for respectively freight

and passenger transport, and these shares are times the employment figures for freight and passenger transport for sea and aviation in RAS309. The share of national navigation from ferries in passenger transport is based on the share of cars on domestic and international ferry routes respectively. The employment shares for domestic maritime and aviation are also used to estimate the GVA for domestic maritime and aviation. In order to distribute the CO_2 base from the tax bases at the industry level, it is computationally assumed that the CO_2 base from the tax base "mineralogical processes etc." only comes from the national accounts industries (69 grouping) "paper industry", "printing industry, etc.", "plastic and rubber industry", "glass and concrete industry", "production of metal", "metal goods industry" and "repair and installation of machinery and equipment". The CO_2 basis from the "general process" tax base is assumed to come solely from the other industrial sectors and the "construction" sector. For the remaining tax bases, there is a 1-to-1 relationship with one of the industries above. The CO_2 basis for "general process" is specifically allocated to these sectors based on national accounts data for GreenREFORM, where a distinction can be made between ETS-coveredand non-ETS-coveredCO_2 emissions at industry level. The same data has been used to calculate the current tax rates for the industries covered by the emissions from the "general process".*It is not possible to estimate the transport industry due to a lack of data.
Source: Own calculations.

Box 2.4

Burden on business

The business economic consequences describe the cost incurred by the taxed industries as a result of the CO2 tax increases.

The business economic costs are calculated after adjustment, i.e. after industries have adapted their production to the new tax levels. The burden after adjustment thus consists of the tax burden that the industries have for their new production and the costs that industries have incurred in converting their production.

Analysis of burden shows that a few selected industries account for half of the burden in model 1

In model 1, the burden for the North Sea and cement production is DKK 300 million and DKK 150 million respectively in 2030, while the burden is DKK 350 million for ferries and DKK 200 million for refineries. These sectors thus account for almost half of the total burden, as they experience the largest tax increase compared to the starting point and are among the most emitting sectors. The high burden also means that these industries in particular have the highest burdens per person employed and relative to GVA, which is particularly the case for cement production, refineries and ferries.

Mineralogy is less burdened in model 2 and other areas are less burdened in model 3

For model 3, the overall conclusions are the same, but the burden is generally at a lower level. Mineralogical processes, etc. are significantly less burdened due to the reduced CO_2 tax rate in models 2 and 3, while both refineries and ferries are less burdened due to the general CO_2 tax reduction in model 3. These sectors continue to be hit harder than most other industries.

A number of sector-specific indicators can also be looked at

The burden on different sectors can also be illustrated by a number of sector-specific indicators. The sector-specific indicators are detailed in *Box 2.5* and presented in *Table 2.7.*

Box 2.5

Sector-specific indicators

The economic consequences, including employment and GVA, can be used as an indication of how much sectors are burdened by a CO_2 tax relative to their contribution to the Danish economy. Alternatively, the burden can be illustrated by a number of sector-specific indicators, which can give a clearer indication of how much the sectors are actually burdened.

It should be stressed that the results should be interpreted for illustrative purposes only. The calculations below should also be seen in the light of the fact that for some sectors – such as horticulture – there is a wide variation in size, which can lead to inappropriate averaging.

There will be a number of secondary impacts as well as an expected geographical impact. The fishing industry, for example, is located in coastal areas. The same applies to national navigation.

Table 2.7. Selected illustrative business economic consequences in selected industries

Sector	Business economic indicator	Model 1 and 2	Model 3	Unit
Agriculture, etc.	Avg. burden per holding	9,500	6,500	DKK per holding
Horticulture	Avg. burden per holding	52,500	47,000	DKK per holding
Fisheries	Avg. burden per commercial fisherman	245,000	205,000	DKK per commercial fisherman
Ferries	Increase in ticket price	30	24	DKK per passenger
Domestic flights	Increase in ticket price	28	16	DKK per passenger

Note: The results are illustrative and calculated by adding the immediate tax burden to the holding, the fishing boat or the ticket price. The results should not be interpreted as expected effects of a CO_2 tax.
Source: Own calculations based on Statistics Denmark (JORD1, FIREGN1, SKIB31 and FLYV32).

2.4 Distributional and employment effects of a CO_2 tax

The calculation principles of the ministries are used for the distributional effects

This section describes the distributional effects of the presented models. This should be seen in the light of the fact that the Climate Act and the terms of reference state that meeting the 70 per cent target must take into account, among other things, the social balance in society. The estimated distributional effects reflect the usual calculation principles of the ministries and the distributional effects shown are assumed to be in the slightly longer term, i.e. after an adjustment.

The CO_2 tax is immediately borne by companies, but will ultimately always be borne by households

The distributional effects of a tax or charge do not necessarily reflect the formal tax payment. A CO_2 tax for industry will immediately fall on the companies, but companies cannot bear the burden of a tax on their own. The burden will always be borne by households as either wage earners, consumers or business owners. This will be done through lower wages, higher consumer prices or reduced returns for business owners - or a combination of these.

An increase in the CO_2 tax is primarily assessed to be reflected in lower private wages

The computation assumes that an increase in the CO_2 tax for industry will eventually have a spillover effect on households through lower wages in the private sector. This is because most of the industry is exposed to international competition and, therefore, only has a limited opportunity to pass on the CO_2 tax in product prices or profits, as investors will otherwise move their investments.

Which will result in a generally lower wage level across society

A spillover effect on lower wages will first affect the employees in the affected sectors. Some of these will move to other occupations, creating downward pressure on wages in sectors that are less or not at all affected by the CO_2 tax. The general salary level for the private sector will be reduced over time and have a corresponding knock-on effect on salaries in the public sector, which are adjusted to the salary level in the private sector, as well as on the wage rate-adjusted transfers.

Therefore, no significant effects on income disparity are estimated

The increase in the CO_2 tax in the areas concerned is not estimated to have a significant impact on income disparity as measured by the Gini coefficient, according to the calculation principles used by the ministries, *see Table 2.8*.[13]

If the tax is passed on in prices, households that consume CO_2-intensive products will be burdened

Alternatively, if the tax burden is passed on in higher consumer prices, it will burden households that consume CO_2-intensive products. This is also expected to be spread relatively broadly across the income distribution but will weigh more heavily on households at the bottom of the income distribution due to a higher propensity to consume.

For selected sectors, parts of the tax will have a spillover effect onto the company's profits

The assumptions are generally considered reasonable, but there may be particularly CO_2-intensive sectors, e.g. mineralogical processes, etc. and the refineries, where not all tax payments can have a spillover effect of lower wages. In the shorter term, part of the increased tax payment may have a spillover effect on companies' profits, but in the longer term the overall effect on companies' returns will be negligible.

Table 2.8. Impact on income disparities of model 1

		Model 1[1)]	Corporate tax -0.6 percentage points	Electricity tax -11 øre per kWh	Model 1 incl. corporate tax	Model 1 incl. electricity tax
Immediate burden	*DKK billion*	2.6	-1.5	-1.3[2)]	1.0	1.3
Revenue after behavioural response	*DKK billion*	0.8	-0.8	-0.7	0	0
Gini coefficient	*Percentage points*	0.00	0.00	-0.02[3)]	0.00	-0.02[3)]

Note: Revenue effects are rounded to DKK 50 million. The indicated impact on income inequality measured by the Gini coefficient is calculated under the assumption of a full spillover effect on wages. Reservations are made for distributional effects especially linked to agriculture, mineralogical processes, etc. and the North Sea.
Note 1: The immediate burden from the increase in CO_2 tax amounts to DKK 2.8 billion, while restructuring the space heating tax results in a reduction of the immediate burden of approximately DKK 270 million. Subsidies for negative emissions also amount to DKK -410 million of the income effect after static effects and behavioural response.
Note 2: Immediate revenue effect incl. VAT excl. electricity tax on public consumption.
Note 3: Electricity tax is not included in the calculation of disposable income and thus does not directly affect income disparities. The shown effect on the Gini coefficient thus reflects an equivalent change in disposable income.
Source: Own calculations.

A corporate tax cut will lead to higher overall wages

The additional revenue from the CO_2 tax is computed via a reduction in the corporate tax rate of approximately 0.6 percentage points. A general reduction in the corporate tax rate is also assumed to have a spillover effect over time via a higher general wage level, thus not significantly affecting income disparity as measured by the Gini coefficient, *see also Figure 2.16*.

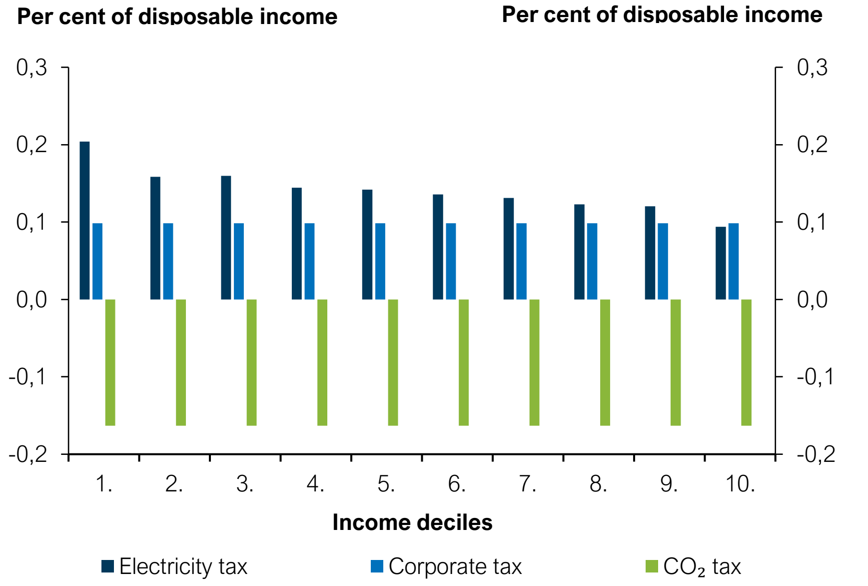
While a reduction in the electricity tax will reduce real income differences

By comparison, a reduction in the general electricity tax leads to a relatively larger equivalent increase in disposable income for people with relatively low incomes than

[13] Income disparities are calculated according to the calculation principles of the ministries based on current disposable incomes and are, therefore, not affected in principle by any changes in consumer prices. The distributional effect of price changes, etc., is therefore instead calculated as a so-called equivalent change in income, which has the same distributional profile as the impact on households' current purchasing power. The calculation of the distributional effect as equivalent changes in the income differences is further documented in *Skatteøkonomisk Redegørelse 2021, Chapter 4.*

for people with relatively high incomes. A reduction in the electricity tax is thus estimated to lead to an equivalent reduction in income disparity as measured by the Gini coefficient of around 0.02 percentage points.

Figure 2.16. Impact of model 1 in per cent of disposable income



Note: Impact in per cent of disposable income of model 1 for an increase in the CO_2 tax for businesses, a reduction in the corporate tax rate by approximately 0.6 percentage points and a reduction in the general electricity tax by approximately 11 øre/kWh in 2030. Income deciles are calculated on the basis of family equivalent incomes in 2018.
Source: Own calculations

Labour supply and conversion effects of a CO_2 tax

This section describes the labour supply and labour market transition effects of the tax models presented.

All models are estimated to have a very small effect on labour supply

The CO_2 tax in the models is estimated in isolation to cause a modest reduction in the labour supply[14]. In contrast, the corporate tax cut in model 1 is expected to lead to a modest increase in labour supply, which overall makes the labour supply effects in the model very small and close to zero. Model 3 includes an increase in the lowest tax rate, which is estimated to cause a minor reduction in the labour supply. All three models are therefore estimated to have a very small effect on labour supply.

However, the CO_2 tax will lead to a minor adjustment and change in the industrial structure

In the long term, a higher CO_2 tax will not reduce employment to any significant extent, but will lead to a minor restructuring of employment. Conversion effects on the labour market occur when the business structure changes in the industry. This happens partly through CO_2-intensive companies downscaling or completely closing their production, whereby the workforce moves to less CO_2-intensive companies, and partly through CO_2-intensive companies spilling over the CO_2 tax through lower wages, with the result that some of the employees in the companies concerned will move to other professions.

[14] The labour supply effect is assumed, in view of the estimated distributional effects, to be estimated on the basis of an equivalent increase in the corporate tax rate.

The increase in the CO_2 tax is estimated in Model 1 to rearrange a total of 4,000 people in the medium term (corresponding to 4-5 years), which corresponds to about 0.7 per cent of employment in the affected industries, *see Table 2.9*. For models 2 and 3, the number of people rearranged is in the order of 3,200 and 2,300, respectively, corresponding to 0.5 and 0.4 per cent of employment in the sectors concerned.

The increase in CO_2 tax results in less than one percent in the affected industries changing jobs

The conversion effects shown should be interpreted as gross figures, i.e., the figures describe the total number of people who change jobs over time due to the increase in the CO_2 tax. As the workforce continuously finds new employment in less CO_2-intensive companies, the real drop in employment will be significantly lower than the conversion effect in individual years. Over time, the decline in employment corresponds to the limited reductions in the labour supply, which is estimated to be close to 0 and a maximum of 300 people. Overall, each of the models results in less than one per cent of employment in the affected industries changing jobs due to the increase in the CO_2 tax, *see Table 2.9*.

Figures should be interpreted as gross figures, and employment is affected significantly less within the individual

Table 2.9. Conversion effects on the labour market for selected industries

		Model 1		Model 2		Model 3	
	Number employed	Change	Percentage	Change	Percentage	Change	Percentage
Agriculture and fishing industry, etc.	70,800	-1,000	-1.5	-1,000	-1.5	-800	-1.1
Utilities	26,300	-500	-1.8	-500	-1.8	-300	-1.0
Mineralogy, etc.	14,100	-1,000	-7.2	-200	-1.4	-200	-1.4
Other industry	478,700	-1,000	-0.2	-1,000	-0.2	-600	-0.1
Domestic transport	10,200	-500	-4.5	-500	-4.5	-400	-3.4
Total	600,100	-4,000	-0.7	-3,200	-0.5	-2,300	-0.4

Note: Employment figures are rounded to the nearest 100 persons. The adustment effects are calculated based on the same method as the structural effects for CO_2 emissions, as described in the report's documentation note. I.e. for most industries, the conversion effects are calculated by multiplying initial employment by (tax burden/VAT)*-2, *see Section 1.3.3 of the documentation note* (the documentation note uses GDP rather than GVA, but for employment effects, GVA is used due to lack of data for GDP. GVA and GDP are broadly similar for most industries). Data and corrections for separating domestic transport from international transport are based on the same sources and assumptions as described in Table 2.6. In contrast to Table 2.6, the 20 largest ETS-registered emitters in industry are taken out of their respective national accounts industry, and the conversion effects for these 20 companies are calculated using the same approach as for the sectors. Data for employment and GVA in the 20 companies are based on their annual accounts for 2019. *Agriculture and fishing industry, etc.* cover the sectors of *agriculture, etc.*, *horticulture* and *fishery*. Utilities cover the *North Sea*, *refineries* and *electricity production* industries. *Mineralogy, etc.* covers the national accounts industry *Glass and concrete industry*, which is assumed to account for the total emissions from mineralogical processes, etc. *Other industry* covers the other industrial sectors in the national accounts, which are assumed to account for total emissions from general process. Domestic transport covers the *ferries* , *railways* and *domestic aircraft* industries.
Source: Own calculations

In general, there is considerable uncertainty about the magnitude of the conversion effects, but the short-term employment effects are estimated to be small. The above is well in line with studies by the Danish Economic Councils, which find similar orders of magnitude for the conversion effects in their model setup, *see Section 3 of the report's documentation note*.

The Danish Economic Councils finds similar conversion effects

2.5 Implementability

In developing the models, the Expert Group has placed great emphasis on the administrative and legal feasibility of implementing the models in time to meet the reduction targets in 2025 and 2030. It is expected that the models can meet this requirement, as system adjustments and changes in administration are considered to be possible in the current tax system. However, state aid approval of the models for the overall tax and subsidy system, including compensatory measures, will be needed.

Overall, the models are considered to be implementable

The Expert Group also notes that future changes in EU climate and energy regulation, including in particular the proposals included in the "Fit for 55" package, may have a significant impact on the achievement of national climate targets and national climate and energy regulation, *see Section 5.3*.

However, they must be considered in the light of future EU regulation

2.6 Recommendations of the Expert Group

The Expert Group's primary recommendation in this report is to introduce a CO_2 tax model that ensures a total reduction of approximately 3.5 million tonnes in the parts of the economy covered by the analysis above.

The Expert Group recommends a reduction of approximately 3.5 million tonnes of CO_2 in 2030

The expert group sees a reduction of this magnitude as necessary to achieve the Climate Act's target of a 70 per cent reduction by 2030. Together with the expected contribution from the agricultural reduction target and the expected effects of a higher emissions allowance price, the Expert Group's proposal is estimated to close the reduction gap in 2030.

The reduction is seen as necessary to reach the 70 per cent target

The rationale for this recommendation is that CO_2 reductions achieved in whole or in part through the tax instrument are cheaper in socio-economic terms than reductions achieved solely through subsidies or direct regulation. This is because a CO_2 tax encourages the use of information about reduction opportunities that the authorities do not have.

The tax instrument ensures cheaper reductions than other regulation

Three tax models are described above, all of which are estimated to deliver CO_2 reductions in the order of magnitude recommended. The models have been selected because they clearly illustrate the need for a political trade-off between the guiding principles of the Climate Act and the terms of reference.

The models illustrate the need for policy trade-offs

Basically, a trade-off has to be made between CO_2 reductions achieved through shifts of business activity from high CO_2 intensity to companies with low CO_2 intensity and reductions achieved through technical reductions of the CO_2 intensity of individual companies.

In particular, between changes in the size of different sectors and the costs of increasing technical reductions

The Expert Group's analysis clearly indicates that the cheapest reductions in socio-economic terms are achieved through a uniform CO_2 tax, but that a uniform CO_2 tax that ensures the recommended overall reduction will lead to significant changes in the size of different sectors.

The cheapest reductions with a uniform tax lead to significant changes in the size of different sectors

As a result, a large share of CO_2-intensive production will move abroad, and the adaptation costs of meeting Danish climate targets will be concentrated in a few sectors. If you want to avoid this, you can work with a reduced CO_2 tax rate for particularly CO_2-intensive and competitive industries combined with subsidies for technical conversion of production, for example via CCS*, see models 2 and 3*. This achieves a shift from reductions achieved through changes in the size of different sectors to technical reductions, but the cost of this is a significantly higher socio-economic shadow price per tonne of CO_2 reduction.

To avoid production moving abroad, a reduced rate and subsidies for technical conversion can be used

The Expert Group's analysis indicates that using the tax revenue for a CO_2 tax rebate does not solve this problem better overall than reduced rates and subsidies. This reflects the fact that the subsidy for CCS is a very targeted instrument to achieve technical CO_2 reductions. In addition, there are a number of implementation challenges with both a general and a targeted basic deduction.

The problem is not better solved by a basic deduction

Subject to the great uncertainty associated with that type of calculation, the Expert Group's various tax models suggest the magnitude of the political dilemma.

The models can suggest the size of the political dilemma

By choosing model 2 over model 1, you increase the proportion of technical CO_2 reductions by approximately 23 percentage points corresponding to just under 0.9 million tonnes. On the other hand, the total socio-economic cost increases from about DKK 0.9 billion (after reversal via corporate tax) to about DKK 1.8 billion, corresponding to a socio-economic cost of just under DKK 1,000 (DKK 550 excluding reversal via corporate tax) for each tonne shifted from reductions achieved via changes in the size of different sectors to reductions via technical conversion.

In the transition from model 1 to 2, the price of DKK 550-1,000 per tonne is an additional technical reduction

As the technical reduction via subsidies does not directly increase the costs for companies, this form of CO_2 reduction will result in less CO_2 leakage abroad. At the same time, it must be assumed that a large part of the reduction through changes in the size of different sectors, which is avoided through the subsidy, would have resulted in close to 100 per cent leakage due to Danish loss of market share and relocation of production. The mentioned socio-economic cost of DKK 1,000 per tonne CO_2 (DKK 550 per tonne CO_2 excl. reversal) for the switch to technical reductions can therefore roughly be seen as the Danish socio-economic cost of preventing an increase in foreign CO_2 emissions of 1 tonne and maintaining the Danish industrial structure.

Roughly speaking, it can be thought of as the cost of limiting 1 tonne of emissions abroad and maintaining the Danish industrial structure

Similarly, it can be calculated that choosing model 3 over model 1 would achieve a shift from CO_2 reductions via changes in the size of different sectors to technical reductions of about 1.0 million tonnes in total. The socio-economic cost of the additional 0.1 million tonnes that will be diverted will be almost DKK 700 per tonne. The amount can be compared to the 550 DKK per tonne from model 1 to 2, which illustrates an increasing marginal cost of getting more technical effects. Similarly, it can be seen as the price of preventing an increase in foreign emissions and maintaining the Danish industrial structure.

