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Small Great Nation

A Climate Reform that Delivers the Magic 70 Percent

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Table of contents

Preface

The collaboration between Kraka and Deloitte on the Small Great Nation project analyses the long-term prospects for the Danish society. The initiative is independent of political and economic ideologies and interests. The initiative utilises existing research-based knowledge and contributes new, independent analyses that result in evidence-based proposals for creating a better Denmark. In this spring of 2020 report, we focus on the climate challenge. This is our first report on climate change, and in it we examine reductions in Danish greenhouse gas emissions.

There is overwhelming scientific evidence that the ongoing climate change is primarily man-made, and it is only by all countries working together that the challenges posed by climate change can be solved. In the Danish debate, therefore, it is sometimes argued that, as Denmark's contribution to global warming is very small, Danish climate action would contribute very little to solving the problem. However, the same is true for most other countries individually, but not overall. If the countries of the world significantly reduce greenhouse gas emissions, climate change can be limited, and Denmark can demonstrate, through smart climate policy, how it can be done cost-effectively.

At the international level, the Paris Agreement sets out the framework for the global climate effort, while in Denmark, the forthcoming Danish climate legislation will legally oblige Danish politicians to ensure the realisation of Denmark's green transition: Specifically, Denmark's greenhouse gas emissions must be reduced by 70 per cent by 2030 compared to 1990, and Denmark must be climate neutral by 2050. At the same time, Danish climate policies must be set such that Danish reductions do not lead to corresponding increases abroad. Not only does the climate legislation enjoy broad political support, it is also widely supported by business and the general public. What's more, there is much focus on the green transition in many other countries.

Thus, the analytical playing field has changed: It is no longer about whether the objectives should be different, as these can now be taken for granted. Focus can now be placed on how the statutory Danish targets are to be realized in the most cost-effective way possible while also taking greenhouse gas leakage into account. Politically, weight will also naturally be placed on the distributional effects.

This report deals precisely with how the green transition can be realized when one wants to keep costs as low as possible while counteracting leakage and, at the same time, not wanting the transition to have a disproportionately negative impact on those with the lowest incomes.

2020 could be a defining moment for Denmark's future climate policy. It is our hope that this report will help to ensure that the upcoming climate plan will be based on long-term sustainable principles that will ensure that Danish climate efforts will work as efficiently as possible, taking into account the other political objectives of the climate legislation.

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Happy reading!

Peter Birch Sørensen, Professor, University of Copenhagen and Senior Fellow, Kraka
Hans Jørgen Whitta-Jacobsen, Professor, University of Copenhagen and Senior Fellow, Kraka
Jørgen Søndergaard, Senior Fellow, Kraka
Peter Mogensen, Director, Kraka
Jens Hauch, Deputy Director, Kraka

1. The road to Denmark's climate goals

Climate change is man-made

There is overwhelming evidence that ongoing climate change is predominantly man-made and that it will have unintended consequences if greenhouse gas emissions are not significantly reduced. Through the Paris Agreement 197 countries committed to taking climate action, but the Agreement does not set binding requirements stipulating what each country must do.

What should a climate-ambitious country do?

Thus, each country must decide how it will reduce its greenhouse gas emissions. As a climate leader, Denmark can hope that other countries follow its good example and adopt similarly ambitious climate targets. However, it is also possible that other countries will not comply with the Paris Agreement, in which case, the efforts of an individual pioneering country will only affect the global emissions and greenhouse effects to a very small extent, particularly if it is a small country. Such considerations have, for a number of years, dominated much of the Danish climate debate.

The Climate Act changes the position

However, following the political agreement on the forthcoming climate legislation, which enjoys broad support in the parliament, and among the general population and the business sector, the circumstances have changed for Denmark. The goal that, by 2030, Denmark must have reduced its emissions by 70 per cent relative to the 1990 level will become law, and greenhouse gas leakage must be taken into account. Leakage occurs if an ambitious climate policy in one country causes companies to move out of that country, or production is taken over by foreign competitors leading to increased emissions abroad. Leakages thus reduces the global impact of the ambitious country's efforts. Denmark's climate law is ambitious in an international context, but given the global climate focus, it is likely that other countries will also tighten their climate targets in the coming years, thereby reducing the risk of leakage effects from Danish climate policy.

How can the costs be kept down?

The broad agreement on the forthcoming climate legislation has resulted in a much-needed calm in the Danish climate debate. It is now less relevant to discuss whether Denmark's current status as a pioneer influences other countries' ambitions, or whether the Danish go-it-alone climate policy has only limited direct climate effects.[1] The 70 per cent target by 2030 and the climate neutrality target by 2050 can now be taken as given. However, there is still a very important task ahead: to achieve the objectives with the smallest possible impact on the Danish economy.

Leakage and inequality

The Climate Act will also confirm that the targets for greenhouse gas emissions from Danish soil must be achieved taking into account the leakage problem, as well as a political desire to avoid climate action leading to increasing inequality across households.

What would it cost?

The climate plan has been set without precise knowledge of the costs. The Environment Economic Council has estimated, with considerable uncertainty, that by 2050 Danish fossil freedom will cost approx. 0.5 per cent of GDP per year. In addition, there will be costs in reducing agricultural emissions of methane and nitrous oxide, and the IPCC and OECD believe that the global cost of living up to the 2-degree objective in the Paris Agreement will correspond to 1-3 years of economic growth until 2050. Calculations by the Confederation of Danish Industry have also indicated that

[1] Although Denmark's reduction target is currently more ambitious than most other countries, it is not over-ambitious when it comes to achieving the objectives of the Paris Agreement. If other countries also take the Paris Agreement seriously, it must be expected that over time they will implement reduction targets similar to those of Denmark. That is to say that Denmark's current status as a pioneer country could quickly be taken over by others. As a climate action leader, Denmark has the opportunity to influence developments in other countries, either in the form of moral pressure or by overcoming technological challenges that other countries can copy. This may have a value beyond what there is in it for Denmark as it steers itself towards achieving the goals of the Paris Agreement.

it is possible to get close to, but not quite meet, the 2030 target with current technologies at a manageable cost.[2] However, in the light of the existing previous work, we believe that the cost of the Danish green transition is neither prohibitive nor insignificant. However, the costs will only be manageable if systematic efforts are made to minimize them, and this is precisely the purpose of this report: How do we achieve the climate targets at the lowest possible cost given the political considerations of leakage and distributional effects?

Contents of the report

Chapter 2 of this report presents a specific proposal for greenhouse gas taxation that could form a key element in the upcoming climate plan. Central to the proposal is consideration of leakage and distributional effects. In Chapter 3, we analyse the distributional effects of achieving the 70 per cent target.

We propose concrete recommendations for tax reform

A cost-effective tax system that takes into account both business and distribution

It is well known that a sufficiently high and uniform tax on all types of greenhouse gas emissions will ensure that a climate target for national emissions is reached at the lowest possible cost. Therefore, greenhouse gas taxes, together with marketable CO_2 quotas, have been economists' main recommendations for how best to achieve climate targets. We also recommend that a climate tax be included as the key element in the upcoming climate plan, however, the need to consider leakage necessitates a more complicated tax system.

Cost minimization, leakage and distribution

The tax system must ensure that:

- The target for reducing national emissions is met at the lowest possible cost.
- Costs are distributed in a way that does not lead to increased inequality.
- The risk of greenhouse gas leakage is limited.
- EU energy saving obligations are complied with.

Specifically, the following tax-based system will meet these objectives:

- In the medium term, from approximately 2030, all emissions of greenhouse gases from Danish territory would be subject to a uniform tax per tonne of CO_2 equivalent, hereafter CO_2e. I.e., not only will there be a tax on CO_2, but also on methane and nitrous oxide calculated by their climate impact.
- The Climate Council would be tasked with recommending the precise level of taxation needed to achieve the Danish objectives. However, DKK 1,250 per tonne of CO_2e from 2030 is a realistic benchmark.
- Initially, a tax program would be put in place for the period up to 2025, during which the CO_2e tax would be gradually raised from the existing CO_2 tax level of approximately DKK 170 per tonne to a significantly higher level, which could be DKK 1,000 per tonne of CO_2e.
- The gradual phase-in would be done to give time for companies and households to have the opportunity to adjust their production and consumption by, e.g., investing in climate-friendly technologies. However, the 2030 target requires a relatively rapid phase-in.
- Companies that are currently eligible for free CO_2 quotas, as well as companies outside the ETS system but with production processes listed on the Ministry of Taxation's energy-intensive processes list, would be eligible for a CO_2e-tax rebate calculated as 80 per cent of their historical emissions. This is done to treat energy-intensive companies in a fair and reasonable manner and to counter leakage.[3] In addition, all companies in the EU-ETS sector would be eligible for a tax rebate of their quota payments. Likewise, the agricultural sector would also be eligible for the CO_2e-tax rebate of up to 80 per cent, with the calculation based on climate accounts for each farm. These tax rebates would be phased out over a predetermined time