Model 3 converts even more to technical reduction, but at an increasing price

Since changes in the size of different sectors also entail adjustment costs for the affected local communities and possibly undesirable geographical distributional effects, the mentioned socio-economic costs can be interpreted more broadly as the total socio-economic cost to avoid leakage and domestic adjustment costs. In any case, it is a political assessment whether, based on these considerations, Danish society should incur additional costs of this order of magnitude by deviating from the

Changes in the size of different sectors may have local consequences in the short term

cost-effective model with a uniform CO_2 tax without additional subsidies other than for negative emissions.

It is not the Expert Group's task to decide on the trade-off

It is not for the Expert Group to take a position on this question, but it may be relevant to point out that the government's climate programme from September 2021 describes a large number of reduction measures that have a significantly higher socio-economic shadow cost than the above-mentioned costs of 550-1,000 per tonne by preventing an increase in CO_2 emissions from abroad.

However, based on the socio-economic costs of the climate programme, it can be pointed out that models 2 and 3 are preferable

If there is a willingness to pay such high socio-economic costs as indicated in the government's climate programme to reduce domestic emissions, and if a reduction in foreign emissions is attributed approximately the same value (since the climate effect is the same wherever the emissions take place), it suggests that the Expert Group's model 2 and 3 - or similar models that depart from strict cost-efficiency and uniform tax to discourage leakage - may be preferable to model 1.

Reorganisation of energy taxes for space heating and road transport

3

3.0 Reorganisation of energy taxes for space heating and road transport

This chapter presents the Expert Group's recommendations for partial restructuring of energy taxes for space heating and road transport.

3.1 Reorganisation of the space heating tax

The terms of reference state that "*The transition from energy taxation to CO_2 taxation must take into account, among other things, the fossil content (in the form of plastics, etc.) of the waste volumes from waste incineration for district heating, as well as how coal can be phased out in district heating. Furthermore, the impact of the district heating price cap, e.g. on surplus heat from surplus heat suppliers, as well as the space heating tax on individual and collective space heating, needs to be clarified*".

This section elaborates on the recommendations of the Expert Group on space heating taxation in the first interim report. The models include a partial restructuring of the space heating tax, where part of the energy tax is converted into a CO_2 tax. The section looks at the implications for the heating sector, focusing on the impact on waste for incineration, district heating, tax-driven heat prices and the phase-out of coal.

3.1.1 Current taxation of space heating

Space heating includes household-style heating and hot water. It also includes the heating of buildings, offices, etc., as well as the heating of hot water for washing, bathing, etc. Businesses account for about 20 per cent of total fossil space heating consumption. CO_2 emissions from space heating are expected to amount to about 1.9 million tonnes in 2030, of which emissions from individual heating are expected to account for about 70 per cent.[15]

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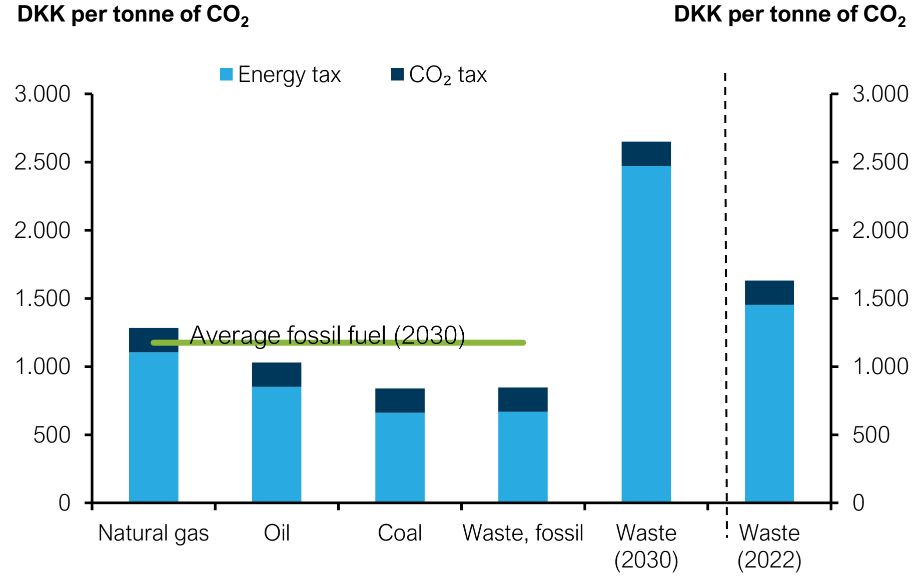
[15] Individual space heating is typically heating with natural gas fire, oil fire, individual heat pump or biomass fire. In addition, individual space heating includes city gas.

The space heating tax currently includes all taxes on fossil fuels used for heat production, i.e. natural gas, oil, coal and waste. Today, both a CO_2 tax and an energy tax are paid on space heating. In addition, NO_x tax and in some cases other taxes are paid. With current energy taxes and the CO_2 tax on space heating, the total tax burden per tonne of CO_2 is about DKK 1,170 on average across all fossil fuels in 2030*, see Figure 3.1*. However, it covers significant differences.

Figure 3.1. Tax burden on fossil fuels for space heating with current taxes, 2022 prices



Source: Own calculations.

Energy taxes on waste are imposed on mixed waste loads and, thus also, on biogenic waste. When taking into account that biogenic waste in mixed loads is subject to energy tax, the average tax on waste converted to DKK per tonne CO_2 is approximately DKK 1,700 in 2022. The average taxes on waste are expected to rise to around DKK 2,600 by 2030. This is because the fossil share of waste is expected to decrease, so the current energy tax on waste will include a smaller amount of CO_2. This estimate is based on the composition of Danish waste and thus does not consider imported waste.

Current regulation of waste

Fossil waste for incineration is currently subject to waste heat and additional tax, which together corresponds to the energy tax on other fossil fuels. Emissions from waste incineration are also subject to CO_2, NO_X and sulphur taxes.

Biogenic waste in clean loads is, like biomass, exempt from tax. However, biogenic waste mixed with fossil waste is in practice subject to both waste heat tax and additional tax.

The majority of Danish waste incineration plants are covered by the EU ETS. This means that most Danish waste incineration plants will have to pay the emissions allowance price for fossil emissions from waste incineration. Plants covered by the EU ETS also pay CO_2 tax, which is based on the calculations for the EU ETS, where the largest plants can measure the fossil share of the waste via the flue gas, while other plants pay CO_2 tax based on the estimated consumption multiplied by a fixed emission factor for mixed waste.

3.1.2 Structure for a reorganisation

The models include a partial restructuring of the space heating tax into a CO_2 tax. A partial restructuring will result in an increase in the CO_2 tax corresponding to the general level in the industry and a corresponding easing of the energy taxes. With the restructuring, there will basically be a more precise taxation of CO_2.

The restructuring is balanced after the tax rate per tonne CO_2 is unchanged for natural gas, applicable to both ETS and non-ETS space heating. This would lead to a change in the total tax (the sum of energy taxes and a CO_2 tax) on fuels other than natural gas and would mean that the total tax burden on other fossil fuels would increase by an average of around DKK 50 per tonne of CO_2 in 2030.

In the case of a partial restructuring, the energy tax on biogenic waste in the mixed waste quantity is relaxed without an opposite increase in the CO_2 tax. The tax on biogenic waste will thus be reduced overall. A partial restructuring of the tax to a CO_2 tax of DKK 750 per tonne of CO_2 in model 1 is estimated to involve a smaller immediate revenue after static effects and behavioural response of around DKK 0.2 billion, as the energy charges as a whole are reduced to around DKK 30.5 per GJ, *see Table 3.1*.

The restructuring does not introduce a reduction in the CO_2 tax for the ETS-coveredfossil heat production. This should be seen in the context that a reduction in the emissions allowance price would, in isolation, lead to a relaxation of the current taxation of fossil heat production within the ETS sector, thus increasing fossil heat consumption and CO_2 emissions.

Table 3.1. Revenue implications of partial tax reorganisation

2030		Basis	Baseline		Partial restructuring		Difference1)
			Rate	*Immediate revenue effect*	*Rate*	*Immediate revenue effect*	*Immediate revenue effect after static effects and behavioural response*
			DKK	*DKK billion*	*DKK*	*DKK billion*	*DKK billion*
Fossil CO_2	*Million tonnes*	1.9	179.2	0.3	750	1.3	0.9
Energy	*PJ*	42.0	63.0	2.4	30.5	1.1	-1.1
Total revenue	***DKK billion***			**2.7**		**2.4**	**-0.2**

Note: Rates express the tax in DKK per tonne CO_2 regarding CO_2 tax and in DKK per GJ for the energy tax. Rates are calculated in 2022 prices, while revenues are calculated in 2022 levels. Revenue in baseline and partial restructuring are calculated as immediate revenue.
Note 1: Difference in revenue is broken down by static effects and behavioural response, where behavioural response includes only the labour supply effect. Source: Own calculations.

For individual heating, where the fossil energy consumption is predominantly natural gas, the behavioural effects are expected to be very limited as the rate is kept unchanged. However, there would be a small effect on residual oil consumption through a higher overall tax. This results in a modest CO_2 reduction from individual heating.

For collective heating, waste is expected to be by far the largest fossil energy use in 2030. Natural gas and a very limited amount of oil make up the remaining share. However, the largest energy tax base is made up of biogenic waste.

A higher tax on fossil waste incineration is estimated to encourage waste incineration plants to receive less fossil waste and possibly separate the fossil waste in mixed waste loads, thus affecting the composition of waste incinerated.

A restructuring of the taxes will thereby encourage a reduction in fossil CO_2 emissions from the waste incineration sector. This is further reinforced by the implementation of the agreed capacity adjustment in *"Climate Plan for a Green Waste Sector and Circular Economy"* from 2020. The higher tax on fossil waste is therefore estimated to contribute to further CO_2 reductions in isolation. Based on this, a limited computational reduction of CO_2 emissions has been factored in.[16]

At present, it is impossible to estimate precisely the CO_2 effects of a restructuring of the space heating taxes in the waste area. This is because a number of measures have been adopted in recent years to reduce the emission of CO_2 within the waste sector, which have not yet come into force. The measures relate to EU obligations for the waste sector, capacity adjustment, imports, sorting and recycling targets. The concrete effects of these measures need to be further examined, including the interaction with other regulation.

[16] The computational effect used may differ if further analysis is performed. The computational effect is described in the documentation note.

This is considered to be immediately outside the scope of the Expert Group's investigation. Therefore, it is recommended that this be investigated separately from the work of the Expert Group.

However, a relaxed tax on biogenic waste may increase the incentive to incinerate biogenic waste, which is contrary to the intentions of *Climate Plan for a Green Waste Sector and Circular Economy* and Denmark's EU commitment to recycle waste rather than incinerate it.

A partial restructuring will have limited distributional effects. Individual heating with oil boilers will become more expensive, while district heating will become cheaper in 2025 due to the tax relief on waste, *see Table 3.2*. This should be seen in the light of the fact that waste heat will become slightly cheaper, while heating with oil boilers will become slightly more expensive, *see Table 3.2*. The majority of oil burners are also expected to be phased out by 2030. However, the figures should be seen in the light of the fact that the composition of district heating production on different heat sources varies widely between the geographically different district heating areas, *see Box 3.1*.

Table 3.2. Annual change in heating prices for households with different heating sources

DKK per year incl. VAT	Partial restructuring to DKK 750 per tonne of CO_2 (models 1 and 2)	Partial restructuring to DKK 600 per tonne of CO_2 (model 3)
Individual heating		
Natural gas	0	0
Oil	800	575
District heating		
National distribution (2025)	-125	-100
Higher share of oil/coal[1)]	300	225
Higher share of waste[2)]	-475	-350
Coal	1,775	1,275
Waste (2030)	-1,450	-1,050

Note: It should be noted that many district heating customers pay a price based on the combination of heat sources, including for example biomass boilers and heat pumps, which are not affected by the restructuring. The calculations are based on a house with an energy consumption of 65 GJ per year. These are stylised price examples, which are based on the full passing on of the tax changes in the prices and do not take into account, for example, efficiencies and losses in relation to heat distribution. 1) The share of oil and coal is assumed to be 14 percentage points higher than the average, while the share of waste is 9 percentage points lower than average. 2) The proportion of waste is assumed to be 40 percentage points higher than the average, and the share of coal is assumed to be 1 percentage point lower than the average, while the share of oil is unchanged.
Source: Denmark's Climate Status and Outlook 2021 and own calculations

In Table 3.2, fossil waste heat becomes more expensive in isolation, but overall waste heat becomes cheaper. Due to many individual circumstances, it cannot be clearly estimated how waste incineration plants will pass on a tax reduction in, for example, waste tariffs and, consequently, municipal waste charges for households and businesses or heating prices. Furthermore, there are geographical differences in energy sources in both individual heating with oil and natural gas boilers and collective heating areas with, among others, waste heat and natural gas, which means that there can be significant geographical differences in the changes in heating price, *see Box 3.1*.

Box 3.1

Change in heating prices for district heating

It can be expected that there will be a large variation in how the district heating price for households heated with district heating will change with a restructuring of the space heating tax.

This is due to the fact that the composition of district heating production on different heat sources varies widely between the different district heating areas. For example, in some areas, waste heat may be dominant, while in others, it is biomass. Typically, district heating production will be based on a combination of heat sources, some of which will not be affected by the restructuring.

The composition of district heating production is also expected to change significantly by 2030, when fossil-based heat production is expected to decline. This includes the expected phasing out of coal, while district heating from heat pumps in particular is expected to increase.

In areas with waste heat, all other things being equal, a reduction in the district heating price must be expected, via the reduced tax on waste, depending on the composition of the waste in terms of biogenic and fossil fuels. Oil is used only to a very limited extent in district heating, so the tax increase on oil is likely to have a limited effect on district heating prices, all other things being equal. Coal is expected to be phased out by 2028. In district heating areas where district heating production is based on natural gas, heat pump and renewable energy (excluding bio-waste), the tax on district heating production will not be affected.

The alternative to a partial restructuring of the space heating tax is a full restructuring of the space heating tax. A full restructuring means that the CO_2 tax rate for space heating becomes a mirror of the current total tax level and thereby breaks with the uniformity across the other areas dealt with in this report.

A full restructuring will entail greater distributional consequences for heating customers and revenue-related consequences, particularly in the waste sector, with limited CO_2 reductions as a result.

In view of the above, a full restructuring has been rejected in the first interim report.

3.1.3 Possible effects of shifting energy taxes and CO_2 tax on waste for incineration

The vast majority of waste for incineration is mixed waste, where it is estimated that the fossil energy content of waste suitable for incineration is about 45 per cent. Fossil energy content is expected to fall to just under 30 per cent by 2030.

A restructuring and increased tax on fossil waste incineration are expected to reduce the incentive to incinerate fossil waste immediately. All other things being equal, this will increase the incentive to sort out the fossil waste in mixed waste loads and thus increase recycling, as well as contribute to meeting the 70 per cent target.

At the same time, the restructuring will lead to a lower tax on the incineration of biogenic waste in mixed loads, which may increase the incentive to incinerate and possibly import a larger amount of biogenic waste in mixed loads. This will discourage capacity adjustment in the waste incineration sector and may challenge the achievement of EU recycling targets.

Waste management in Denmark complies with the waste hierarchy in the EU Waste Framework Directive. Against this background, legally binding recycling targets have been set for 2025, 2030 and 2035 respectively, which all Member States are obliged to meet.

Compliance with the directive at national level is achieved, among other things, through the agreement *Climate Plan for a Green Waste Sector and Circular Economy* from 2020 (S, V, RV, SF, KF, LA and Å), which aims to reduce the amounts of waste incinerated by increasing sorting and recycling. It has also been decided that the Danish waste incineration capacity will be reduced to adapt to the expected reduced Danish quantities of waste suitable for incineration in 2030.

The consequences of a shift to a more uniform CO_2 tax in relation to other policy objectives and EU obligations in the waste area are outside the scope of the Expert Group's study, and the Expert Group recommends that this be further investigated outside the scope of the Expert Group.

Cap on district heating prices

Since the Expert Group was set up, where the terms of reference called for the impact of the district heating price cap, including the price of surplus heat, to be clarified, new rules for the future use of surplus heat have been agreed upon.

With the *Agreement on the Promotion of Surplus Heat* (S, V, RV, SF, EL, KF, LA and Å) from September 2021, it has been decided that 1) surplus heat will be subject to a price cap based on renewable energy, and 2) companies that are part of a scheme that ensures energy efficiency improvements can be exempted from their surplus heat tax. Companies participating in the scheme are obliged to carry out energy audits and implement energy efficiency measures of processes and installations related to surplus heat.

The agreement thus introduces a new price regulation for surplus heat with a cap on the price of surplus heat delivered by a company to a district heating supplier. One of the objectives of the price cap is to provide a stable and clear framework for regulating the price of surplus heat to ensure the use of surplus heat and fair heat prices for consumers.

The price ceiling must be set so that the costs of utilising surplus heat must not exceed the average costs of the district heating company's cheapest alternative green heat production. The price cap must provide a robust and fair picture of the alternative cost for surplus heating. The alternative cost could be for district heating companies to invest in a large heat pump.

Different options for flexibility in relation to the price cap have been decided, among other things, to support that the price cap is not a barrier to using surplus heat. A lower threshold has also been introduced, which exempts small suppliers of surplus heat with a capacity of less than 0.25 MW from the price regulation.

The Expert Group has taken note of the new rules and considers that it is not necessary to clarify the issue further.

Phasing out coal in district heating

With *Climate Projections and Status 2021*, coal is expected to be phased out by 2028, when Nordjylland Power Station is expected to shut down as the last plant that uses coal as a primary fuel. However, some plants can continue to use coal in exceptional situations for reasons of electricity supply security, for example, in the event of cable outages.

A restructuring of the energy tax on space heating to a CO_2 tax will increase the tax on coal, as coal has a high CO_2 content per GJ compared to other fossil fuels, e.g. natural gas. Thus, a restructuring balanced according to CO_2 content will, other things being equal, reduce the incentive to use coal in CHP plants. However, it is estimated that the restructuring will not affect the phasing out of coal to a greater extent beyond the already expected phasing out, given the costs associated with using or converting to other fuels.

The Expert Group notes the expected phasing out of coal in district heating and considers on this basis that it is not necessary to elucidate further measures.

3.2 Recommendations regarding road transport

This section elaborates on the Expert Group's recommendations for the regulation of charges for the road transport sector in the first interim report and what is expected to be considered as part of the final report.

3.2.1 Road transport in the first interim report

The Expert Group is tasked with making recommendations for a more uniform taxation of CO_2. This will generally mean that the lowest tax rates are increased and that the tax bases are expanded. The transport sector differs from other areas in that current overall taxes on petrol and diesel are relatively high, *see Chapter 5*.

Projections show that emissions from road transport will be around 10.5 million tonnes in 2030 if no new initiatives are taken to reduce emissions. This corresponds to almost one third of the expected total Danish greenhouse gas emissions in 2030.

Table 3.3. Taxes per litre of petrol and diesel

	Energy tax	CO_2 tax	NO_X tax	Total	Energy and CO_2 tax
2030, 2021 prices		*Øre per litre*			*DKK per tonne of CO_2*
Petrol (E10)	427.9	38.8	0.8	467.5	2.161
Diesel (B7)	279.0	44.3	0.9	324.2	1,389

Note: In addition to energy and CO_2 taxes, cars are subject to additional CO_2-related taxes on purchase and ownership (registration tax and green tax on ownership). The share of renewable fuels is assumed to be 9.8 per cent by volume for petrol (E10). For diesel, the share of renewable fuels is assumed to be 6.8 per cent by volume in 2022 (B7 diesel) and 12.8 per cent in 2030.
Source: Own calculations.

In 2030, the taxes on petrol and diesel are expected to correspond to approximately DKK 2,150 and DKK 1,400 per tonne of CO_2, respectively, *see Table 3.3*. Diesel cars pay a countervailing charge that depends on fuel economy. The countervailing charge is set to correspond to the saving made by taxing diesel at a lower rate than petrol for a car with an average number of driven kilometres.

Overall, it applies to the transport area that:

- CO_2 reductions through increases in taxes on fuels for road transport in general are significantly more expensive from a socio-economic perspective than in other sectors. This is partly because overall taxes on passenger cars are already very high compared to other areas, and fuel sales are sensitive to cross-border trade.

- The future of EU transport regulation is unclear. The European Commission's "Fit for 55" package contains initiatives that could have a significant impact on the overall regulation of the transport sector in the coming years, including the proposal for tighter CO_2 requirements for cars and vans and the establishment of a new CO_2 emissions allowance trading system, including transport fuels.