[2] In the autumn of 2019 considerable funding was allocated to the development of the "Green Reform" model, which should be able to more accurately calculate the cost of Danish green transition. The model will be able to contribute important new knowledge, but it won't be ready for approximately two years.
[3] Thus, the value of the rebate would be 0.8 times historical emissions times the tax rate.

schedule and would be completely removed by 2050. The CO_2e tax rebates would also be conditional on fulfilment of activity prerequisites, cf. Chapter 2.

- Companies that deduct less than their entitlement would be eligible for a subsidy of the same value as the tax rate. This would ensure that these companies are also encouraged to further reduce emissions.
- In order to treat energy-intensive companies fairly and to counteract leakage, the new and higher taxes would be phased in at different rates so that companies that are eligible for the CO_2e-tax rebate are subject to a lower tax rate than others in the transition phase. The differentiation should be phased out over a predetermined time schedule, but long before 2050, with 2030 as a realistic end year.
- Transport companies and personal transport would not be eligible for either a CO_2e-tax rebate or a temporarily reduced CO_2e-tax rate, and the current fuel tax, excluding the CO_2e tax, would be maintained due to the other negative externalities from transport (e.g., air pollution, congestion, accidents, noise and road wear). However, taking into account the border trade problem, the CO_2e tax plus fuel tax would not fully reflect the total external costs of transport.
- Danish electricity producers' use of fossil fuels would be subject to a reduced CO_2e tax to take into account that Danish electricity generation lowers net imports of electricity and thus displaces a certain amount of fossil-based electricity production abroad. The annual reduction in the CO_2e tax on Danish electricity producers must correspond to the Danish Energy Agency's annual estimate of the CO_2e content of foreign-produced electricity. On the other hand, electricity consumers, i.e., businesses as well as households, would be subject to a tax corresponding to the estimated CO_2e content of foreign-produced electricity. This reflects that an increase in domestic electricity consumption leads to an increase in electricity imports, which gives rise to increased emissions abroad. These rules ensure that both electricity producers and consumers are taxed on their net contribution to global emissions and that the leakage effect of taxing domestic fossil-fuelled electricity generation is taken into account.
- Biomass that is used for energy purposes, but which is not certified as being sufficiently climate neutral, would be subject to a CO_2e tax in accordance with the rules stated above. The certification scheme should be state-regulated and follow the guidelines recommended in the Climate Council (2018b).
- As CO_2e taxes are phased in, current energy taxes should be reduced so that the overall climate and energy tax system focuses on reducing greenhouse gas emissions. However, phasing out of energy taxes should not be done faster than what is required to comply with the EU Energy Saving Directive, and there should be sufficient public finances available to offset any politically undesirable distributional effects. Estimations in Chapter 3 of this report indicate that a simultaneous phasing in of CO_2e taxes and the reduction of energy taxes, except those on petrol and diesel, to 25 per cent of the current level would reconcile the climate aims with the distributional considerations.

The system is based on existing data and institutional setup

In addition to the considerations described above, another important point is that the proposed changes to the tax system would be mainly based on existing accounting and administrative systems. For example, the CO_2e-tax rebate would be granted to companies that are currently either already eligible for a deduction of the existing CO_2 taxes or are allocated free quotas. Presumably, therefore, the proposed changes would not conflict with EU state aid rules.[4]

Taxes affect behaviours in various ways

An important benefit of a tax-based system is that it not only encourages cost-minimizing investments in new technology, it also encourages changes in consumption and behaviour that are not directly linked to technology and investment. For example, if taxes are levied on the use of fossil fuels for transport, consumers will be encouraged to buy more energy-efficient cars and also be encouraged to ride a bicycle over driving a car.

[4] However, the EU would have to formally approve that the system does not conflict with state aid rules. Such approval is a fundamental premise of the proposed system. If approval is not granted, it may be necessary to implement a significantly different system.

Behavioural effect can be decisive

In work carried out by Ea Energy Analyses for the Confederation of Danish Industry, it was estimated that it would only be possible to reach a 65 per cent emissions reduction with current technologies. There is no reason to doubt the validity of these calculations, however, the behavioural effect attainable by taxation is not included. This, together with the tax incentives to develop new technology, may be what would be required to reach the 70 per cent reduction by 2030 without the socio-economic costs being very high.

The leakage issue

In the Climate Act - and therefore also in our proposal - emphasis is placed on the consideration of leakage. When one country has a more ambitious climate policy than other countries, businesses in that country have higher costs than similar businesses abroad. This can lead to production being shifted out of the higher-cost country. As a result, greenhouse gas emissions in other countries are rising, i.e., the higher-cost country's own reductions are only partly reflected in lower global emissions. Leakages can occur in two ways: Either by businesses shifting production to other countries, or by reduced competitiveness of businesses in the climate ambitious country resulting from higher production costs, leading to them becoming wholly or partly uncompetitive relative to businesses in the less climate-ambitious countries.

Countering leakage increases costs but increases the impact of climate policy

It is more expensive to lower emissions from Danish soil when leakage needs to be taken into account than would otherwise be the case. Just as the pace of the green transition should fundamentally be a political decision, so too should the concern about leakage be. If a great deal of emphasis is placed on countering leakage, Danish climate policy will lead to higher global reductions than otherwise, but at the same time the costs for Denmark will be higher. Conversely, a very rapid phase-in, which does not take leakage into account, can, however, also be expensive, as companies do not have time to adapt. In addition, it must be regarded as an end in itself that Danish companies are treated fairly and given time for the necessary adjustments without encountering an unnecessarily strong regulatory-induced degradation of competitiveness.

The degree of leakage is difficult to calculate

It is complicated to account for leakage: First, the calculation of leakage requires a precision in the economic models that does not exist today. Second, the degree of leakage depends on what other countries do. Namely, no leakage can occur to countries that have binding targets for their overall greenhouse gas emissions. If production and emissions are moved from Denmark to a country with binding targets, that country must implement other climate measures so that its total emissions do not exceed that country's emission targets. This is also true, even if the reduction target in the trading country is less ambitious than Denmark's - the goal just has to be binding.

This proposal addresses, to a large extent, leakage

It must be expected that international climate cooperation within the EU and the UN will lead to more and more countries adopting binding reduction targets. Thus, the problem of leakage will gradually disappear over time. In the short term, where it is impossible to assume that all of Denmark's trading partners have binding reduction targets, leakage from some industries can be significant if Denmark's climate policy goes far out in front of the field. However, with the considerable CO_2e-tax rebate for the most exposed industries and the gradual phase-in of uniform taxes, we believe that the problem of leakage would be largely addressed.

Energy saving directive

In its energy saving directive, the EU requires that Denmark and the other member states meet certain energy savings obligations. At the moment, a significant fraction of energy production continues to be based on fossil fuels, therefore, lower energy consumption would, to a certain extent, reduce greenhouse gas emissions. However, in a green future, where the world's energy consumption is based on fossil-free technologies, energy consumption does not affect greenhouse gas emissions. Energy saving efforts must, therefore, primarily be regarded as a temporary instrument. The EU-ETS quota market can, in the short and long term, further contribute to reducing the effectiveness of energy saving efforts. Whether the directive is appropriate or not, Denmark has a duty to comply with it, and this must be envisaged in the climate plan.

Distributional effects of the transition

Distributional considerations ...

The political agreement on the forthcoming climate legislation stated that the green transition must not particularly burden the lowest income groups. Therefore, distributional effects must be accounted for in a politically relevant climate plan.

... ensured by CO_2e taxes and lower energy taxes

The analysis in Chapter 3 shows that, in isolation, CO_2e taxes are regressive, i.e. they burden the low-income groups relatively heavily. However, the analysis in the chapter also shows that the current energy taxes are even more regressive, and they are less efficient in terms of achieving a climate effect. If CO_2e taxes are phased in at the same time as energy taxes are reduced, on the whole, the burden will fall more on the high-income groups than the low-income groups, while simultaneously achieving large climate effects. Furthermore, lowering energy taxes will offset some of the negative effects that the CO_2e tax would have on the labour supply. Hence it is possible to simultaneously achieve ambitious climate targets, maintain the income distribution and reduce the risk of leakage through CO_2e-tax rebates for the most energy-intensive companies. However, negative labour supply effects cannot be completely avoided unless the ambitions for climate, distribution or leakage are lowered or, alternatively, further financing by other means is secured.