When CO_2-reducing measures in the area of road transport are considered, there will therefore be a trade-off between relatively high socio-economic costs and significant greenhouse gas emissions by 2030.

Recommendations on road transport in the work on a more uniform taxation of CO_2 will also have to be seen in the context of *Agreement on Green Transformation of Road Transport* concluded in December 2020 (S, RV, SF and EL). The agreement contains long-term initiatives based on recommendations from *The Commission for a Transition to Green Passenger Cars*. The Expert Group has noted that sales of green cars in 2021 have increased significantly faster than expected.

Based on the above, the Expert Group recommends that fuel taxes be partially restructured in the first instance. As part of the final report, the Expert Group will consider final recommendations on a possible change in the level of taxation for petrol and diesel.

The partial restructuring is recommended to be carried out by increasing the general CO_2 tax, which also includes fuels for transport, and that the energy taxes on petrol and diesel be reduced accordingly, with the aim that the total tax level for petrol and diesel remains unchanged. The concrete adaptation of the tax rates will have to be considered in relation to EU law.

Restructuring fuel taxation from energy to CO_2 taxation would, in principle, support a shift from fossil fuels to renewable fuels, as renewable fuels are not subject to the CO_2 tax and thus gain a competitive advantage over fossil fuels, *see Box 3.2*.

However, the price of renewable fuels for transport is significantly higher than conventional fuels. The additional price of the relevant renewable fuels is estimated to be in the order of DKK 2,500 per tonne of CO_2 displaced by the renewable fuels. The CO_2 tax is thus estimated with considerable uncertainty to be in the order of DKK 2,500 per tonne of CO_2 before fuel suppliers will significantly increase the share of renewable fuels.

Box 3.2

Renewable fuels

Renewable fuels is a generic term for greenhouse gas reducing fuels based on renewable energy, all of which are counted as greenhouse gas neutral according to the UN's calculation method.

Renewable fuels can be divided into fuels of biological and non-biological origin. Today, renewable fuels of biological origin, such as biodiesel and bioethanol, make up the majority of renewable fuels used in road transport. Renewable fuels can also be fuels based on Power-to-X technology.

Supplementary models

4

4.0 Supplementary tax models

This chapter presents a number of supplementary tax models as well as other considerations regarding the increasing emissions allowance price and the use of revenues in the main models.

For the supplementary models, the key trade-offs are unfolded by deviating from the main models with, among other things, different reduction levels, different reductions in the CO_2 tax for emissions allowance payment and effects of an activity-based basic deduction. The models can be seen as a set of alternatives reflecting different weightings of the mandate considerations and as sensitivity calculations of how the effects change by adjusting parts of the basic elements of the models.

4.1 The starting point for the models are the main models presented

The starting point for the chapter is the main models, *see Chapter 2*. These models all have a reduction of about 3.5 million tonnes of CO_2 and a reduction for the emissions allowance price of 50 per cent. Furthermore, no basic deduction has been introduced in these.

The selected models are the result of a series of choices and weighting of considerations which, in the assessment of the Expert Group, are best met in the main models, but may also be weighted differently. In the following, models are presented with a number of adjustments in the central elements:

1. Reduction/ambition level: Models with reductions of 2.5, about 3.5 (main models) and 4.5 million tonnes of CO_2 in 2030 are shown here.
2. Emissions allowance price reductions: Models with 0 per cent, 50 per cent (main models) and 100 per cent reductions are shown here for comparison.
3. Basic deduction: A number of models with an activity-based basic deduction are shown here, which are compared with corresponding tax models.

In the calculations for the supplementary models, the starting point is model 2, which has uniform taxes with a reduction for the emissions allowance price of 50 per cent, a rate of DKK 100 per tonne of CO_2 for mineralogical processes, etc., and where the tax revenue is used to subsidise CCS.

4.2 Reduction level

The Expert Group's main models include a reduction level of about 3.5 million tonnes of CO_2. However, various other considerations may justify other reduction levels. This could be a desire for less burden on business, or for further reductions from industry to be decided later. Conversely, there may also be a desire for industry, non-road transport and electricity production to contribute even more to meeting the climate goals.

Table 4.1 and *Figure 4.1* illustrate the charging system for models with different reduction levels, but where the basic structure of model 2 is retained. A model with a reduction level of 2.5 million tonnes of CO_2 and 4.5 million tonnes of CO_2 respectively, and main model 2 with a reduction level of about 3.5 million tonnes of CO_2 are shown for comparison.

Table 4.1. Comparison of main results at different levels of ambition

2030		2.5 million tonnes	3.5 million tonnes (model 2)	4.5 million tonnes
Rate (non-ETS/ETS/mineralogical processes, etc.)		*525/150/100*	*750/375/100*	*900 /525/100*
Maximum subsidy rate for CCS per tonne of CO_2 captured		*750*	*850*	*900*
CO_2 reductions				
2030	Million tonnes	2.5	3.5	4.5
- of which subsidies	*Million tonnes*	*1.1*	*1.7*	*2.1*
Financial consequences				
Immediate burden on business[1)]	DKK billion	1.2	2.3	3.0
Burden on business after adjustment	DKK billion	1.0	1.7	2.2
Revenue after behavioural response (after financing)[2)]	DKK billion	0.0	0.0	-0.2 (0.0)
Macroeconomics				
Average shadow price (after compensation)	DKK per tonne	425	500	550 (550)
Marginal shadow price	DKK per tonne	750	850	900

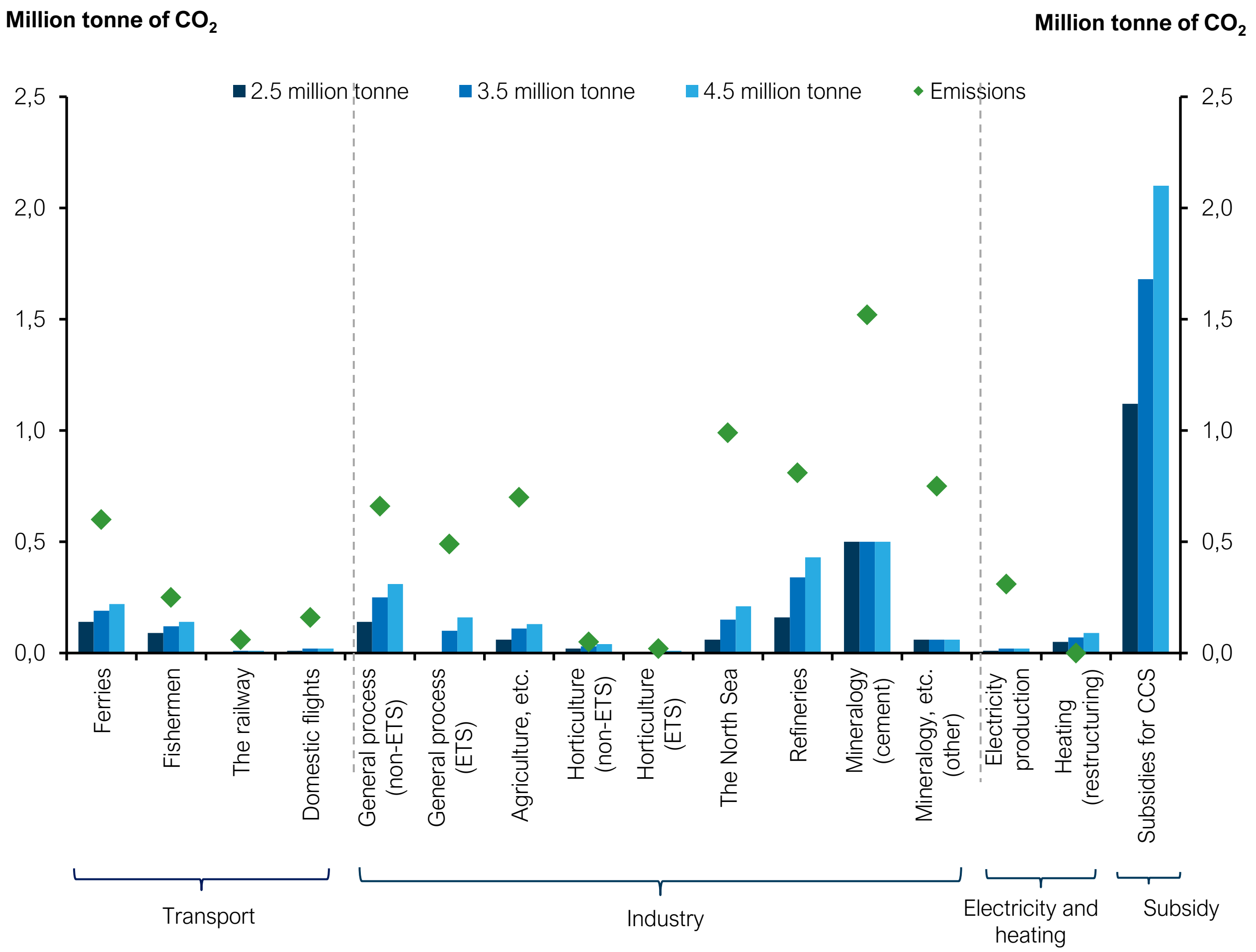
Note: Revenue effects are rounded to the nearest DKK 50 million. Socio-economic costs are rounded to the nearest DKK 25 million. Totals may differ from the sum due to rounding. Rates are shown in 2022 prices, while revenue effects are shown in 2022 levels. It is assumed that the taxes are continuously indexed with the general price level. The return flow is calculated assuming a full spillover effect in wages, *see Section 2.4*. The computation assumes that any shortfall is covered by an increase in the lowest tax rate, and that any surplus in 2030 is used for a general reduction in corporate tax.

Note 1: Calculated excl. restructuring the space heating.

Note 2: Calculated after restructuring the space heating tax and subsidies for CCS.

Source: Own calculations.

Figure 4.1. Comparison of reductions at different ambition levels



Note: For the model with a reduction level of about 3.5 million tonnes of CO_2, the starting point is model 2.
Source: Own calculations.

Model with 2.5 million tonnes of CO_2 reduction in 2030

Lowering the level of ambition for CO_2 reductions from tax increases can reduce the burden on businesses, including the large CO_2-intensive emitters that are particularly burdened by the CO_2 tax. This could be done via a model where the CO_2 tax is instead increased to DKK 525 per tonne with a 50 per cent reduction of the emissions allowance price and a rate of DKK 100 per tonne for mineralogical processes, etc.

Such a model is estimated to imply a reduction in the order of 2.5 million tonnes of CO_2 in 2030. It is estimated that with a tax level of this magnitude, production from the largest and most leakage-prone companies can be retained with some probability.

Although the reductions are lower in this model than in the main models, they can also be attributed mainly to the most CO_2-intensive industries, as it is precisely for these that the tax is raised the most. The most CO_2-intensive industries have the lowest tax rates under current rules.

The reductions in this model will be socio-economically cheaper than in main model 2, illustrated by the average shadow price of DKK 475 per tonne of CO_2, which reflects the fact that the cheapest reductions are only achieved when taxes are raised, including in particular those areas that currently have the lowest taxes or no tax.

The model can thus be seen as a desire to reduce the burden on business and thereby avoid large reductions in output from the largest emitters by lowering the level of ambition of their contribution to the 70 per cent target. In isolation, a lower tax rate model better addresses the current industry structure and leakage risks from the largest emitters. On the other hand, reductions are not as significant in 2030 as in the main models, and those reductions will then have to be found elsewhere or at a different time.

Model with 4.5 million tonnes of CO_2 reduction

Alternatively, a model could be considered where the level of ambition is increased to 4.5 million tonnes of CO_2. This may be based on a desire for industry (including business, non-road transport and electricity production) to contribute even more to achieving climate targets in 2025 and 2030, for example, because reductions in this area are expected to have relatively low socio-economic costs compared to other sectors, such as transport.

In this case, the taxes are set at around DKK 900 per tonne of CO_2 outside the ETS sector and around DKK 525 per tonne of CO_2 within the ETS sector.

When the tax rate exceeds a certain level and the subsidy for CCS is calibrated to the tax rate in the non-ETS sector, the subsidy for CCS starts to become so large that it exceeds the additional revenue from the higher CO_2 tax. In concrete terms, this means a reduction level of around 4.5 million tonnes of CO_2. Therefore, this model implies a shortfall in revenue of about DKK 0.2 billion, which is financed by a 0.02 percentage point increase in the basic deduction.

For CO_2-intensive industries – apart from mineralogical processes, etc., which have a reduced tax of DKK 100 per tonne of CO_2 – the high taxation is a challenge, as they are highly exposed to international competition. In addition, the costs of switching to renewable technologies are high for these companies. A large proportion of these industries are, therefore, likely to reduce production significantly or shut down, including refineries, fisheries and other major ETS-coveredemitters. In other sectors, however, a large part of the reduction will come from technical changes, such as electrification and energy efficiency.

The reductions would imply an average shadow price of DKK 550 per tonne of CO_2, while the marginal shadow price would be somewhat higher at around DKK 900 per tonne of CO_2. These are still relatively cheap reductions, but the higher marginal shadow price reflects that the additional reductions will be relatively more expensive at a higher level of ambition. The high level of ambition is also reflected in the immediate burden on business of about DKK 3.0 billion, which is about DKK 0.7 billion more than in the main model (model 2).

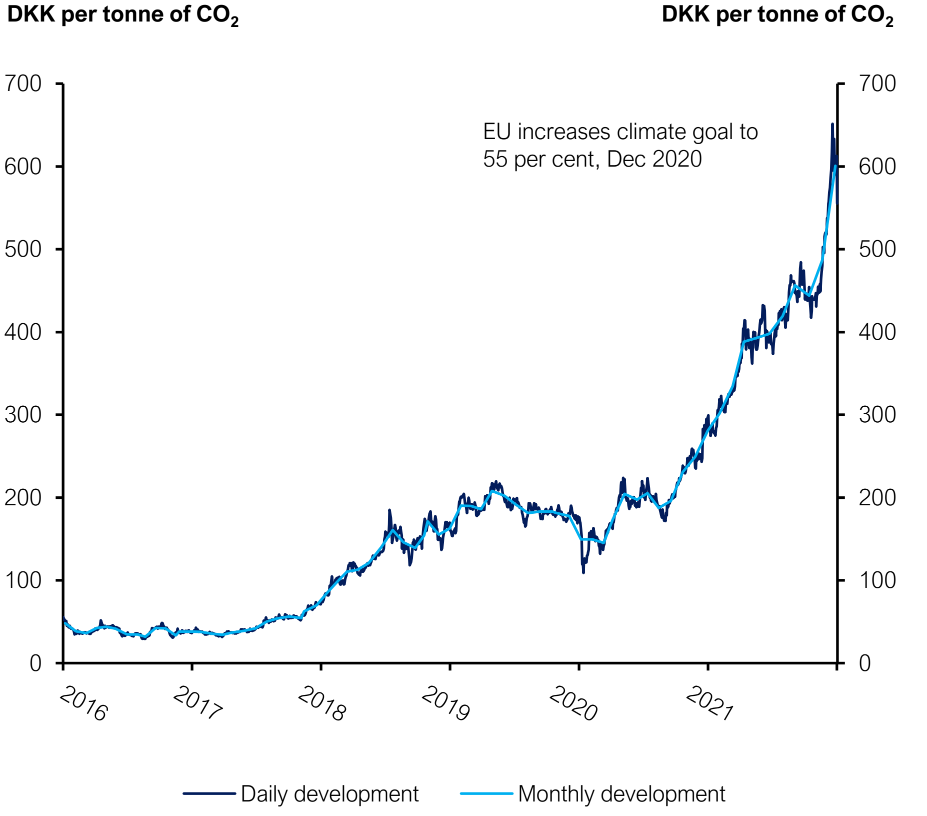
It is noted that the immediate burden on business in the model with a reduction of 4.5 million tonnes of CO_2 is more than twice as large as in the model, with a reduction of 2.5 million tonnes of CO_2. This illustrates that companies make the most and cheapest reductions at low tax rates, and therefore it takes a greater tax burden at high tax rates to achieve a given additional reduction, just as the cheapest reductions from CCS are achieved first.

4.3 Higher emissions allowance price

The EU ETS regulates greenhouse gas emissions from large installations, *see Section 5.3*. The CO_2 emissions allowances do not expire and can in principle be kept forever. Therefore, CO_2 emissions allowances can be equated with a financial asset, and the emissions allowance price is therefore projected in the same way.

In its "Fit for 55" package, the European Commission announced plans to limit the number of emissions allowances in the current ETS. This, together with higher-than-expected economic activity, has put upward pressure on the emissions allowance price, which has more than tripled in the last year and a half, *see Figure 4.2*.

Figure 4.2. Historical development in the EU's CO_2 emissions allowance price



Note: The emissions allowance price is calculated in 2021 prices.
Source: Own calculations based on the European Energy Exchange (EEX).

The Ministry of Finance makes projections on an ongoing basis, and the projection of the 2030 emissions allowance price has increased significantly during 2021. The latest projection, made in early 2022, contains a CO_2 price that, compared to the *Climate Status and Projection 2021*, has increased by roughly 100 per cent, *see Figure 4.3*.

A emissions allowance price increase affects all European companies. Danish companies will thus not become less competitive relative to their European competitors, and the increase in the emissions allowance price can be interpreted as a common price increase for ETS-coveredproducts. As an approximation of the expected effect of the emissions allowance price increase, it has been assumed that the emissions allowance price only changes the incentive of Danish companies to technical conversion, unlike a national tax, which also has a structural effect on the economy as a result of changed competitiveness, *see Chapter 2*. This means that all reductions from the emissions allowance price increase are of a technical nature. This means that the increase in the CO_2 emissions allowance price basically has two types of effects, which have a decisive effect on the Expert Group's models:

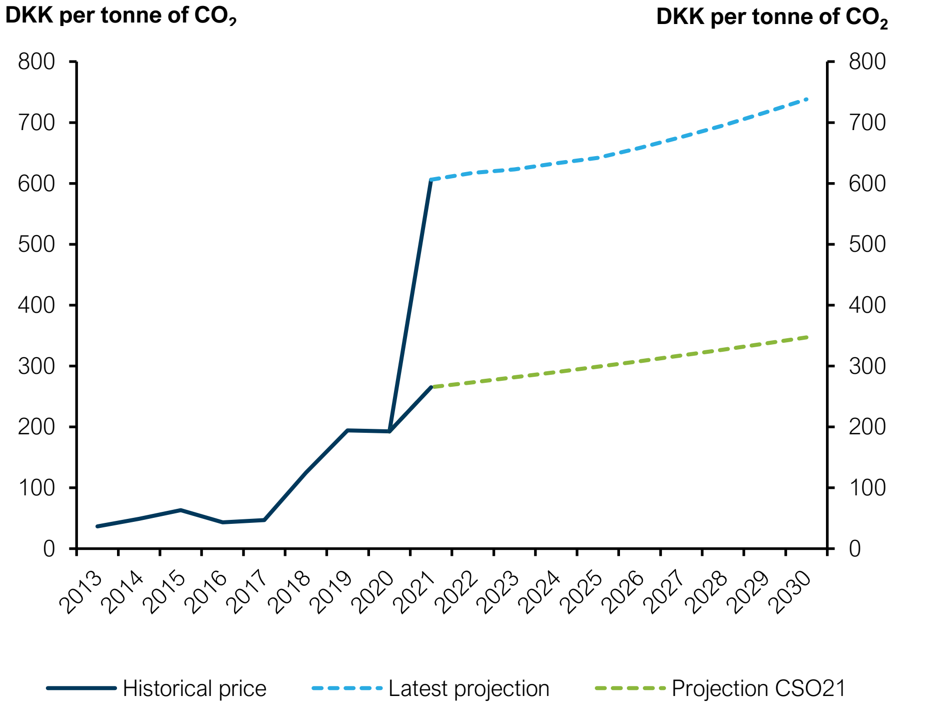
1) In isolation, a higher emissions allowance price gives companies more incentive to make technical changes that reduce their CO_2 emissions. This means that by 2030, CO_2 emissions and the requirement for reductions from a national tax based on the 70 per cent target will have fallen, all other things being equal.

2) As a result of the emissions allowance price increase, companies will already have made some of the technical adjustments that a national tax would otherwise have entailed. The CO_2 effects from a national tax will, therefore, for a given tax rate, all other things being equal, be smaller than in a situation without a emissions allowance price increase.[17]

Based on the significantly increased emissions allowance price, the Expert Group has chosen to estimate the isolated effect of the higher emissions allowance price in 2030. The estimate is based on the same approach as when calculating the effects of tax changes. It is estimated that the emissions allowance price increase in isolation will contribute to reductions in the order of 1 million tonnes of CO_2, all due to technical reductions in the ETS-coveredcompanies.