Taxes: politically a double-edged sword

One benefit of taxes is that they create transparency. They make it easier for businesses to make climate-friendly investments, and consumers do not have to work out whether their daily choices are more or less climate-friendly - climate considerations are embedded in prices via the tax. Politically, however, the clarity of taxes may be a disadvantage: Taxes make it easy for individuals and businesses to see the costs, which can create greater resistance than if the costs are less visible. This may tempt politicians to choose direct regulation, such as technology requirements for businesses, because the cost will then become less obvious. But with direct regulation, consumers and businesses cannot make the most cost-effective choices. The overall socio-economic costs will, therefore, be higher than with taxes, and the bill will certainly end up with consumers either in the form of higher prices of goods or lower incomes. Therefore, we recommend that higher taxes on greenhouse gas emissions play a key part of the cost-effective green transition in Denmark.

2. Business- and distribution-friendly climate taxes

Significant green transition impending

By 2030, Denmark's annual greenhouse gas emissions must be reduced by 70 per cent relative to the 1990 level and Denmark's goal is to be completely climate neutral by 2050.[5] It is expected that in 2020 around 46.6 million tonnes of CO_2e will be discharged from Danish territory,[6] which, as a result of the target must be reduced to 22.2 million tonnes a year by 2030. This means that over a period of just 10 years, Denmark must halve emissions. Parts of the Danish economy are, therefore, facing a significant transition. The transition will be costly, but the costs will not be of a prohibitive magnitude for a prosperous country like Denmark.

Taxation should be the central instrument

However, the size of the bill for Denmark could vary considerably, depending on whether the green transition is carried out in a cost-effective way or whether it becomes unnecessarily expensive because of the use of ineffective measures. Therefore, it is crucial that taxes on CO_2e emissions play a central role in climate policy. Uniform taxes ensure that everyone has the same financial incentives to reduce CO_2e emissions, and that the reductions are thus made in the places in the economy where it is easiest and cheapest. Cost efficiency is also an important consideration in the agreement on the Climate Act.

Contents of the chapter

This chapter presents a plan for business- and distribution-friendly climate taxes. In Section 2.1, we review the basic structure, which is, essentially, to replace the existing energy taxes with a tax on CO_2e emissions. Then, in Section 2.2, we discuss a number of important details, including the consideration of greenhouse gas leakage and its consequences for the tax system, as well as specific conditions for three particular sectors: The agriculture, transport and electricity sector. Section 2.3 presents a concrete proposal for the future tax structure, while Section 2.4 presents calculations of the revenue from the proposed system.

2.1 Tax restructuring and cost effectiveness

A proposal for a highly cost-effective tax system

The purpose of this chapter is to outline a system of taxes on CO_2e emissions that:

- ensures a high degree of cost-effectiveness in the green transition
- takes into account distributional effects
- takes into account the competitiveness of Danish businesses and thus the leakage problem

Our proposal for reform involves a gradual reorganization of the current tax system so that it is predominantly the emissions of CO_2e that is taxed, while energy taxes are sharply reduced. The price of greenhouse gas emissions must necessarily be increased relative to their current tax level. The actual rates must be adjusted as new information is gained about how effectively the taxes work towards achieving the targets, and it should be a task for the Climate Council to continually assess the rate of transition and propose adjustments to the tax rates. If the proposed structure

[5] See the agreement on the forthcoming Climate Act (in Danish), https://kefm.dk/media/12965/aftale-om-klimalov-af-6-december-2019.pdf

[6] See The Danish Energy Agency's Basic Projections 2019 (in Danish), https://ens.dk/service/fremskrivninger-analyser-modeller/basisfremskrivninger. The figures include uptake and discharge from forests and agricultural land (Land Use, Land Use Change and Forestry or LULUCF).

of the tax system is implemented and combined with an appropriate mechanism for adjusting the taxes, the tax system outlined can be the cornerstone of Danish climate policy that ensures high cost efficiency.

The alternatives to taxes are inferior and more expensive

Not using taxes as an instrument would not mean that the transition would be cost-free. On the contrary, the costs will be less transparent and will be higher for society as a whole. Taxes encourage the most cost-effective reductions, that give the most bang for the buck, to be introduced, while a lack of such an incentive structure may result in more expensive reductions being implemented. The alternative to taxes would typically be so-called command and control policies, where the state, using bans, injunctions, minimum standards, etc., has a very direct influence on the behaviour of businesses and households, including investment and technology decisions. Whereas, imposing the taxes on businesses, leaves the businesses themselves to find the most effective reduction options, but if command and control policy is conducted instead, the decision about reduction options are imposed on them.