[17] This is true in all cases where there is a decreasing marginal effect of price changes, as assumed in the Expert Group's model setup. When backstop technologies such as CCS are used (which interfere with basic deduction models), there will be opposite effects, as there is thus no diminishing marginal effect along the entire demand curve. In this situation, general conclusions cannot be drawn about the CO_2 effects of a emissions allowance price increase.

Figure 4.3. Projection of the EU's CO_2 emissions allowance price



Note: The emissions allowance price is calculated in 2021 prices. CSO21 stands for *Denmark's Climate Status and Outlook 2021.*
Source: Own calculations based on the European Energy Exchange (EEX).

The calculations of the increased emissions allowance price are further detailed in the documentation note.

4.4 Reduction of the emissions allowance price

In order to accommodate the ETS companies, which include the most CO_2-intensive emitters – and are generally hit hardest by the uniform tax – a reduction in the CO_2 tax can be given corresponding to a proportion of the emissions allowance payment. At present, companies covered by emissions allowances are completely exempt from the current CO_2 tax. The following are models with 0 per cent, 50 per cent and 100 per cent reductions. *Table 4.2* and *Figures 4.2 and 4.3* compare the main results, the distribution of business costs (immediately and after adjustment) and the distribution of reductions at different reductions for the emissions allowance price.

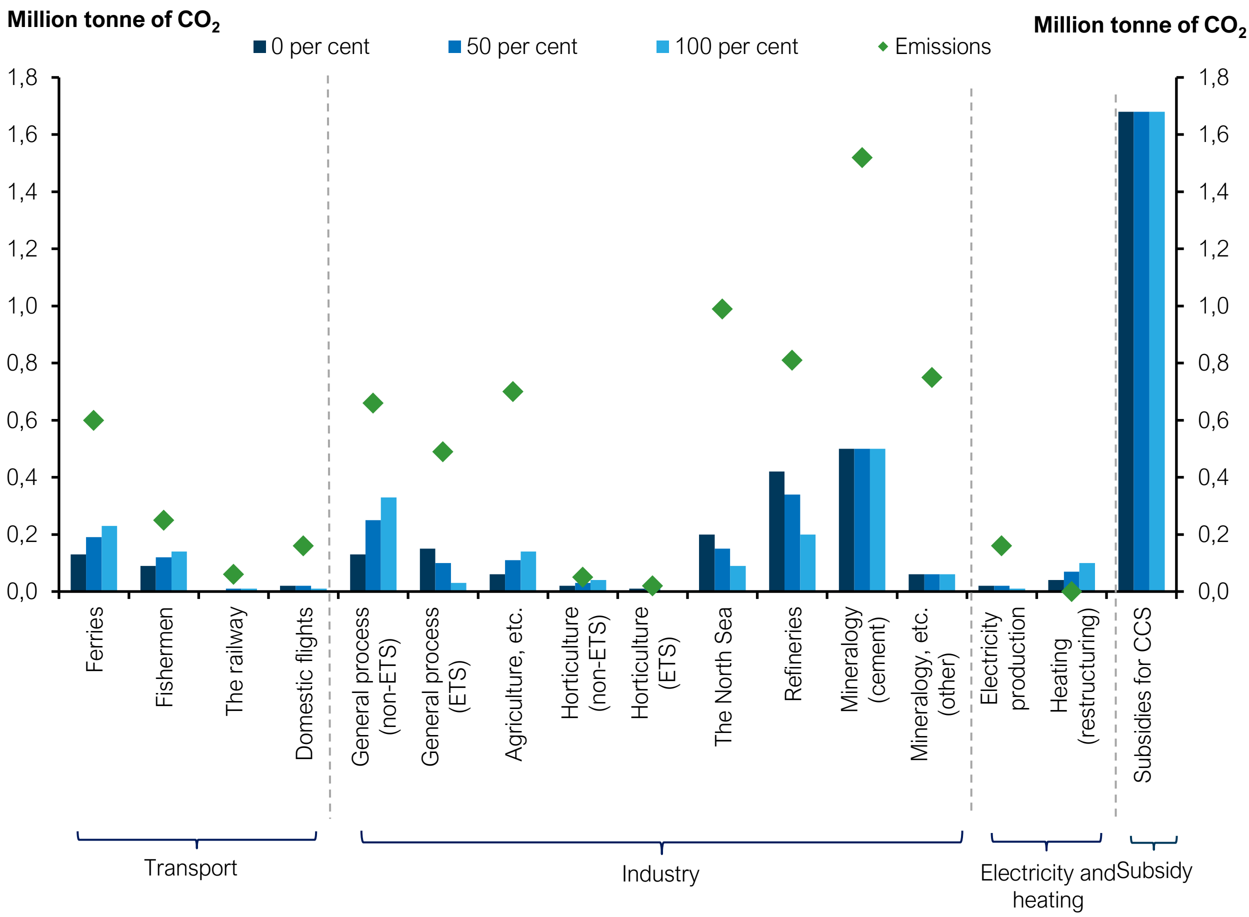
The models with 0 and 100 per cent emissions allowance reductions are compared with model 2, and mineralogical processes etc., are therefore given a rate of DKK 100 per tonne of CO_2. The reduction from subsidies is held constant across all three models. A pure "all else being equal" approach is thus adopted.

Table 4.2. Comparison of main results for different emissions allowance price reductions

2030		0 per cent reduction	50 per cent reduction (model 2)	100 per cent reduction
Rate (non-ETS/ETS/mineralogical processes, etc.)		*500/500/100*	*750/375/100*	*950/200/100*
CO_2 reductions				
2030	*Million tonnes*	3.5	3.5	3.5
- of which subsidies	*Million tonnes*	1.7	1.7	1.7
Financial consequences				
Immediate burden on business	*DKK billion*	2.1	2.3	2.3
Burden on business after adjustment	*DKK billion*	1.6	1.7	1.7
Revenue after behavioural response	*DKK billion*	0.0	0.0	-0.2
Macroeconomics				
Average shadow price (after additional financing)	*DKK per tonne*	475	500	525 (550)
Marginal shadow price	*DKK per tonne*	500	750	950

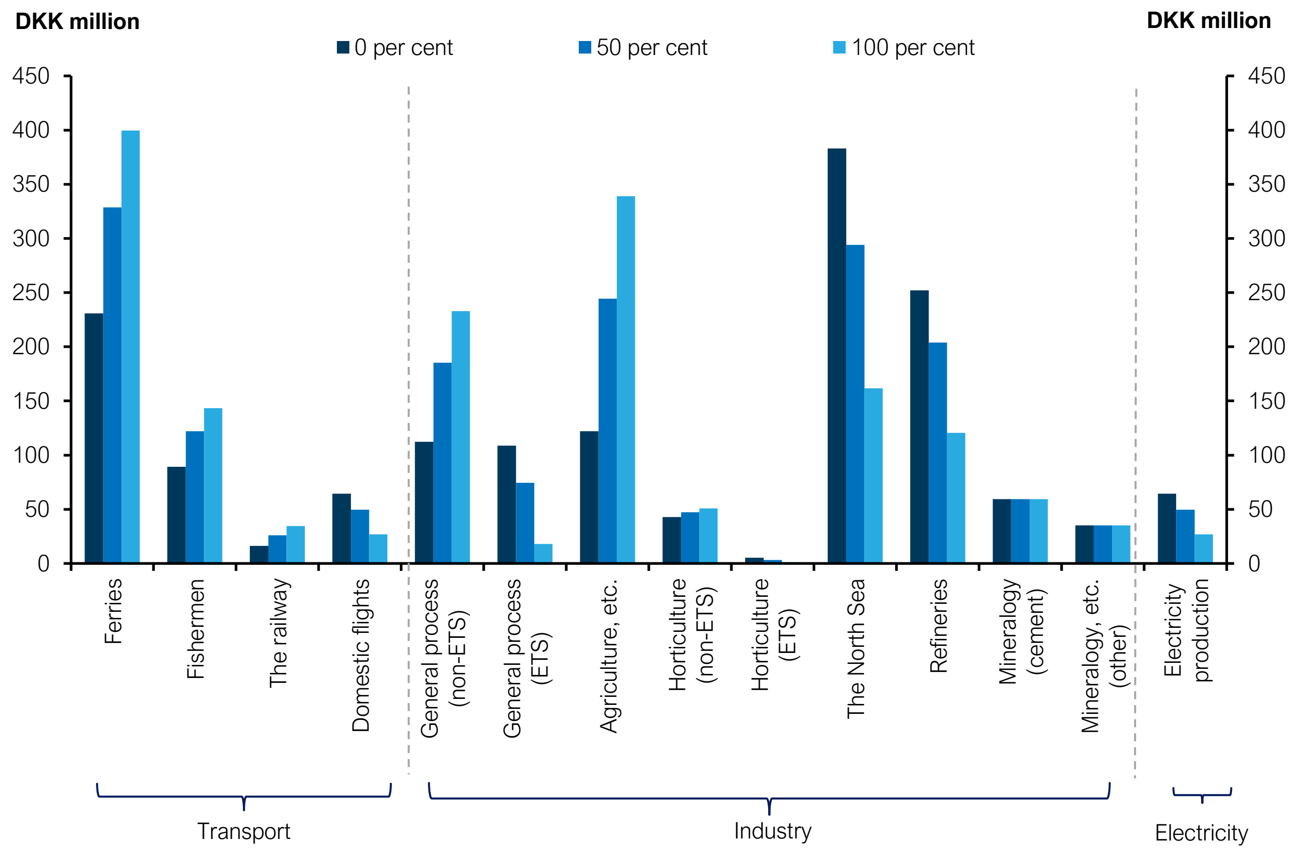
Note: See *Table 4.1*. The burden on business (immediate and after adjustment) is larger in the model with the 100 per cent reduction than the model with the 50 per cent reduction, but due to rounding this is not shown in the table. However, for all the Expert Group's models, a larger emissions allowance price reduction implies, in isolation, a larger immediate burden if the same level of reduction is desired.
Source: Own calculations.

Figure 4.4. Distribution of reductions for different emissions allowance price reductions



Note: For the model with 50 per cent reduction, the starting point is based on model 2.
Source: Own calculations.

Figure 4.5. Comparison of burden on business after adjustment for different emissions allowance price reductions



Note: For the model with 50 per cent reduction, the starting point is based on model 2.
Source: Own calculations.

As noted, a European approach would require a uniform marginal price to be set for all emissions. Thus, there should be the same CO_2 price in the ETS and non-ETS sectors, which implies a 100 per cent ETS reduction.

ETS-coveredcompanies will also typically be more exposed to competition, and thus leakage, than other companies. This also pulls in the direction of setting up the tax system with full emissions allowance reduction. However, ETS-coveredcompanies receive free emissions allowances, so they do not bear the full economic cost of an increase in the emissions allowance price. In addition, the consideration of achieving the lowest socio-economic cost when meeting the 70 per cent target implies that no emissions allowance price reduction must be given, as the emissions allowance payment is not a direct payment to the Danish treasury for Danish emissions.

In comparing the different reductions for the emissions allowance price, the result is confirmed that the lowest socio-economic costs are found in the model without a reduction in the CO_2 tax for the emissions allowance price. However, *Table 4.2* shows that the average socio-economic cost increases only to a limited extent with a higher emissions allowance price reduction.

With 0 per cent reduction, the socio-economic cost is DKK 475 per tonne CO_2, while it rises to DKK 525/550 per tonnes of CO_2 at a 100 per cent reduction. For a reduction volume of about 3.5 million tonnes of CO_2, this covers about DKK 200 million higher total costs for society. This is because the highest CO_2 tax rate increases from DKK 500 per tonne of CO_2 to DKK 950 per tonne of CO_2, which means that some reduction measures are more expensive. In the model with a 100 per cent reduction for the emissions allowance price, the tax in the non-ETS sector must therefore be set relatively high in order to achieve a reduction of approximately 3.5 million tonnes of CO_2, which means that the tax increase and subsidies for CCS will result in less revenue overall. The model, therefore, incorporates a financing contribution from a 0.02 percentage point increase in the basic tax rate, which also increases the socioeconomic costs.

The increase in the tax rate at higher reductions is linked to the fact that a very large part of the reductions will in any case have to be found within the ETS sector, as almost 70 per cent of emissions from industry, business, non-road transport and electricity production comes from companies that are part of the EU ETS.

Therefore, if the same reduction is to be achieved with a higher emissions allowance price reduction, the natural consequence is also that the CO_2 tax in the non-ETS sector will have to be set so high that, despite the reduction in the ETS sector, there will still be a relatively high CO_2 tax in the ETS sector and thus a risk of displacement and leakage among certain industries.

A higher emissions allowance price reduction would shift the overall burden of the CO_2 tax from the ETS sector to the non-ETS sector. It follows naturally from the reduction and is also shown in *Figure 4.3* that all ETS areas experience a *smaller* burden at larger reductions, while all non-ETS areas experience a *larger* burden.

Since the models are calibrated to the same reduction level, a shift in the burden will similarly shift the distribution of reductions. Therefore, a larger reduction in the emissions allowance price will result in a larger share of reductions taking place outside the ETS sector.

Since the CO_2 emissions are largely concentrated on the ETS companies, models with a partial or full reduction for the emissions allowance price will thus cause the concentration on the companies to be slightly reduced, while, on the contrary, there will also only be a limited increase in the socio-economic costs.

Seen in isolation, a emissions allowance reduction should be justified by other arguments than only exempting the most CO_2-intensive companies. As explained in Chapter 2, the Expert Group recommends that a reduction in the emissions allowance price should be based on a trade-off between low socio-economic costs, a consideration of the higher risk of leakage for ETS-coveredcompanies, a reasonable test of the same marginal price for companies inside and outside the ETS sector, and the importance of free emissions allowances for the real tax and emissions allowance pressure on the ETS sector.

4.5 Basic deduction

The purpose of a basic deduction in the CO_2 tax is to redistribute the total tax burden across companies. In this way, a larger share of the total CO_2 reductions comes from technical reductions rather than changes in the size of different sectors, reducing the risk of leakage. However, basic deductions also give rise to implementation, state financial, EU legal and administrative challenges.

4.5.1 General information on the basic deduction

When introducing a basic deduction, a decision must be made as to which companies are entitled to the deduction, and how the deduction should be designed, as well as how the basic deduction is achieved.

In general, the following types of basic deductions can be identified:

- Deduction based on historical emissions: The basic deduction can be based on historical emissions/energy consumption in a previous base period. This lowers the overall tax burden without marginally weakening the incentive for companies to reduce their emissions. This is because companies continue to save the full CO_2 tax for each tonne they reduce their emissions (provided that unused basic deductions can be paid).

  However, a fixed basic deduction, which is independent of the company's current production, also means that the CO_2 tax has a full effect on the companies' marginal costs. In addition, it may be inappropriate for companies with declining production to receive a deduction based on historically higher production while companies with increasing production obtain a deduction based on historically low production. For new companies, there will be no deduction if the base deduction is based on purely historical emissions. Overall, this can have a negative impact on business dynamics and productivity in society. Furthermore, a protection rule will be needed to ensure that the basic deduction is not given in the event of a sale, closure or relocation of large parts of the company.

- Activity-based basic deduction: If a basic deduction is to have an effect on relocation and industrial structure, it must be conditional on business activity being maintained in Denmark. Therefore, a basic deduction in a CO_2 tax can be based on a target for the company's production. This implies that if production increases, a proportional increase in the basic deduction is triggered, which counteracts the cost-driving effect of the CO_2 tax. Thus, the basic deduction reduces the marginal cost of production for the company while preserving the marginal incentive to reduce emissions through technological change. The basic deduction will be able to include new companies in that their deduction is based on a benchmark for, for example, the relevant industry.

The basic deduction can either be given to all companies or in a targeted way, so that it is especially CO_2-intensive and competitive companies that receive it – for example all ETS-coveredcompanies or only companies that receive free emissions allowances.

The advantage of basing the basic deduction on recipients of free emissions allowances is that the group of companies is well defined and small, and that the companies are both CO_2-intensive and competitive. A disadvantage may be that free emissions allowances are allocated on the basis of common European criteria for the risk of leakage from the EU area to third countries, assessed in terms of trade flows between the EU and the rest of the world. However, the introduction of a Danish CO_2 tax on ETS-covered companies also creates a risk of leakage from the Danish ETS sector to other EU countries, and this risk is not necessarily captured by the current criteria for the allocation of free emissions allowances. There may therefore be companies with a significant risk of leakage that are not allocated a basic deduction.

In general, it is noted that the more businesses covered, the greater the administrative challenge will be. Conversely, targeting may pose challenges in terms of state aid and is also likely to lead to ongoing pressure for more companies/industries to be covered. Challenges in implementing basic deductions in practice are detailed below.

4.5.2 Activity-based basic deduction in practice

The above section describes the effect of an activity-based basic deduction if it is fully arranged according to the theoretical principles. In practice, however, the effect of an activity-based basic deduction will depend on the specific target of the company's output on which the deduction is based. This could be Danish physical production or value creation.

An activity-based basic deduction would increase the activity at which the subsidy is targeted. The purpose of an activity-based basic deduction is precisely to increase activity and thus counteract industry structural reductions. However, the basic deduction would also provide an incentive to distort production so that a larger base is subject to the basic deduction. These inappropriate distortions of business behaviour will increase the socio-economic costs and may lead to changes in business production and thus their CO_2 emissions.

In the following, distortions in the behaviour of companies are elaborated for a basic deduction targeting physical production and value creation respectively.

A basic deduction based on Danish physical production would act as a subsidy for the production of these goods. If a basic deduction is based on the physical production of goods, each type of good receiving a basic deduction would have to be defined. For example, for steel production, this would be a basic deduction of DKK x per tonne of steel produced in Denmark. For example, if there are two types of steel, there must be two types of basic deductions for steel.

Depending on how the products covered by a basic deduction are defined, consumption will be skewed towards these types of products. For example, to the extent that the subsidy is given to CO_2-intensive production, it will shift production towards CO_2-intensive products.

In addition, a basic deduction for all product variants would require detailed knowledge of the CO_2 intensity of each product. Thus, there will be significant implementation challenges associated with setting up this type of basic deduction while requiring annual reviews in the form of, for example, auditor's statements and the like.

This argues in favour of targeting the basic deduction to a few defined groups of products that are particularly prone to leakage. These can be, for example, products such as steel, iron, aluminium, cement and fertiliser.

If the basic deduction is applied to one or a few products, it must be examined whether a specific arrangement would be in line with the state aid rules. At first sight, it appears difficult to set up a basic deduction which is general in nature, targeted at activity and at the same time covers a number of specific products.

In relation to products such as steel, iron, aluminium, cement and fertilisers, it is noted that the EU Commission has proposed to include these product groups as part of their proposal for a Carbon Border Adjustment Mechanism (CBAM) to address the risk of CO_2 greenhouse gas leakage from the EU to third countries with less ambitious climate policies. The special status that these goods could have in terms of leakage is therefore minimised in relation to countries outside the EU with the introduction of CBAM. However, CBAM will not be a safeguard against leakage to other EU countries.

Alternatively, given the difficulties in quantifying the output of individual companies in physical units, the activity subject to a basic deduction may be measured by the value added based on the companies' VAT accounts.

If the basic deduction is to be based on domestic activity, export sales must be included in the value added, while import expenditure must be deducted. In addition, there will be an incentive for companies to shift their economic activities to those entities that have a basic deduction. For example, by acquiring taxable companies, changing transfer prices or moving non-CO_2-intensive processes in-house. This increases the value added and the base covered by the basic deduction.

Targeting a basic deduction to CO_2-intensive companies raises further practical problems. Experience has shown that it is difficult to distinguish between energy-intensive and non-energy-intensive companies on the basis of general criteria when determining the basic deduction. In particular, companies may have both energy-intensive and non-energy-intensive production, whereby it is really the individual activities of the company that need to be assessed. Moreover, a tax relief dependent on specific circumstances provides an incentive for artificial divisions of companies in order to have part of the company covered by the reduced taxes.

The implementation, administrative and state aid issues with the basic deduction, which are described above, can make the basic deduction a more unsuitable instrument for countering leakage compared to other methods, such as the combination of relaxed tax rates and subsidies, *see Chapter 2*.

4.5.3 Models with basic deduction

On the basis of the above, the impact of an activity-based basic deduction has been estimated. The calculations do not include distortions from targeting a basic deduction in practice, *see section 4.5.2*.

To counter the risk of leakage, a basic deduction or, alternatively, a tax reduction could be included in the uniform CO_2 tax for competitive and CO_2-intensive companies. In the following, models with respectively basic deductions and relaxed tax rates are compared, where tax rates incl. basic deduction roughly corresponds to the relaxed tax rates.

First, models are compared in which a basic deduction and a reduced tax rate are given respectively exclusively to mineralogical processes, etc.

In model B.1, a base deduction of about 76 per cent is given for mineralogical processes, etc., so that the tax rate including the base deduction amounts to about DKK 100 per tonne of CO_2. In model B.2, the tax rate is reduced to DKK 100 per tonne of CO_2 for mineralogical processes, etc. In both models, there is a reduction in the tax rate for the emissions allowance price of 50 per cent.

Model B.1 also provides a subsidy for CCS from negative emissions equal to the tax rate in the non-ETS sector. In model B.2, there is an additional revenue, given that there is no cost for the basic deduction. Therefore, additional subsidies are given to CCS so that the remaining revenue in the two models is the same.
The calculations show that a basic deduction ensures a large proportion of technical reductions, and a very precise return of revenue to the companies that are affected by the CO_2 tax. The calculations thus confirm the theoretical result that introducing a basic deduction for a given tax rate lowers the industrial structural effects on the economy but preserves the incentive for technical reductions corresponding to the marginal tax rate.

However, the calculations also indicate that in the two models, there are largely the same industrial structural and technical reductions as well as the level of socio-economic costs, *see Table 4.3*.

A model with a basic deduction for all ETS-covered sectors is then compared with a model with correspondingly relaxed tax rates.

Model B.3 gives a basic deduction of about 86 pe cent for mineralogical processes etc. and about 50 per cent for the remaining ETS-covered sectors. In model B.4, the rate is relaxed for mineralogical processes, etc. to DKK 100 per tonne of CO_2, and there is a reduction in the tax rate for the emissions allowance price of 50 per cent for the remaining ETS sectors.

In model B.3 with a basic deduction, the marginal tax rate of DKK 750 per tonne of CO_2 for all sectors means that CCS will be undertaken for both fossil and negative emissions up to this marginal cost. In model B.4 without a basic deduction, subsidies for CCS are given for both fossil and negative emissions, so the models do not differ on this point. In model B.4, there is an additional revenue, given that there is no cost for the basic deduction. Therefore, additional subsidies are given to CCS compared to model B.3, so that the remaining revenue in the two models is approximately the same.

The comparison of the two models gives the same overall result as for models B.1. and B.2, namely that they imply roughly similar industrial structural and technical effects. In addition, the socio-economic costs are lower in the basic deduction model, but the difference is limited, *see Table 4.3*.

As mentioned above, the basic deduction models do not take into account distortions in companies' behaviour responses, thus significantly underestimating the socio-economic costs and likely reducing the marginal costs of a basic reduction approach.

Overall, the calculations indicate that basic deductions are not a socio-economically cheaper method of reducing the risk of leakage for the most CO_2-intensive companies and companies exposed to competition than relaxed tax rates and subsidies for CCS.

Table 4.3. Comparison of main results for models with the same average rate at the base deduction and relaxed tax rates, respectively

2030		Model B.1	Model B.2	Model B.3	Model B.4
Rate (non-ETS/ETS/mineralogical processes, etc.)		*800/425*	*800/425/100*	*750*	*750/375/100*
CCS subsidy rate for fossil and negative emissions/only for negative emissions [3)]		-/800	-/825	-/750	825/-
Basic deduction		76 per cent for mineralogical processes, etc.	-	86 per cent and 50 per cent respectively for mineralogical processes, etc. and other ETS-coveredareas	-
CO_2 reductions					
2030	Million tonnes	3.5	3.3	3.5	3.5
Technical reductions	Percentage	66	67	71	71
Industry structural	Percentage	34	33	29	29
Financial consequences					
Immediate burden on business[1)]	DKK billion	2.5	2.5	2.2	2.2
Revenue after behavioural response and CCS [2)]	DKK billion	0.4	0.4	0	0
Macroeconomics					
Average shadow price	DKK per tonne	450	475	475	500
Marginal shadow price	DKK per tonne	800	825	750	825

Note: Revenue effects are rounded to the nearest DKK 50 million. Socio-economic costs are rounded to the nearest DKK 25 million. Totals may differ from the sum due to rounding. Rates are shown in 2022 prices, while revenue effects are shown in 2022 levels. It is assumed that the taxes are continuously indexed with the general price level. The return flow is calculated assuming a full spillover effect in wages, *see Section 2.4*. The computation assumes that any shortfall is covered by an increase in the lowest tax rate, and that any surplus in 2030 is used for a general reduction in corporate tax.
Note 1: Calculated excl. restructuring the space heating.
Note 2: Calculated after restructuring the space heating tax and subsidies for CCS.
Note 3: If the number is to the left of "/", then it indicates a subsidy rate for CCS for both fossil and negative emissions. If the number is to the right of "/", then it indicates a subsidy rate for CCS for negative emissions only.
Source: Own calculations.

4.6 Use of revenue

The tax models, where the revenue is not used for subsidies, leave additional revenue that can be used to reduce general taxes. This includes the main model 1.

As mentioned, it is fundamentally difficult to return the revenue to the companies and industries which are hit hardest by the CO_2 tax if this has to be done in the

general tax system. General tax breaks will typically not be targeted at these particular companies.
The following shows the effects of using the revenue to relax the corporate tax rate, which is the starting point of the models with excess revenue. *Table 4.4* shows the relief if the revenue from model 1 are used to lower the general corporate tax rate.

Table 4.4. Effects of a corporate tax cut in model 1

	Burden from CO_2 tax after adjustment	Reduction in corporate tax	Total burden after corporate tax	Number of employees
		DKK million		*Persons*
Transportation				
Ferries[1]	350	20	340	2,900
Fisheries	150	0	130	2,400
Railway[1]	50	0	30	6,900
Domestic flights[1]	50	0	50	400
Industry				
General process				
– Food, beverage and tobacco industry	*50*	*20*	*40*	*49,900*
– Chemical industry	*50*	*20*	*20*	*11,300*
	50	*10*	*10*	*77,600*
– Construction	*150*	*60*	*80*	*192,600*
– Machinery, electronics and textile industry	*0*	*190*	*-190*	*114,200*
Agriculture, etc.	250	10	260	64,700
Horticulture	50	0	50	3,700
North Sea	300	30	290	4,500
Refineries	200	0	220	500
Mineralogical processes, etc.	350	20	330	14,100
- of which cement[2]	*150*	-	-	*300*
Timber industry	0	0	0	8,800
Pharmaceutical industry	0	200	-200	24.400
Service				
Motor vehicles, retail and wholesale trade	0	260	-260	488,100
Financial service	0	310	-310	79,600
Other service industries	0	250	-250	750,700
Electricity and heating				
Electricity production	100	120	-20	21,200
Total	2,150	1,530	630	1,918,500

Note: The reduction in corporate tax is calculated using table SELSK3 from Statistics Denmark. The burden after adjustment is rounded to the nearest DKK 50 million, the reduction in corporate tax and the burden after corporate tax to the nearest DKK 10 million and the number of employees to the nearest 100 people.
Note 1: There is additional uncertainty in the calculations for the transport sectors excluding fisheries due to data challenges in separating rail transport from the remaining land transport and in separating the domestic transport for sea and air from the foreign transport, *see Table 2.5*.
Note 2: For cement production, it is not possible to calculate the reduction in corporate tax and hence the total burden after corporate tax.
Source: Own calculations.

The relief will mainly go to industries with little or no CO_2 emissions. Overall, there is thus no clear link between high CO_2 emissions and high corporate tax payments. The corporate tax cut is mainly allocated to the financial sector, the pharmaceutical industry and other large service industries and other industry. Conversely, mineralogical processes, etc., refineries and fisheries do not receive significant relief.

A relaxation of corporate tax can, however, have positive structural effects, which can counter the socio-economic loss that occurs from an increase in the CO_2 tax. Corporate tax cut provides a socio-economic gain by influencing the scope of investment and thus the capital apparatus per person employed and labour productivity. This causes general wages to rise.

Ultimately, as with the CO_2 tax, households are affected by a corporate tax cut through higher wages across the board. In addition, it is expected to have roughly the same distribution profile as the CO_2 tax. This may justify the allocation of surplus revenue from the CO_2 tax to a corporate tax cut.

Reduction of the general electricity tax

If you want to compensate the consumer more directly, you can alternatively lower other consumer-oriented taxes and fees. General personal taxes or a reduction in, for example, the general electricity tax could be considered. A reduction of the electricity tax is focused more towards the lower income groups than the corporate tax, as they spend a larger part of their disposable income on the consumption of electricity compared to the higher income deciles. Thus, in isolation, a reduction in the general electricity tax would be equivalent to a reduction in income inequality.

The introduction of a tax on fossil fuels for electricity production argues that there should not also be a tax on the consumption of electricity, as, in principle, there should not be a tax on the consumption of electricity from renewable energy sources. The reduction of the general electricity tax can be seen in the context of the fact that the electric heating tax and the electricity tax for process purposes only correspond to the Energy Taxation Directive's minimum taxes on electricity, i.e. respectively, 0.8 øre per kWh for households and 0.4 øre per kWh for businesses.

Main features of current regulation

5

5.0 Main features of current regulation

The Expert Group's considerations and recommendations should be seen in the context of the current regulation of greenhouse gas emissions. Today, there are energy taxes, a CO_2 tax and other taxes on fossil fuels, etc. There are also a number of subsidy schemes that intend to support the green transition.

In addition, there are emissions allowances on certain emissions as a result of the EU ETS. Taxes measured in terms of CO_2 emissions vary across sectors and fuels. There are areas with very high taxes on CO_2 emissions, and there are areas with low or no CO_2 tax. Subsidy schemes target CO_2 emissions only to a very limited extent. This chapter describes the current regulation in Denmark and the EU and compares the Danish tax system with CO_2 taxation in selected countries. Only direct regulation of CO_2 emissions has been considered, not other regulation that may have an indirect impact.

5.1 The current tax system

The current tax system related to greenhouse gas emissions consists mainly of energy taxes and a CO_2 tax on a part of the emissions. Since CO_2 emissions follow the consumption of individual types of fossil fuels, the taxes on fossil fuels will also be equal to taxes on CO_2 emissions.

The taxes mainly cover emissions from fossil fuels. Thus, non-energy related emissions are not subject to taxation. The non-energy-related emissions are, to a large extent, agriculture's emissions of greenhouse gases other than CO_2 as well as the emissions and uptake of CO_2e by forests and other areas (the so-called LULUCF sector)[18].

In addition to taxes, companies covered by the EU ETS pay a emissions allowance price for their marginal annual CO_2 emissions but receive part of the emissions allowances for free. Today, the vast majority of production by companies covered by emissions allowances is exempt from the Danish CO_2 tax in order to avoid double regulation (both emissions allowance payment and national CO_2 tax).

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[18] The category Land Use, Land Use Change and Forestry (LULUCF) covers emissions and removals mainly from forests and soils.

The current tax system includes a wide range of tax exemptions and differentiated tax rates according to CO_2 emissions.

The energy tax represents a relatively small burden on CO_2 emissions if used for production (so-called process) and is also differentiated according to sectors/production processes.

Energy taxes and a CO_2 tax encourage a reduction of the use of fossil fuels and thus CO_2 emissions. Energy taxes are currently balanced according to the energy content of fossil fuels, while CO_2 taxes are balanced according to the CO_2 content of each fuel.

Targeting energy taxes according to CO_2 content would change the tax burden on individual fuels. For example, coal has a high CO_2 content per unit of energy, while natural gas has a relatively lower CO_2 content per unit of energy. Thus, coal will have a relatively higher tax burden compared to, for example, natural gas. This will impact the total amount of fossil fuels used and thus on CO_2 emissions.

Differentiation in the level of taxes according to use has the consequence that the energy tax for production is relatively low for industry and that the tax for energy consumption in agriculture and horticulture, as well as for the so-called mineralogical processes, etc., is lower than for the rest of industry, *see Figure 2.4*.

Taxes are significantly higher for households than for businesses. However, it should be noted that businesses pay the same taxes as households for consumption for comfort heating in offices, etc. and hot water of a domestic nature (so-called space heating). Certain energy-related emissions are exempt, including emissions from the North Sea, refineries, shipping, aviation and rail transport. In addition, the tax burden is differentiated across fuels on a per tonne of CO_2 basis, *see Figure 2.4*.

All sectors covered by the EU ETS pay a emissions allowance price for their CO_2 emissions. Process emissions from industrial processes are not taxed, but the EU ETS covers the majority of emissions from industrial processes. Companies deemed to be at risk of relocating production outside the EU as a result of EU climate regulation are allocated free emissions allowances to varying degrees, *see Section 5.3*. Thus, recipients of free emissions allowances do not bear the full cost of the emissions. At the margin, however, free emissions allowance recipients continue to have the full incentive for CO_2 reductions, equivalent to the emissions allowance price.

Under current rules, some Danish companies with energy-intensive processes outside the ETS sector receive a basic deduction in their payment of the current CO_2 tax. The basic deduction was introduced to put it on equal footing with free emissions allowances at companies within the ETS sector, *see Section 4.5*.

Table 5.1 shows the structure of the current taxes (energy and CO_2) and emissions allowance price on CO_2 emissions.

In addition, there are taxes on certain industrial greenhouse gases (the fluorinated gases CFCs, HFCs, PFCs and SF_6), where the tax is balanced according to the level of the CO_2 tax.

In addition, there are energy taxes on electricity consumption. The purpose of the tax on electricity consumption is mainly fiscal. Lower electricity consumption will indirectly reduce CO_2 emissions to the extent that electricity is produced with fossil fuels. However, the taxes on electricity consumption are not targeted at reducing CO_2 emissions that occur in the production of fossil electricity. In addition, emissions from electricity production are covered by the EU ETS.

Table 5.1. Current tax and emissions allowance burden in 2022 by selected application areas

(2022 prices)	Energy tax	CO_2 tax	ETS [1]	Total
	DKK per tonne of CO_2			*DKK per tonne of CO_2*
Transportation				
Petrol[2]	1,978	179.2	-	2,021
Diesel[2]	1,133	179.2	-	1,237
Ferries	-	-	-	-
Fisheries	-	-	-	-
Railway	-	179.2	-	179.2
Domestic flights	-	-	601	601
Industry				
General process (non-ETS)	78.9[3]	179.2		258
General process (ETS)	78.9[3]	-	601	680
Agriculture, etc. (non-ETS)[4]	20.3-26.3[6]	179.2	-	200-206
Agriculture, etc. (ETS)[4]	26.3[3]	-	601	627
North Sea	-	-	601	601
Refineries	-	-	601	601
Mineralogical processes, etc. (energy)[5]	-	-	601	601
Mineralogical processes, etc. (non-energy)[5]	-	-	601	601
Electricity and heating				
Electricity production	-	-	601	601
Space heating (non-ETS)	661-1,482[7]	179.2	-	840-1,662[7]
Space heating (ETS)	661-1,482[7]	179.2	601	1,441-2,262[7]

Note: The above does not take into account the fact that a significant share of free emissions allowances is allocated, i.e. companies do not necessarily pay the emissions allowance price. The starting point is natural gas for space heating and process. The table excludes the SO_2 and the NOX taxes and any fiscal content of the tariffs. With the *Agreement on Green Tax Reform* , an increase in the energy tax for businesses by DKK 6 per GJ, which is phased in for general process from 2023 and agriculture etc. and mineralogical processes etc. from 2025. However, they have not yet been implemented and are therefore not included in the calculation.

1) The emissions allowance price varies over time. A emissions allowance price of approximately DKK 601 per tonne of CO_2, corresponding to the price in December 2021.

2) In addition to energy and CO_2 taxes, cars are subject to additional CO_2-related taxes on purchase and ownership (registration tax and green tax on ownership). The share of renewable fuels is assumed to be 9.8 per cent by volume for petrol (E10). For diesel, the share of renewable fuels is assumed to be 6.8 per cent by volume in 2022 (B7 diesel) and 12.8 per cent in 2030.

3) Calculated with emission factor for natural gas.

4) Agriculture, etc. pays either 1.6 per cent of the full tax or the actual EU minimum rate. These rates are relatively similar.

5) Includes mineralogical and metallurgical processes (cement, brickworks, glass, mineral wool (insulation), steel rolling mills, etc.). These are ETS-coveredand do not pay CO_2 tax.

6) Tax rates are for energy-related emissions from agriculture (calculated with emission factor for oil) and horticulture (calculated with emission factor for natural gas).

7) Taxes amount to DKK 661 per tonne CO_2 for coal, DKK 851 per tonneCO_2 for oil, DKK 1,284 per tonne CO_2 for natural gas and an average tax for fossil and biogenic waste amounts to DKK 1,482 per tonne CO_2.

Source: Own calculations

Greenhouse gas emissions from biomass combustion are calculated as CO_2 neutral according to international rules and the UN inventory methodology. International rules require that emissions from biomass are not accounted for when it is burned, for example, for energy purposes. Instead, they are recorded in the country where the biomass is harvested. For the same reason, biomass is included as a renewable energy source in, for example, CHP production and is not subject to energy taxes. From 30 June 2021, Denmark will have legal requirements for, among other things, the sustainability of wood biomass for energy that go beyond the EU's requirements. The legal requirements mean, among other things, that biomass from countries whose forests are in decline may not be used in Denmark unless it comes from sustainably managed forests or is a residual product.

5.2 Current subsidy system

There are today a number of different subsidy pools that intend to support the green transition, *see Box 5.1*.

The rationale behind the allocation of subsidy across the existing subsidy schemes has not been to provide a uniform subsidy per tonne of CO_2 displaced, but to promote different purposes such as renewable energy or energy efficiency improvements. When subsidies are given as *price support*, the subsidy is typically given per unit of energy and thus not per CO_2 unit. For pools where the subsidy is given as *start-up aid*, e.g. the current building and business pools, there is correspondingly no uniform subsidy per displaced tonnes of CO_2.

The current subsidy schemes that relate directly or indirectly to emissions from energy consumption and industry are primarily the following (the list is not exhaustive):

- Subsidy for renewable electricity production
- Subsidy for biogas
- Subsidy pools for households, businesses and the public sector for, among other things, energy efficiency improvements, switching to renewable energy or less CO_2-emitting fossil sources
- Basic amount pools
- Subsidy pools for new technologies (e.g. CCS and PtX) as well as research, development and demonstration.

There has been a move in subsidy schemes towards allowing technologies to compete against each other through technology-neutral tender.

One example is the technology-neutral tenders for renewable electricity production from 2018, where projects in onshore wind, solar cells, wave power, hydropower plants and open-door offshore wind turbines can apply.

The subsidies vary across applications and across technologies. The subsidies also vary in the way they are given. Subsidy is thus awarded both as a one-off subsidy for capital investment and as various forms of price support, which can function via CfD[19], guaranteed settlement price or fixed price supplement. In practice, this often means that subsidy levels and subsidy per unit of energy decrease over time and

[19] With "Contract for Difference" (CfD), an electricity price is offered. When the electricity price is below the bid price, the state pays the price difference to the bidder, and vice versa when the price is above the bid price.

that today different subsidy is given to the same technology depending on the time of deployment.

Box 5.1

Description of current subsidy schemes

Subsidy schemes for renewable electricity production (RE) include schemes to promote renewable energy, including electricity production from biomass, biogas, onshore wind turbines, offshore wind turbines and solar cells. The purpose of subsidies for renewable electricity production is largely to promote renewable energy sources by making them competitive compared to fossil energy sources.

The current schemes for biogas subsidy include biogas for transport, process and heating as well as upgrading of biogas which is fed into the gas network. The subsidy depends on the price of gas and the scale of biogas production, so there is considerable uncertainty about the expected cost of subsidisation up to 2030. The new biogas pool, established by the 2020 *Climate Change Agreement for Energy, Industry, etc.*, aims to support biogas upgraded and fed into the gas grid to displace natural gas.

A number of subsidy pools for households, businesses and the public sector were introduced in the *Energy Agreement 2018*, among other things, to replace oil and gas boilers with greener heating such as heat pumps and district heating. In addition, the Business Pool has been introduced with the aim of improving the efficiency and conversion of energy consumption by businesses, thereby reducing CO_2 emissions.

Basic amount pools cover some smaller pools targeted at former smaller Danish CHP plants and their customers. Basic amounts have historically been given to smaller natural gas-fired CHP plants to be available with electricity capacity but have now lapsed. The support, which is being phased out, consists of advisory efforts, subsidy for switching to renewable energy, handling stranded costs and subsidies for heat pumps on a subscription basis. In addition, an investment subsidy (start-up aid) to displace fossil fuels from district heating production.

The pools for developing new technologies include a new Carbon Capture, Use and Storage (CCUS) pool established by the 2020 *Climate Agreement for Energy, Industry, etc.* , which will promote carbon capture and storage to help deliver greenhouse gas reductions by 2030. Furthermore, it was agreed in the Finance Act 2022 that the capture of CO_2, etc., will yield 0.5 million tonnes of CO_2 reductions from 2025. EUDP funds can be applied to develop new energy technologies and aim to increase Denmark's supply security, considering the global climate and a cleaner environment.

Today, subsidy schemes for CCS have also been agreed upon, including subsidies for negative emissions from sub-agreement to the Finance Act 2022 *Investeringer i et fortsat grønnere Danmark* (Investment in a continued greener Denmark). CCS is immediately relevant for individual point sources within industry, waste incineration, biogas and biomass plants. By supporting CCS technology, it is estimated that significant CO_2 reductions can be achieved, although a significant subsidy is needed, *see Box 5.2*.

Box 5.2

CCS

Carbon Capture and Storage (CCS) works by capturing CO_2 and storing it underground. Via CCS, you can, among other things, capture the fossil or biogenic emissions from burning in waste incineration plants or capture the CO_2 that is released when lime is burned to make cement. One can also capture the CO_2 emitted when biomass is burned for energy production.

The technologies are known and used in certain forms already today commercially. However, there is limited experience with large-scale application in Denmark. There is therefore a need for the development and maturation of existing technologies. Today, it is estimated that about 90 per cent of the CO_2 emitted can be captured.

Based on the technical costs and the expected emissions allowance price, it is estimated with high uncertainty that about 3.3 million tonnes of CO_2 reductions can be realised by capture and storage of CO_2 from fossil and biogenic sources at an initial subsidy level increasing from tax and subsidy incentives in the range of DKK 600 to DKK 1,000 per tonne of CO2. The actual aid requirement depends on the tax rate.

Finally, it should be noted that in the case of a higher willingness to pay for CO_2, e.g. through a market where CO_2 is demanded for use in e.g. Power-to-X, the willingness to pay may exceed the estimated level of subsidy, which would, all else equal, reduce the effects of a CCS pool, but free up funds for other potential reductions.

5.3 EU commitments and targets for 2030 ("Fit for 55")

EU regulation contributes to a more level playing field, reducing the risk of leakage and relocation of jobs – both within and outside the EU. EU climate regulation consists mainly of the EU ETS, country-specific reduction commitments for the other sectors[20] through the so-called Burden-Sharing Agreement, and specific targets for renewable energy, etc.

The EU has raised its target for greenhouse gas reductions from at least 40 per cent to at least 55 per cent by 2030 compared to 1990. On 14 July 2021, the European Commission presented a major legislative package ("Fit for 55" package) proposing a number of directives and regulations to support the achievement of the increased target at EU level. The "Fit for 55" package has not yet been finalised but is described at the end of the chapter. Therefore, the current EU climate and energy rules, including the resulting obligations, will continue to apply.

5.3.1 Current EU regulation

In the EU ETS, greenhouse gas emissions from large installations, including most of the electricity, district heating and industrial sectors, and aviation within the EU are regulated.[21] The EU ETS currently has an EU target of reducing greenhouse gas emissions by 43 per cent by 2030 compared to 2005 levels. 57 per cent of

[20] These sectors are transport, agriculture, households, other industry, waste and a number of smaller, decentralised CHP plants.

[21] In addition, it is possible for the member states to include larger waste incineration plants in the ETS, which Denmark, among others, has used.

emissions allowances are sold at auction and 43 per cent are allocated as free emissions allowances to companies. The emissions allowances can be traded freely, and the emissions thus put a price on greenhouse gas emissions for the sectors covered. Emissions allowance trading should thus contribute to the cost-effective achievement of the pan-European objective.

Emissions allowances do not expire and can, in principle, be kept forever. Therefore, CO_2 emissions allowances can be equated with a financial asset. This implies that the valuation of emissions allowances is also projected as a financial asset. In the EU Commission's "Fit for 55" package, the Commission announced that it would tighten up the number of allowances in the current CO_2 emissions allowance system. This has put upward pressure on the emissions allowance price, which the latest projection from the Ministry of Finance expects to more than double by 2030 compared to the estimate used in the *Climate Status and Outlook 2021*, *see Figure 4.3 in Section 4.3*.

Free emissions allowances are allocated to companies with the aim of reducing the risk of businesses exposed to competition moving production out of the EU as a consequence of the EU's climate regulation being more ambitious than the regulation in countries outside the EU. Producers can save surplus free emissions allowances for later or sell them on the emissions allowance market. The free emissions allowances are allocated to producers on the basis of rules based on the quantity of product produced, e.g. tonnes of cement, mineral wool, bricks, etc., or on the basis of heat or fuel consumption depending on the products[22]. District heating producers are allocated emissions allowances based on the heat distributed to the district heating network, while no emissions allowances are allocated for the production of electricity, *see Box 5.3* .

Box 5.3
Allocation of free emissions allowances

The allocation of free emissions allowances is based on four factors:

1. The manufacturer's historical production as an estimate of the expected production.
2. The product's reference value based on the greenhouse gas intensity for the 10 per cent least greenhouse gas-intensive companies within each product. This should provide incentives to reduce emissions.
3. The product's leakage factor as an assessment of the risk of relocation based on international competition and greenhouse gas intensity.
4. A cross-sectoral correction factor that caps the proportion of total emissions allowances in the ETS that can be free emissions allowances. The cap is currently 43 per cent for the period 2021-30.

In 2020, 274 producers and aviation operators received free emissions allowances in Denmark, covering on average around 58 per cent of their emissions from 2018-2020. The amount of free emissions allowances is continuously reduced, and from 2021 free emissions allowances are adjusted to a new period in the emissions allowance trading period, so that in 2021 Danish companies received on average about 40 per cent of their emissions allowances for free. Towards 2030, the free emissions allowance allocation is expected to be further reduced, which however, depends on

[22] This is a broad category that covers several different activities, including steel plates, food ingredients and extraction of oil and gas.

negotiations on the revision of the EU ETS and the CO_2 limit adjustment mechanism as part of the "Fit for 55" package, *see below*.

There is a wide variation in the allocation depending on how exposed to leakage the different sectors are assessed to be, as well as how relatively CO_2-efficient Danish production is compared to the most CO_2-efficient within each product. For example, Danish cement production was allocated free emissions allowances equivalent to 69 per cent of their emissions in 2018-2020, compared to 18 per cent for the Danish utilities sector.

The *Burden-Sharing Agreement* implements a common EU reduction target of 30 per cent by 2030 compared to 2005 for the non-ETS sectors, including agriculture, transport, parts of individual building heating and non-ETS process energy consumption. Legally binding annual reduction commitments are distributed among countries based primarily on wealth levels. Denmark's reduction target is 39 per cent by 2030 compared to 2005. The reduction target in the Burden-Sharing Agreement can be achieved through national reduction measures and common EU regulation.

There is also the possibility of using flexibility mechanisms for redemption, *see Box 5.4*.

Box 5.4

Denmark's access to flexibility mechanisms in relation to. existing reduction commitment in the non-ETS sector (2021-2030)

Under the EU's current 2030 framework for climate and energy policy, Denmark has access to a number of flexibility mechanisms, including 1) LULUCF credits, 2) emissions allowance cancellation, 3) unlimited access to buy other member states' emission rights, 4) the possibility to defer the reduction commitment over time (banking and borrowing) and 5) unlimited access to purchase intra-EU project credits.

Denmark has the option of including LULUCF credits of up to DKK 14.6 million tonnes of CO_2e for the period 2021-2030, provided that the carbon balance improves by at least this amount in the LULUCF sector. The commission's proposal to revise the accounting rules could potentially change the number of LULUCF credits in Denmark.

In addition, Denmark has the option of using up to 8 million CO_2 emissions allowances, corresponding to 8 million tonnes of CO_2, through the flexibility mechanism emissions allowance cancellation for target fulfilment in the period 2021-2030, which is an option Denmark has maintained. The notification does not bind Denmark as to whether Denmark should specifically use emissions allowance cancellation as part of compliance under the Burden-Sharing Agreement.

With the latest *Climate Status and Outlook 2021*, Denmark is expected to have an accumulated reduction gap in the Burden-Sharing Agreement of 3 million tonnes CO_2e in the period 2021-30. It is estimated with some uncertainty that *Aftale om grøn omstilling af dansk landbrug* (Agreement on Green Transformation of Danish Agriculture) from October 2021 will reduce the accumulated emissions covered by the Burden-Sharing agreement sufficiently to meet Denmark's current commitments without recourse to Denmark's access to flexibility mechanisms. This does not include development measures from *Aftale om grøn omstilling af dansk landbrug* (Agreement on Green Transformation of Danish Agriculture).

The Energy Taxation Directive sets out a framework for Member States' taxation of energy products, including fossil fuels, used as motor fuel or heating and electricity.

The directive contains minimum rates for various energy products and electricity and sets the framework for the Member States' application of tax differentiations as well as mandatory and voluntary exemptions in energy taxes.

The directive does not apply to biomass in the form of firewood, charcoal, etc. Energy products used in refineries benefit from a mandatory tax exemption, while energy products and electricity used for power generation, railway, national navigation and aviation benefit from a voluntary tax exemption.

5.3.2 Overview of EU's "Fit for 55"

The Expert Group's work towards the final report is going on in parallel with negotiations on the "Fit for 55" package, which is not expected to enter into force until 2023-2026. The Fit for 55 package contains a wide range of climate and energy legislative proposals to support the achievement of the EU's increased reduction target of at least 55 per cent by 2030 compared to 1990. The overall proposals of the "Fit for 55" package are shown below, *see Table 5.2*.

The "Fit for 55" package is expected to have both a direct and indirect impact on meeting the 70 per cent target. These include economic implications, as well as implications for national obligations, minimum rates and the architecture of the tax system. For example, land and forest uptake and emissions (LULUCF) are counted in the EU's overall climate targets for the first time. It is noted that this has the potential to create an incentive for negative emissions at European level.

The EU ETS is being revised as part of the "Fit for 55" package with a proposal to strengthen the EU ETS, extend the system to include shipping and establish a separate ETS for road transport and heating of buildings.

As part of this, two changes to the allocation of free emissions allowances are proposed. Firstly, a reduced allocation of the free emissions allowances after 2026 is proposed for a number of products where it is assessed that there are opportunities for a technical conversion and thus greenhouse gas reductions, without this leading to (significant) leakage.

In addition, an independent bill proposes a Carbon Border Adjustment Mechanism (CBAM), which imposes a CO_2 price corresponding to the emissions allowance price on selected imported products. The proposal covers steel, iron, aluminium, cement, fertilisers and electricity production, with the possibility of later expansion to other sectors. As the mechanism is an alternative to free emissions allowances, a gradual phasing out of free emissions allowances for the covered products is introduced over 2026-2036. It will particularly affect CO_2-intensive companies and companies exposed to competition that currently receive a significant proportion of free emissions allowances.

The *Burden-Sharing Agreement* sets out tougher, binding reduction commitments for Member States in the sectors covered, which are mainly agriculture, transport and individual heating. Denmark is one of several countries to be awarded the highest reduction target in the covered sectors of 50 per cent by 2030 compared to the 2005 level. In addition, the European Commission proposes stricter targets and obligations in relation to revision of the Renewable Energy Directive and the Energy Efficiency Directive and, as something new, national reduction obligations for the LULUCF sector.

The national obligations for Denmark resulting from EU regulation should be taken into account when meeting Denmark's 70 per cent target.

The European Commission has also proposed a revision of the *Energy Taxation Directive* as part of the "Fit for 55" package. The proposal includes biomass in the taxable area. However, this only applies to firewood and charcoal but not to waste.

In addition, the possibility of applying tax exemptions to energy products and electricity for domestic shipping and aviation is abolished. In addition, the possibility of using tax exemptions for electricity production and railways will continue. Finally, the mandatory exemption for refineries is maintained.

Table 5.2. Proposals in the "Fit for 55" package

Proposal	Purpose
Strengthening the EU ETS with extension to maritime transport (revision). Separate ETS for road transport, heating of buildings (new)	Ensure a uniform CO_2 price that can drive the transition in the sectors covered by emissions allowance trading and across member states with a view to cost-effectively meeting the EU's climate goals.
Burden-Sharing Agreement (revision)	Commit EU Member States to reduce greenhouse gas emissions nationally through binding national reduction targets.
LULUCF (regulation of uptake and emissions from soils and forests) (revision)	Promote increased net uptake of CO_2 in forests and soils through national targets, including new national annual reduction commitments from 2026-2030.
CO_2 border adjustment mechanism (new)	Address the risk of carbon leakage – i.e. relocation of CO_2-intensive production from the EU to third countries with a less ambitious climate policy – as well as giving third countries an incentive to increase their climate ambitions.
CO_2 standards for cars and vans (revision)	Increase CO_2 standards for cars and vans to promote the transformation of road transport.
Directive for renewable energy incl. increase in renewable energy targets (revision)	Raise the level of ambition for renewable energy deployment in the EU.
Directive for energy efficiency incl. increasing energy efficiency targets, and the energy saving obligation (revision)	Raise the level of ambition for energy efficiency in the EU.
Energy Taxation Directive (revision)	Establish rules and minimum excise duty rates for taxation of energy products used as motor fuel and fuel for heating, as well as electricity
Sustainable fuels for air transport (new)	An increasing share of aviation fuel in the EU is sustainable and a level playing field for the aviation sector is ensured.
Sustainable fuels for shipping (new)	To promote the use of alternative fuels in shipping.
Regulation on the development of infrastructure for alternative fuels (revision)	Promote the development of alternative fuel infrastructure in the EU for vehicles, ships and aircraft.
Proposal for a new social climate fund (new)	To contribute to the transition towards climate neutrality by addressing social impacts on vulnerable groups resulting from the introduction of the new ETS for road transport and buildings.

Source: Climate Program 2021.

5.4 CO_2 taxation in other countries

It is generally difficult to compare tax systems across countries as there are differences in rates, bases, differentiations, exemptions as well as underlying factors, such as the share of renewable energy.

Most OECD countries tax fossil fuels with an energy tax and possibly a CO_2 tax[23]. The transport sector is taxed most heavily in the vast majority of OECD countries. In contrast, the remaining fossil emissions outside the transport sector are taxed more lightly. In particular, CO_2 emissions from industry and agriculture are usually taxed at a lower rate than the remaining fossil emissions of CO_2. The CO_2 tax rarely covers the majority of emissions, as each country has many different exemptions and relaxations, especially for industry and agriculture.

5.4.1 CO_2 taxes in Germany and the Netherlands

A number of countries (e.g. Germany and the Netherlands) have introduced new or higher taxes in recent years. The different tax systems make cross-comparisons difficult, but the basic point is that if other countries, in parallel with Denmark, increase CO_2 tax rates, including in particular countries with which Denmark trades a lot, this will lead to less risk of leakage.

From 1 January 2021, Germany has introduced a national CO_2 emissions allowance system covering fuels and heating oil not covered by the EU ETS. The German CO_2 emissions allowance system is implemented in two phases. During the first phase in the years 2021-2025, the emissions allowance price is set by law, increasing from DKK 186 in 2021 to DKK 409 per tonne of CO_2 in 2025. The price does not depend on the supply and demand of CO_2 emissions allowances and thus has the same effect as tax increases. In the second phase, from 2026, the price of CO_2 emissions allowances will be set on market terms, although a minimum of DKK 409 and a maximum of DKK 483 have been set for the emissions allowance price.

From 1 January 2021, the Netherlands has introduced a national tax on greenhouse gas emissions from industry covered by the EU ETS and waste incineration (which in the Netherlands is not included in the ETS).

The level of taxation is linked to the emissions allowance price in the EU ETS, whereby a tax is only paid to the extent that the national CO_2 tax rate is above the average annual price of CO_2 emissions allowances in the EU. The Dutch CO_2 tax thus has the character of an overall minimum price on CO_2 emissions. The tax will be phased in from 1 January 2021 from a level of DKK 223 per tonne of CO_2, rising linearly each year thereafter towards DKK 930 per tonne of CO_2 in 2030.

Industrial companies at risk of CO_2 leakage are granted so-called 'exemption rights' determined on the basis of reference values for free emissions allowance allocation in the EU ETS, *see Section 5.3.1.* Exemption rights can be traded between covered companies.

Revenue from the national tax is used to finance green activities in industry through so-called '*carbon contracts for difference',* where companies are awarded subsidies

[23] Source: OECD "Taxing Energy Use 2019: Using taxes for climate action"

up to a fixed price on CO_2 emissions, so that the subsidy rate is reduced as the CO_2 tax increases.

5.4.2 Comparison with CO_2 and energy taxes in Sweden

Based on the challenges of comparing effective taxation across countries, a more selective comparison of CO_2 and energy taxation can instead be taken as a starting point. A comparison with Sweden is obvious, as the country is similar to Denmark in many other respects and is also a high-tax country.

Denmark and Sweden are very similar in the overall tax structure and the overall level of taxation of CO_2 emissions. In both Denmark and Sweden, the taxation of fossil energy is divided into energy taxes and a CO_2 tax. However, Sweden has generally a higher CO_2 tax but lower energy taxes than Denmark, *see Table 5.3*. Sweden, like Denmark, does not have a broad and high uniform tax for all CO_2 emissions, as there are exemptions and reliefs for the CO_2 tax as well as areas that are not taxed.

Denmark and Sweden set energy taxes and the CO_2 tax differently. In Denmark, energy taxes in DKK per GJ and CO_2 tax in DKK per tonne of CO_2, respectively, are the same regardless of the fuel. The Swedish CO_2 tax varies between about DKK 750-890 per tonne of CO_2 for different fuels. Sweden adds several different fuels together at the same rate for both energy and CO_2 tax, even if there is a difference in the fuel's calorific value or its CO_2 emissions. The Swedish CO_2 tax is thus not fully targeted at actual CO_2 emissions.

Table 5.3. Danish and Swedish CO_2 and energy taxes on selected fossil fuels in 2020

	Energy tax		CO_2 tax		Total	
DKK per GJ	Denmark	Sweden	Denmark	Sweden	Denmark	Sweden
Petrol [1]	133.4	88.6	12.4	56	145.8	144.6
Diesel[2]	77.7	48.7	10.5	44.5	88.2	93.2
Heating oil	56.7	17.9	13.1	67.7	69.8	85.6
Fuel oil	56.7	16.2	13.8	61.3	70.5	77.4
Natural gas	56.7	17.9	10.1	45.9	66.8	63.8
Coal	56.7	17.9	16.8	84.5	73.5	104
DKK per tonne of CO_2						
Petrol [1]	1,904	1,265	177	799	2,081	2,064
Diesel[2]	1,312	823	177	752	1,489	1,574
Heating oil	766	242	177	915	943	1,157
Fuel oil	727	208	177	786	904	994
Natural gas	994	314	177	804	1,171	1,118
Coal	597	189	177	890	774	1,079

Note: Converted from Swedish trading units to DKK per tonne of CO_2 at Danish standard assumptions about density, energy content per tonne (GJ per tonne) and CO_2 per GJ. The Swedish rates are converted with the factor SEK 1 = DKK 0.71. 1) For petrol with forced blending of approximately 6.5 volume percentage of biofuel (indicated to reduce CO_2 by approximately 2.6 per cent). 2) For diesel with forced blending of 25 volume percentage of biofuel (indicated to reduce CO_2 by approximately 19.3 per cent).

Transport is the most heavily taxed sector in Sweden, but both Denmark and Sweden have broadly similar levels of total energy taxes and CO_2 taxes on standard petrol and diesel.

As far as individual and collective heating is concerned, space heating in households and the commercial sector is taxed relatively high in Sweden, just like in Denmark. Individual heating has roughly the same level of total energy taxes and CO_2 tax in Denmark and Sweden[24], while collective heating with fossil fuels is taxed slightly lower in Sweden than in Denmark.

Industry

Denmark and Sweden both have tax reductions for fossil fuels used for industrial and agricultural production (tractors and greenhouses) respectively. The overall level of taxes on CO_2 emissions is roughly the same for most industry in Denmark and Sweden. However, Sweden has significantly higher taxes on process consumption in industry outside the ETS sector and on agriculture.

In Denmark, the energy tax on fossil fuels for production in industry amounts to DKK 4.5 per GJ and for agriculture, etc., DKK 1.5 per GJ. In addition, industry and agriculture pay full space heating tax, which amounted to DKK 56.7 per GJ in 2020. In Sweden, there is no systematic distinction between space heating and process, but there are special reliefs for companies registered in agriculture and industry. In Sweden, 30 per cent energy tax is paid for industry for both process and heating. This means that the energy tax is about DKK 5.5 per GJ for natural gas for both production and space heating.

For consumption for production in industry *within* the ETS sector, both Denmark and Sweden exempt fossil fuels from CO_2 tax. Both Denmark and Sweden also exempt mineralogical processes etc. from both energy taxes and CO_2 tax. In addition, both countries exempt fuels for aircraft and ships as well as refineries, etc. from taxes.

For consumption for production in industry *outside* the ETS sector and agriculture (tractors and greenhouses), full CO_2 tax is paid on fossil fuels in both Sweden and Denmark. Since the CO_2 tax rates are somewhat higher in Sweden than in Denmark, the total Swedish taxes on CO_2 emissions are significantly higher for these sectors. For example, an industrial company using oil, 80 per cent of which is used for production and 20 per cent for space heating, would have to pay SEK 73.1 per GJ in Sweden and DKK 28 per GJ in Denmark.

Overall, the Swedish and Danish tax systems have broadly comparable structures and levels. The Swedish tax system is immediately more targeted at CO_2 emissions, but in practice, the Swedish CO_2 tax varies more than the Danish CO_2 tax. Moreover, the Swedish tax system covers fewer climate gases than the Danish one. Conversely, higher taxes have been agreed upon in Denmark for heavy industry (mineralogical processes, etc.) than apply in Sweden. Similarly, Danish taxes are higher on cogeneration from coal.

[24] For individual heating in households, the public sector and trade and service industries with Danish fuel mix, while taxes are slightly higher in Sweden with Swedish fuel mix.

Subsidy

6

6.0 Subsidies

A uniform CO_2 tax and corresponding subsidy for negative emissions is the most cost-effective way to meet the 70 per cent target.

The tax puts a price on CO_2 emissions, so the emitter pays for the negative effect the emissions have on the climate. A subsidy for technical conversion, on the other hand, lowers the price of one or more technologies that reduce CO_2 emissions. It can provide the same incentive to switch to the supported technologies as a tax on CO_2 emissions, but does not generally ensure that CO_2 emissions are priced in line with the negative impact on the climate. However, subsidies may be used as a means of promoting technological change and development, thereby reducing the decline in production and the changes in the size of different sectors that may result from the application of taxes.

Subsidies are a less cost-effective instrument than taxes for achieving CO_2 reductions, as it is challenging to target subsidies to the projects that businesses and citizens must use to reduce emissions most cost-effectively. One reason for this is that the government does not have full knowledge of possible measures and costs for each individual company. With a uniform CO_2 tax, the company's own information is used to achieve reductions as cheaply as possible. This is not possible with a subsidy, and there will therefore be higher socio-economic costs associated with subsidies.

Whether subsidies are an appropriate instrument thus depends on prioritising purposes other than cost-effectiveness. In addition, where the subsidy instrument is to be used, there are a number of issues to be considered, including the concrete design of subsidy pools.

The following describes considerations for granting subsidies in relation to current subsidies and in connection with the design of new subsidies in combination with a uniform CO_2 tax.

6.1 Subsidies for production and consumption

In general, subsidies can be given to producers of energy or to consumers of energy in the form of citizens and businesses. When subsidising the production of renewable energy (RE) or the use of CO_2e-reducing technologies, a number of principles must be taken into account, *see Table 6.1*.

Table 6.1. Principles for the organisation of subsidies

Subsidy for energy producers	Subsidy for energy consumers
• Fuels for electricity production are subject to CO_2 tax. Renewable energy is not subject to a CO_2 tax, and RE production should not be subsidised if the CO_2 tax is high enough to reach the given reduction target. • Biogas for the natural gas grid, taxed with the CO_2 tax, must obtain a subsidy equal to the tax (de facto tax exemption for biogas). • Any subsidy for the development of non-mature technologies should be explicitly justified in the guiding principles of the Climate Act.	• Incentives for energy efficiency, switching to renewable energy and switching to less emitting fossil technologies are addressed through the CO_2 tax. • The guiding principles of the Climate Act may in certain cases justify subsidies for CO_2-reducing technology, e.g. renewable energy technology or CCS.

6.1.1 Subsidy for energy producers

There is currently a subsidy for promoting renewable energy production from, for example, solar PV, onshore wind, offshore wind and biogas. The subsidy is not cost-effective in relation to the 70 per cent target. When introducing a CO_2 tax, this subsidy should be considered in the future and potentially phased out.

A uniform CO_2 tax on fossil fuels will cause the price of using fossil fuels to rise, which raises the price of fossil energy. A subsidy for renewable energy production can lower the price of renewable energy relative to fossil energy. Thus, in the same way as a subsidy for renewable energy production, a uniform CO_2 tax would create incentives for renewable energy production. Future subsidy for renewable generation should therefore be considered in the context of a higher and more uniform CO_2 tax on the use of fossil fuels. However, this will depend on the level of the CO_2 tax.

Biogas, a renewable fuel, is mixed in the gas grid with fossil gas, which means that all piped gas is taxed. It is currently not possible to separate biogenic and fossil gas in the gas network. Therefore, to obtain a *de facto* tax exemption for biogas, biogas fed into the gas grid must receive a subsidy equivalent to the CO_2 tax on natural gas.

The Expert Group recommends that subsidies for biogas production should initially be supported at a rate equivalent to the CO_2 tax rate on fossil gas, which is equivalent to the use of biogas being tax exempt. Other socio-economic positive or negative effects of biogas production than the displacement of natural gas consumption (so-called externalities) must be compensated for by additional or lower subsidies for biogas production.

There are currently several subsidy schemes for biogas. The subsidy for producing bio-natural gas fed into the gas grid varies from year to year and depends, among other things, on the price of natural gas. In the period 2021-2030, bio-natural gas producers are expected to receive an average subsidy rate of just over DKK 100 per GJ (2022 prices). This corresponds to a price of just under DKK 1,800 per tonne of reduced CO_2, assuming that bio-natural gas replaces natural gas. The conversion does not take into account other greenhouse gas reductions and emissions, such as reduced evaporation from slurry or methane emissions from biogas plants[25].

6.1.2 Subsidy for energy consumers

Citizens and businesses can now apply for a subsidy for energy efficiency improvements, switching to renewable energy or less CO_2-emitting fossil sources, among other things, through a number of subsidy pools. A uniform CO_2 tax on fossil fuels would increase the price of using fossil fuels. All other things being equal, it will provide incentives for energy savings and the use of renewable energy, just like the subsidy schemes.

A uniform CO_2 tax will provide an incentive to reduce emissions in the cheapest possible way for consumers, without choosing where the reductions will come from. The subsidy schemes do not do this. Therefore, a uniform CO_2 tax is more cost-effective.

Although taxes in principle ensure more cost-effective reductions than subsidies, the guiding principles of the Climate Act may in certain cases justify the use of subsidies, for example for companies exposed to competition. However, it should always be considered whether subsidies are the most effective instrument for a given purpose.

6.1.3 Possibility of reprioritisation

When introducing a higher and more uniform CO_2 tax, the interaction between the tax and the current subsidy system should be considered. For example, there may be an overlap in effects where the tax provides an incentive to change production or consumption if existing subsidy pools are designed for the same purpose in a given area.

At the same time, the EU's CO_2 emissions allowance price has increased significantly during 2021, *see Section 4.3*. In isolation, this increases the incentive for companies covered by emissions allowances to apply for subsidy pools to reduce the cost of emissions allowances. Conversely, the higher emissions allowance price in itself entails reductions within the ETS-covered sectors, which will mean that the

[25] In the conversion of subsidy per GJ to subsidy per CO_2 reduction, it is assumed for calculation purposes that bio-natural gas supplied to the natural gas grid displaces the consumption of natural gas 1:1. However, biogas production also affects greenhouse gas emissions both positively and negatively in other ways, including through lower agricultural emissions. Other externalities, such as improved nitrogen use or odour nuisance, associated with biogas production are not considered too.

subsidy need per CO_2 reduction, other things being equal, will be less after the increase in the emissions allowance price.

A number of existing subsidy pools could therefore be reconsidered, including whether funds could be reprioritised. However, it should be noted that several of the existing subsidy schemes are not only targeted at CO_2 reductions, but also serve other purposes, such as a number of EU obligations. There are also a number of legal issues associated with possible reprioritisation, including the fact that not all existing subsidy schemes can be abolished or reprioritised.
As a general rule, it is legally possible to reprioritise or cancel subsidies that have not yet been committed to specific subsidy recipients. If the funds are spent, there may be expropriation if the pools are reprioritised or abolished.

Within the area of the Ministry of Climate, Energy and Supply, the total existing subsidies for green transition are in the region of DKK 70 billion in the period 2022-2030. There are a number of these existing subsidy funds which have not yet been used and which can legally be reprioritised, or the pools can be arranged differently, *see Table 6.2*.

CO_2 effects, energy savings and economic effects of the existing pools have been factored into climate policy and economic projections, which, other things being equal, are changed by reprioritisation or abolition. Reprioritisation of existing subsidies may allow subsidies to be better targeted at CO_2 reductions. However, this will need to be investigated further. It should be noted that any reprioritisation would require political support from different signatory parties to the agreement.

Funding through reprioritisation of existing grant pools should also be seen in the light of the fact that it may lead to fewer distortions than other funding (e.g. raising more distortionary taxes).

The Expert Group recommends examining the extent to which existing pools can be re-prioritised and better used, particularly in the light of the introduction of a higher and more uniform CO_2 tax. The Expert Group will work further on subsidies as part of the final report.

Table 6.2. Overview of existing subsidy pools where reprioritisation is legally possible, 2022-2030 in DKK million in 2021 prices

	2022-2030	Of which contribution to recovery plan
Technology-neutral tendering	275	-
New pool for biogas	2,944	-
The building pool	1,400	137
The scrapping scheme	148	20
The decoupling scheme	400	40
The district heating pool	185	70
The business pool	2,420	220
Subsidy pool for green transition and targeted energy efficiency improvements	160	-
Expanded advisory efforts	4	-
Heat pumps on subscription	10	-
Energy improvements and digital solutions etc. in municipal and regional buildings	72	72
Pool for CCUS	3.830	-
Technology-neutral pool to support negative emissions (FL22)	2,011	-
EUDP funds	1,836	50
Non-distributed		
Sum	15,696	609

Note: Legal possibility for reprioritisation runs from 1 July 2022 up to and including 2030. Abolishing or reprioritising the pools could increase CO_2 emissions in the baseline.
Source: Danish Energy Agency

6.2 Organisation of subsidies

A subsidy pool must be arranged appropriately according to the purpose, for example, to ensure CO_2 reductions taking into account the guiding principles of the Climate Act, *see Box 6.1*.

Box 6.1

Principles for the organisation of subsidies

- Subsidies must not be used if taxes ensure the same purpose, as taxes are more cost-effective. Similarly, subsidies should not be used if other regulation can achieve the same objective more cost-effectively.
- Subsidies must be designed for the purpose. For example, subsidies may be intended to contribute to further reductions under the guiding principles of the Climate Act.
- Subsidies within the 70 per cent target should target CO_2 reductions and therefore be awarded per reduced tonnes of CO_2.
- Subsidies must be designed to achieve their objectives in the most cost-effective manner.
- The interaction between taxes, other regulation and subsidies must be considered.
- Administrative costs must be balanced against the impact of subsidies.

A subsidy that targets CO_2 reductions must be given with a subsidy rate calculated in DKK per tonne of CO_2 reduction. The subsidy can be given either as a start-up aid or as an activity-based subsidy. In the case of start-up aid, the aid is measured in proportion to the capacity of the aided installation to reduce CO_2 emissions, but not to the start-up of the installation, i.e. the actual reduction of CO_2 emissions. Start-up aid is either paid upfront or spread over a number of years. A ceiling may be set on the total payment of support to support budget security for the state. There will be administrative costs associated with setting up subsidies and disbursing funds. The administrative costs depend on the arrangement of the subsidy pool and will generally increase when the complexity of the pool increases.

In addition, some subsidy will be given to projects that would have been carried out without the aid. This will increase the socio-economic costs, as the need for financing through distortionary taxes increases.

Start-up aid can make it possible for companies to invest in a particular plant, but it can also provide an incentive to invest in plants, even when it is not the cheapest way to reduce emissions.

Activity-based aid will act as a production aid, with the level of aid depending on the production of the company, which may provide an incentive to maintain a higher level of production simply as a result of the subsidy. Activity-based subsidies may also pose some challenges under state aid law, as according to the European Commission, activity-based aid distorts competition to a greater extent than start-up aid.

The aid should not be based on reduction in energy consumption, as energy is produced with different CO_2 intensities. For example, reducing energy consumption based on renewable energy will not immediately reduce CO_2 emissions unless the renewable energy source is a scarce resource that has alternative uses. It is possible to calculate the aid in DKK per tonne of CO_2 reduction based on the CO_2 emissions of the companies and the CO_2-saving potential of the projects that are supported.

The subsidy can be targeted at green investments where it is expected that they would not have been carried out in the absence of the subsidy. Therefore, the design of the pool should seek to ensure that aid is given to companies that would not be able to undertake the investment without aid. In practice, however, it is difficult to target the subsidy to these investments, as companies that would have made the investment in the absence of the subsidy would also be able to apply for the subsidy.

Subsidy pools can either be set up with a fixed rate or through a competitive model, where the cheapest bids win, and where the rate is defined by the bids of the applicants until the pool is exhausted. A competitive pool (without targeting) would primarily benefit applicants who would have made the investments in the absence of the pool, and thus the pool would predominantly compensate for green investments. In addition, pools can be delimited according to the technical reductions included in the subsidy. Subsidies can thus be targeted at selected technologies, which, however, entails the risk of not supporting the cheapest technologies.

For subsidies for technologies such as CCS, where there may be few potential bidders, the design of the pool and the allocation of subsidy funds must take into account the limited competition. For example, negotiations could be held with the winner of a tender, where all the financial conditions of the project are presented to ensure that there is no overcompensation. Furthermore, for new, immature technology, there may be a need to ensure a certain risk sharing between the state and aid recipients.

6.2.1 Connection to the CO_2 tax

The number of applications for subsidies for projects that would have been carried out independently of the subsidy pool will increase when the subsidy scheme is introduced at the same time as a tax increase. This is because many of the projects that will be implemented in response to the CO_2 tax will also be eligible for subsidy.

In addition, part of the subsidy will go to companies that would have shut down without the subsidy due to the tax. With the subsidy, these companies will continue production with lower CO_2 intensity. In this case, the subsidy will not provide additional CO_2 reductions within the 70 per cent target, as emissions would otherwise have been reduced due to the shutdown of production. Thus, the subsidy may downwardly adjust the effect of a tax, but the subsidy will conversely in this case reduce changes in the size of different sectors and thereby meet the guiding principles of the Climate Act. The subsidy will contribute to changing part of the reductions from a decline in production into technical reductions, so that the existing business structure can be preserved to a greater extent.

Subsidy pools should generally be considered in terms of administrative costs, feasibility for government, industry and households, socio-economic costs, etc. Furthermore, the setting up of a subsidy scheme must be in line with EU state aid rules. For example, depending on the specific rules, there may be limits on the maximum proportion of aid for capital costs.

The work focused on the future

7

7.0 The work focused on the future

The work of the Expert Group is divided into two reports, which together form a comprehensive analysis. This first report contains recommendations for changing taxes from energy to a more direct tax on CO_2 and expanding the tax base to well-defined areas.

The final report will be presented in autumn 2022 and will initially address all emissions covered by the 70 per cent target, including agriculture.

7.1 The final report

With the final report, the Expert Group will elucidate models for a more uniform CO_2e regulation, taking into account the guiding principles of the Climate Act.

As part of this, the expert group will analyse different tax levels and phase-in profiles up to 2030, as well as their economic and practical consequences. In the final report, the Expert Group will consider all emissions covered by the 70 per cent target, including road transport and non-energy emissions from agriculture.

This includes a position on whether to fully reform energy taxes on space heating, petrol and diesel in the long term. In addition, consideration could be given to a further alignment of tax levels across applications. In the final report, the Expert Group may also examine whether a restructuring of tariffs is appropriate in the context of uniform CO_2e regulation.

Finally, the terms of reference state that the Expert Group should make suggestions on possible ways to construct compensation mechanisms, including, among other things, subsidy schemes and linkages to existing subsidy pools, general measures and other possible mechanisms, including European regulation and the EU ETS.

Recommendations in this first interim report should thus be seen as part of an overall analysis towards a more uniform CO_2 regulation of all covered emissions, including a more uniform CO_2 tax.

The Expert Group will work on the final report on the basis of the same principles as this report. The Expert Group may revisit principles and recommendations from the first interim report in the final report.

The final report must contain various scenarios that contribute significantly to achieving the 70 per cent target, taking into account the guiding principles of the Climate Act.

7.2 Recommendations for regulating agricultural emissions

The final report will address the regulation of CO_2e emissions from agriculture and forestry. The Expert Group was established in early 2021. In the meantime, a broad majority (S, V, DF, SF, RV, EL, K, NB, LA and KD) has in October 2021 concluded *Aftale om grøn omstilling af dansk landbrug* (Agreement on Green Transformation of Danish Agriculture), which will support the green transformation of the agricultural and forestry sector until 2030.

With the agricultural agreement, a binding reduction target for the agricultural and forestry sector's greenhouse gas emissions (excluding energy-related emissions) of 55-65 per cent in 2030 compared to 1990 has been agreed upon. This corresponds to an additional reduction of around 4-6 million tonnes of CO_2e from the sector, in addition to the concrete measures that have been decided with the agricultural agreement. With the agricultural agreement, development measures are launched at the same time, which are estimated to have technical reduction potentials in the agricultural and forestry sector of approximately 5 million tonnes of CO_2e. The development measures include, e.g. new technologies such as feed additives, manure and fertilizer management and pyrolysis.

There is currently no comprehensive regulation of greenhouse gas emissions from agriculture and forestry that provides sufficient incentives to reduce overall greenhouse gas emissions from the sector.

The terms of reference state that the final report should, therefore, "*include an assessment of the advantages and disadvantages of a regulatory solution for the agricultural sector, a subsidy solution within EU agricultural subsidy and a CO_2e tax for this sector, or a combination of these, as well as possible measures for cost-effective regulation of agriculture that address CO_2e emissions and other externalities, including, e.g. environment and health. [...] It must also include an assessment of the advantages and disadvantages of different solutions for emissions from agricultural land and other emissions from LULUCF that the Expert Group considers relevant to highlight*".

The Expert Group's recommendations for future regulation of greenhouse gas emissions from agriculture and forestry can thus make a significant contribution to securing the reductions needed to meet the sector's binding reduction target and the national 70 per cent target by 2030.

Appendices

8

8.0 Appendices

8.1 Terms of reference for the green tax reform

This chapter reiterates the terms of reference.

8.1.1 Purpose and background

The agreement on Green Tax Reform reached between the Government (Social Democrats), the Left Party, the Radical Left Party, the Socialist People's Party and the Conservative People's Party on 8 December 2020 states that a CO_2e tax should be a key instrument for achieving the 70 per cent target, taking into account the guiding principles of the Climate Act, including sustainable business development and Danish competitiveness, sound public finances and employment, a strong welfare society, social cohesion and social balance, and thus real CO_2e reductions (minimising CO_2e leakage) and without overall job losses abroad.

In the short term, taking the first and essential steps towards a more uniform CO_2 tax is possible. However, in a number of areas, appropriate tax models will require further development, and EU legal, administrative and implementation issues will need to be examined.

The government and the parties to the agreement have therefore agreed to implement the green tax reform in two phases. The first phase will focus on adjustments within the existing tax system as well as extensions to well-defined areas. The second phase will set the framework for a uniform CO_2e tax.

It is the ambition of the parties to the agreement that in 2030, Denmark will have a uniform CO_2e tax taking into account leakage effects, etc.

8.1.2 Tax structure

A uniform CO_2 e-tax on all emissions is the most cost-effective way to ensure that the 70 per cent target is met, as it sets a uniform price for the emission of greenhouse gas equivalents, with which the reductions across sectors take place where they are cheapest.

Danish CO_2 emissions from fossil fuels are currently taxed with a combination of climate and energy taxes. In addition, parts of industry and large energy and combustion plants are covered by the EU ETS. One of the aims of the tax system is to favour companies in competition with foreign companies. The industries exposed to competition (e.g. mineralogical processes, etc., electricity production and agriculture) therefore pay the lowest energy taxes or are completely exempt from paying energy taxes. Conversely, other businesses and Danish households are taxed more heavily, for example, in connection with heating and their consumption of petrol and diesel.

In addition, the current tax system is characterised by significant variations in the level of taxation depending on the use of fossil fuels.

Under the current tax system, for example, companies pay a much higher tax to heat their buildings than to produce their goods. Taxes on space heating for buildings amount to about DKK 1,300 per tonne of CO_2, while taxes on industrial processes in production amount to about DKK 0-250 per tonne of CO_2. Similarly, subsidies per tonne of CO_2 vary significantly across areas.

Overall, there are high taxes on CO_2 emissions from fossil fuels used for transport and for general heating in houses, etc. Mineralogical processes (cement production etc.) and fossil fuels for electricity production are effectively tax-exempt in the current tax system, but covered by emissions allowances, just as non-energy-related emissions from agriculture, such as methane from cattle or nitrous oxide from fertiliser use, are also tax-exempt.

However, non-energy agricultural emissions of methane from livestock, nitrous oxide from fertiliser application and carbon sequestration on agricultural land need to be seen in the context of other regulated nutrient emissions. However, there is currently not a sufficient basis to tax CO_2e from all non-energy agricultural emissions.

Thus, restructuring the tax system, including a shift from energy taxation to CO_2, would imply a major restructuring that would have to be seen in conjunction with national subsidy schemes, the EU Energy Taxation Directive, the EU Emissions Trading Directive and the state aid rules, as well as forthcoming proposals to revise EU climate and energy legislation, including the Energy Taxation Directive and the EU Emissions Trading Directive, expected in mid-2021. Among other things, the EU Commission is expected to propose strengthening the ETS and models for extending ETS to additional sectors, including road transport and individual heating of buildings.

8.1.3 Tasks of the Expert Group

The Expert Group will be tasked with developing models for uniform CO_{2e} regulation, including the design of a more uniform CO_2e tax. A comprehensive analysis will be provided in the form of sub-reports assessing the impacts of different models for a more uniform CO_2e tax. Therefore, the optimal tax structure must be explained in relation to the 70 per cent target, and any derived conditions, including other regulation of other externalities, administrative conditions and barriers to national regulation, must be explicitly stated.

The Expert Group will develop different scenarios that contribute significantly to the 70 per cent target by 2030.

The Expert Group will also consider how to operationalise the guiding principles of the Climate Act. In this context, the Expert Group should present different scenarios that weight the considerations differently (e.g. weight leakage high or low). The starting point for all the scenarios should be that they deliver the cheapest socio-

economic solution. To the extent that this consideration is departed from, reasons must be given.
The Expert Group should aim for scenarios that are revenue neutral overall and support GDP and labour supply in a socially balanced way. However, the proposals need not be revenue-neutral year-on-year. The Expert Group should also include a proposal where taxes and duties do not increase overall.

In addition to the end goal, different phasing-in scenarios must be created, including sensitivity scenarios with regard to uncertainty associated with the projections. Uncertainties in the phasing-in scenarios need to be taken into account. Among other things, these scenarios should be seen in the context of meeting the 2025 target.

Each scenario should highlight the following:

Socio-economic: The total socio-economic impact measured by distortion losses both in total and as a share of CO_2e reduction (shadow price).
National economic consequences: Revenue, including tax burden, GDP, labour supply, competitiveness and employment, burden on industries (including detailed industry breakdowns) and households. These consequences must be outlined in the short term (adjustment/transition costs) and structurally.
Emissions, leakage and environmental impact: $CO2_e$ reductions, CO_2e leakage, contribution to EU climate targets and other environmental impacts etc. (externalities), if deemed relevant.
Social balance: distributional effects, GINI, regional differences, etc.

In addition, the work must consider the fact that technological development is uncertain and that this uncertainty has consequences for the socio-economic costs of meeting the 70 per cent target. As a result, the Expert Group will look at the technological conditions and opportunities across each sector, including the current and future technological options for restructuring.

The work of the Expert Group will ensure that the proposed CO_2e regulation best supports the introduction of new resource-saving technologies for both industry and agriculture.

Finally, the Expert Group's proposals must be implementable and take into account regulatory, EU legal, systemic and administrative implications. Consideration must also be given to the proposal's compliance with the energy taxation directive, a possible proposal for a new energy taxation directive, the EU's state aid rules and other relevant international regulation. This must be seen in the light of the fact that the development time and implementation time for initiatives in the tax area, including new tax structures, is considerable.

The work must also be considered in conjunction with other climate policy measures, including current subsidy pools and agreement schemes, etc., and regulation of other environmental impacts (externalities).

It must be ensured that the rescheduling of phase 1, where the rescheduling of the agreed increase in DKK per GJ balanced by CO_2 must be consistent with the long-term solution.

An interim report will be prepared at the end of 2021 in order to be able to convene the contracting parties for discussions at the end of 2021 on the basis of the report. Final reporting will take place in autumn 2022.

8.1.4 Content of the first interim report

The first interim report will describe the overall architecture for a uniform CO_2e regulation, including leakage, the link with the 70 per cent target and the emissions allowance system (current and future) and subsidy schemes, as a basis for working towards the concrete models to be included in the final report. If possible, the first report may also include recommendations for the level of a uniform CO_2e tax in 2030.

As a step towards the final architecture for a more uniform CO_2e regulation, the first interim report will outline a model for shifting energy taxation to a more direct tax on CO_2e emissions.

With the first phase of a green tax reform, the government and the agreement parties have agreed to increase the energy tax on fossil fuels for businesses by DKK 6 per GJ. This element is expected to lead to reductions in climate-changing emissions of around 0.5 million tonnes of CO_2e by 2025.

At the same time, the Expert Group will work towards broadening the tax base to areas that are relatively well-defined, including CO_2 emissions from oil and gas extraction and refining, CO_2 emissions from mineralogical processes, etc., fossil fuels for electricity production and any other CO_2 tax exemptions that the Expert Group considers relevant to include in the first phase.

When changing from energy taxation to CO_2 taxation must take into account, among other things, the fossil content (in the form of plastics, etc.) of the waste volumes from waste incineration for district heating, as well as how coal can be phased out in district heating. Furthermore, the impact of the district heating price cap, e.g. on surplus heat from surplus heat suppliers, as well as the space heating tax on individual and collective space heating, needs to be clarified.

The Expert Group must identify appropriate compensation and feed-back mechanisms. The compensation mechanisms can, for example, be in the form of basic deductions, subsidies, differentiated rates and/or delayed phasing in of taxes as well as more general compensation measures.

The Expert Group should also assess the interaction between the extended tax base, national subsidy schemes and the European ETS system to ensure a uniform CO_2e regulation. In particular, whether it would be appropriate to give a deduction in the CO_2e-tax for emissions allowance payments must also be addressed. In addition, for comparison, CO_2 taxation in other relevant countries can be looked at.

8.1.5 Content of the final report

With the second report, the Expert Group will elucidate models for a more uniform CO_2e regulation of all covered emissions. Including different tax levels and phase-in profiles up to 2030 and their economic and practical consequences.

The second report will also assess the advantages and disadvantages of a regulatory solution for the agricultural sector, a subsidy solution for EU agricultural subsidy and a CO_2e tax for this sector or a combination of these, as well as possible measures for cost-effective regulation of agriculture that address CO_2e emissions and other externalities, including, e.g. environment and health. Farm accounts are a prerequisite for CO_2e taxes on agriculture. It is assumed that this work will be carried out separately. In addition, an assessment of the advantages and disadvantages of different solutions for emissions from agricultural land and other emissions from LULUCF must be included, which the Expert Group deems relevant to highlight. Future EU legislation in this area, including a potential new approach to regulating the climate impact of agriculture through the revision of the EU Burden-Sharing Agreement and LULUCF regulation and a separate agricultural pillar in the EU emissions allowance system, will be taken into account.

Finally, the Expert Group must come up with proposals for possible ways to construct compensation mechanisms, including, among other things, basic deductions, subsidy schemes, differentiated rates, delayed phasing in and connection to existing subsidy pools, general measures and other possible mechanisms, including European regulation and through the ETS. Compensation mechanisms should also be seen in the light of, among other things, leakage, competitiveness of companies and employment. This should take into account the wide variation in the burden on business both between and within sectors. Proposals for compensation mechanisms must be weighed against other effects thereof.

The work could involve the whole tax and subsidy system, including deductions, exemptions, compensatory measures and grant schemes, whether as a contribution to climate objectives, a financing element, or to address other unintended effects of the reform, such as distributional concerns.

8.1.6 Organisation of the Expert Group

The commission will consist of an external chairman and, in addition, five external members.

In addition, heads of departments from the Danish Ministry of Taxation, the Ministry of Finance of Denmark, the Danish Ministry of Climate, Energy and Utilities, the Ministry of Industry, Business and Financial Affairs and the Minister for Food, Agriculture and Fisheries of Denmark participate in the discussions. Heads of departments from other ministries are involved as needed.

The Expert Group will be provided with an independent secretariat composed of officials from the ministries involved and co-chaired by the Danish Ministry of Taxation and the Ministry of Finance of Denmark.

In addition, a follow-up group to the expert group will be established, consisting of the Confederation of Danish Industry, the Danish Chamber of Commerce, Green Power Denmark, the Danish Agriculture & Food Council, the Danish Trade Union Confederation, Kraka, Concito, Green Transition Denmark, the Danish Council on Climate Change and the Secretariat of the Danish Environmental Economic Council. The follow-up group can function as a useful knowledge bank for the commission. In this way, the follow-up group will be able to contribute current and relevant knowledge to the Expert Group's work on, e.g. the technological development, incentives and economic conditions. In addition, the Expert Group may use external experts, including when ordering external analyses.

8.2 Leakage

The terms of reference state that greenhouse gas regulation should be described taking into account leakage effects. The desire to reduce the risk of leakage is part of the guiding principles of the Climate Act. To maximise global reductions and reduce leakage, the optimal CO_2 tax should theoretically be corrected for leakage effects so that industries more exposed to leakage pay lower taxes. This chapter explains the Expert Group's work on leakage, including why leakage-corrected rates are not recommended.

Greenhouse gas leakage covers a situation where domestic measures to reduce emissions in Denmark create increased emissions abroad, for example, if part or all of the production of a given product is moved abroad. This means that Danish climate policy measures potentially reduce global greenhouse gas emissions *less* than Danish emissions are reduced. This effect can be measured as a so-called leakage rate, which expresses the share of domestic CO_2 emissions that are replaced by foreign emissions by a given measure.

It is not considered appropriate at this stage to explicitly correct specific tax rates for precise leakage rates. This should be seen in the light of the forthcoming adjustments to the EU ETS, which are expected to have a significant impact on leakage effects, and there is fundamental uncertainty associated with estimates of the effect of changes in Danish production on foreign production and emissions. It is generally inappropriate to set tax rates on the basis of, for example, domestic and foreign relative greenhouse gas intensities or trade patterns, which can potentially change significantly over time.

8.2.1 Types of leakage

Leakage effects can occur through various mechanisms, including foreign trade, price effects on fossil fuels and international regulation (e.g. the EU ETS).[26]

Greenhouse gas leakage can only occur if other countries have the opportunity to increase their emissions. Countries with a binding commitment to reduce CO_2 emissions, e.g. through EU's Burden-Sharing Agreement, can thus in principle not let their emissions increase as a consequence of Danish climate policy, unless they over-fulfil the commitment. For example, if a Danish climate measure causes a company to move production to another EU country, the company's emissions will be included in the other country's emissions and reduction requirements. This is why climate agreements with binding commitments for individual countries are generally expected to reduce leakage effects. However, if there are joint commitments - for example under the EU ETS, which are not allocated to individual countries - leakage can occur, since, for example, a more ambitious Danish climate policy can mean that the commitment can be achieved without a corresponding contribution from the other countries.

Leakage through foreign trade occurs when policy measures distort the price ratio between home and abroad. For example, if Denmark introduces a higher tax on greenhouse gas emissions than other countries, producing greenhouse gas-

[26] There may also be leakage effects through other regulation, e.g. EU requirements for reduced emissions from new cars, and through other policies, for example, because Denmark is a pioneering country. These effects are not readily estimable in the available economic models.

intensive goods in Denmark will be relatively more expensive. This worsens the competitiveness of Danish production. If demand remains unchanged, the higher tax leads to increased imports of CO_2-intensive goods and increased foreign emissions through relocation of production. The relocation of production can be in the form of market share or outsourcing, or by companies closing or moving altogether.

Leakage can also occur more indirectly through the international fossil fuel market. Increasing taxes on fossil fuels will make it less attractive to use them in production. This reduces domestic demand for fossil fuels, which will cause the price of fossil fuels on the international market to fall marginally. This price drop will increase the demand for fossil fuels abroad. Although the price drop may be very modest, the resulting increase in foreign fuel consumption can constitute a significant proportion of the drop in domestic fuel consumption when the foreign economy is huge in relation to the domestic economy. Therefore, the leakage rate through the international fuel market can be significant even in a small economy with very little influence on international fuel prices.

It is difficult to estimate leakage rates empirically, because in principle, one has to determine the causal effect of a given domestic addition on both domestic and foreign CO_2 emissions. Therefore, leakage effects are usually estimated using computable general equilibrium (CGE) models, e.g. GreenREFORM, which is being developed by the DREAM group on behalf of the Danish Ministry of Finance and includes a leakage model.[27] The Danish Economic Councils have also estimated leakage rates using a similar approach in publications from 2019 and 2021 respectively, *see below*.

8.2.2 Leakage effect through foreign trade

A prerequisite for calculating leakage effects is that Danish trade with the rest of the world can be described sufficiently accurately. As it is not technically possible in practice to describe Danish trade with each of the other countries of the world in each sector in one economic model, the rest of the world is typically grouped into regions or the like. In such an approach, a given foreign industry from a Danish point of view would thus be composed of the industry in question in each region weighted according to the share of trade with Denmark in the industry in question that each region represents. Leakage effects through foreign trade are calculated by, for example, a reduction in Danish production in a given industry, giving rise to a corresponding increase in output in each of the other regions based on a trade-weighted average, i.e. depending on the initial trade with Denmark in the industry in question in each region.

Even if initial trade patterns are expected to follow to some extent the current differences in production and transport costs, product quality, etc., across regions, it is not certain that changes in Danish production will lead to proportional changes in foreign output according to current trade patterns.
For example, production could be taken over entirely by one of the other regions, or simply distributed among the regions in a way that differs from the initial Danish trade pattern. However, it would require extensive analysis of each industry across the relevant countries to describe the change in the distribution of production by country or region at such a high level of detail. Therefore, the more general

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[27] GreenREFORM is, in principle, a description of the Danish economy, and the effects abroad in connection with leakage calculations in GreenREFORM are thus partly based on an extension of the global, general equilibrium model GTAP *(Global Trade Analysis Project)*.

assumption presented above is used and the leakage effects through foreign trade are thus subject to some uncertainty.

Just as the groupings of the rest of the world are made up of different countries, the sectors of the economy are usually made up of very different companies - especially when it comes to international comparisons. For example, the emissions in the national accounts industry *non-metallic minerals* in Denmark originate almost exclusively from CO_2-intensive cement production, whereas the same industry abroad contains to a greater extent other and less CO_2-intensive production.

If Danish cement production is reduced, this is likely to lead to increased cement production abroad, but under the industry definition given, it leads to increased foreign production of non-metallic minerals in general.

This composition effect can potentially give rise to an underestimated leakage effect in the industry concerned. From a Danish point of view, it would, in principle, be more accurate to estimate a leakage effect specifically for cement production rather than for non-metallic minerals, but this requires data at a very high level of detail for both domestic and foreign production and will in practice not be feasible for all industries. It should be noted that compositional effects may also give rise to overestimated leakage effects.

8.2.3 Greenhouse gas intensity and compositional effects

Differences in the greenhouse gas intensity of production, i.e. emissions relative to value added, in individual sectors at home and abroad affect leakage effects. If a Danish industry is less greenhouse gas intensive than the corresponding industry abroad, a tax that results in a larger share of production in the industry moving abroad will result in higher CO_2 leakage. The greenhouse gas intensity in a given sector can change over time, for example, due to the inclusion of new technologies in production. If new technologies enter domestic and foreign production at different times, the greenhouse gas intensity may prove sensitive to the timing of the assessment. This is a particular problem in the setting of tax rates, which are generally not revised regularly based on new data.

The problem can be illustrated by the fact that in 2019 the Danish Economic Councils estimated the leakage rate in Danish agriculture to be in the range 27-75 per cent,[28] while in 2021 they estimated the same leakage rate to be around 25 per cent.[29]

The downward adjustment of the estimated leakage rate was partly due to the shorter time horizon adopted by the Danish Economic Councils in 2021, but two additional factors contributed to the downward adjustment. According to the data underlying the first estimate, Danish agriculture was *less* greenhouse gas-intensive than agriculture abroad, while according to the data underlying the latest estimate, Danish agriculture is *more* greenhouse gas-intensive than agriculture abroad.

[28] The Danish Economic Councils (2019): Economy and Environment 2019

[29] The Danish Economic Councils (2021): Economy and Environment 2020

In addition, the Danish Economic Councils improved the modelling of the reduction potential of agriculture between the two publications so that in the latest assessment, agriculture could reduce emissions to a greater extent without reducing production and exports. Before the leakage effects are used as a basis for tax rates, it should therefore be investigated to what extent the calculations of the relative greenhouse gas intensity between domestic and foreign countries in the affected industries change over time.

8.2.4 Leakage linked to the EU ETS

In a normal emissions allowance system, with a given amount of emissions allowances, there will initially be a leakage rate of 100 per cent, as other countries can instead consume emissions allowances that are not consumed in Denmark. This means that total emissions in the EU remain unchanged, but simply shift between countries. However, the leakage rate within the EU ETS is influenced by the so-called Market Stability Reserve (MSR). If the amount of unused emissions allowances reaches a certain limit, they will be temporarily placed in the MSR and, from 2023, the surplus emissions allowances will be cancelled if the amount of emissions allowances in the MSR exceeds the amount of emissions allowances auctioned in the previous year. Thus, to the extent that MSR leads to cancelled emissions allowances, there will be a leakage rate of less than 100 per cent in the EU ETS.

EU climate legislation imposes a binding cap on CO_2 emissions in the non-ETS sectors as a whole. In the calculation of leakage effects in GreenREFORM, it is assumed that the total greenhouse gas emissions in the non-ETS sectors in the EU excluding Denmark cannot increase. This means that changes in Denmark's imports and exports cannot affect total emissions in the non-ETS sector, and there will be no leakage between EU countries in sectors not covered by the EU ETS.

However, the EU ETS is expected to change in the coming years. On 14 July 2021, the European Commission presented a legislative package, the "Fit for 55" package, proposing a revision of EU climate and energy legislation*, see Section 5.3.2*. The legislative package is expected to result in changed leakage effects for both ETS-coveredand non-ETS-covered sectors compared to the EU ETS, which is the basis for the current estimates of leakage effects.

The overall legislative package will be negotiated in the coming years. It is, therefore, impossible to assess exactly what effects the forthcoming legislation will have on leakage in the EU ETS. Still, leakage effects must be consolidated once the new legislation is implemented. Leakage effects should not be used as a basis for policy assessments as long as adjustments to such a key element as the EU ETS are expected in the relatively short term.

8.2.5 General equilibrium effects

In addition to the above, leakage effects will also be influenced by general equilibrium effects, including industry shifts due to adjustments to changing prices by firms and consumers.
An important effect, for example, is that wage levels in the economy fall if firms demand less labour as a result of greenhouse gas taxation reducing their competitiveness. When wage levels fall, competitiveness with the rest of the world improves in industries with low greenhouse gas emissions, where exports, output and employment thus increase.

For example, a CO_2 tax on energy-intensive industrial products in Denmark would make it easier for foreign producers of similar products to sell their goods in Denmark. If demand remains unchanged, the production of energy-intensive industrial products abroad will therefore displace some of the production in Denmark. The increase in foreign production of energy-intensive industrial products comes at the expense of production in other foreign sectors, some of which are non-energy intensive. When non-energy-intensive production abroad decreases in favour of energy-intensive industrial production, this will lead to increased greenhouse gas emissions abroad in isolation. The reverse is true in non-energy-intensive industries, where a tax on Danish production would lead to increased imports and production of non-energy-intensive industrial goods abroad, which would lower greenhouse gas emissions abroad.

The general equilibrium effects vary according to the number of taxes imposed and the sectors concerned. For example, if a tax is imposed on all industries at the same time, there are no industries that are exempt from the tax and thereby can attract labour and the other production factors, but there will be a tendency for less CO_2-intensive industries to attract labour from the more CO_2-intensive industries that will experience the biggest cost increases as a result of a general tax. In practice, taxes are rarely imposed on a single industry, and the sectoral leakage effects are thus, in most cases, less relevant than the overall leakage effects associated with a specific tax change – especially in the case of industries where general equilibrium effects dominate.

The overall magnitude of the general equilibrium effects can be illustrated by comparing different tax shocks in GreenREFORM. If each sector is individually taxed on greenhouse gas emissions, while the other sectors are exempted, the leakage effects of all these shocks add up to about 9 per cent, and if all sectors are taxed simultaneously, the total leakage rate becomes about 31 per cent. For comparison, the Danish Economic Councils calculated the total Danish leakage rate in 2019 and 2021 at 45-53 per cent and 21 per cent, respectively. These estimates should be seen in the light of all the uncertainties mentioned above and should therefore be interpreted with caution.