Other instruments can supplement CO_2 taxes …

This does not mean that other instruments cannot play an important role. In particular, new investments in research, development and demonstration projects for climate-friendly technology would be important instruments that would also contribute to the transition outside Denmark. In addition, state-sponsored information and advisory efforts may play a role.

… but should be used with caution

The premise is that climate taxes give businesses and households the right incentives to make investments that reduce their climate impact. Thus, under the right tax structure, the market will make most of the adjustments necessary for the climate transition. It is important that significant government funds are not used to support investments that would be made in any case, as this would make the transition unnecessarily expensive. On the other hand, it cannot be entirely ruled out that there are areas where direct government interference would make sense, either in the form of loan programs or direct government investment in 'green infrastructure'. However, such state interference should only occur if there is a high degree of certainty that it is necessary to have particular measures implemented. Climate change cannot be solved solely through government investments, which should only be seen as an adjunct to a cost-effective tax structure.

Greenhouse gas leakage reduces the effectiveness of Danish reductions

A particular problem for the climate policy is greenhouse gas leakage.[7] The phenomenon of greenhouse gas leakage occurs when a reduction in CO_2e emissions in Denmark causes increased emissions elsewhere in the world. Leakages can occur in several ways, the most important being through increased imports of goods that have caused emissions abroad. One can distinguish between leakage on the extensive margin, i.e., closure of companies in Denmark and relocation of their production to another country, and leakage on the intensive margin, i.e., a decline in domestic production due to reduced competitiveness relative to foreign companies. Both increase emissions abroad and make reductions in greenhouse gas emissions in Denmark less beneficial globally.

Particular attention to leakage in the Climate Act

Because, at least for a period, Denmark will be a climate-pioneering country with its 70 per cent reduction target, the problem of leakage is particularly relevant to the design of a Danish tax system. Leakage not only makes Danish reductions less effective globally, it also has negative consequences for Danish businesses and their employees. Leakage has a prominent role in the agreement on the climate legislation.[8] Leakage occurs because not all countries have binding targets for reducing greenhouse gas emissions, so companies in these countries can increase their production without the cost of the resulting increased emissions. This is particularly the case for countries outside the EU, but it is also possible for leakage to take place via the EU-ETS quota trading system.[9] From a global perspective, the most cost-effective transition would occur in a situation

[7] Greenhouse gas leakage is often referred to as carbon leakage, cf., the Danish Economic Councils (2019) [in Danish with an English summary]. Since the reduction targets concern CO_2e, which includes methane and nitrous oxide in addition to CO_2, it is more accurate to use the term greenhouse gas leakage.

[8] The Agreement on the Climate Act of 6 December 2019 states that, the measures we use to reduce greenhouse gas emissions must "*… result in real, domestic reductions, but we must also ensure that Danish measures do not simply move the entire greenhouse gas emissions outside Denmark*". See, Aftale om klimalov af 6. december 2019, https://kefm.dk/media/12965/aftale-om-klimalov-af-6-december-2019.pdf (in Danish).

[9] In a situation where all available quotas in the EU quota system were used, Danish reductions in the quota sector would simply mean that the quota price would fall slightly, and the quotas would be used elsewhere in the EU. Thus,

where the prices of CO_2e emissions were set at the same level throughout the world. Therefore, Denmark should continue to work for global solutions in the climate field.

The tax system requires approval of the European Commission

Our proposal includes elements that are expected to fall under EU state aid rules, including CO_2e-tax rebates for some companies and tax rates that would be differentiated for a number of years. Implementation of our proposed restructuring of the tax system would, therefore, have to be approved by the European Commission. Our proposal assumes that the CO_2e-tax rebate would not be in conflict with EU state aid rules. However, it is worth noting that the CO_2e-tax rebate would only be granted to companies that, with the EU's approval, are already eligible for a deduction of their existing CO_2 taxes, and companies that are allocated free quotas, and that the total tax burden would actually increase. Furthermore, that meeting the Paris Agreement target is the purpose of the restructuring should weigh positively in its favour when seeking EU approval. However, if the approval were not granted, it may be necessary to implement a significantly different system.

2.2 A model for taxes on greenhouse gas emissions

Uniform taxation of CO_2e is the starting point

A future tax system should, in principle, tax emissions of CO_2e uniformly, regardless of the sector that emits them and what the source is. This is far from the case in the current tax system.[10] Uniform taxation would lead to a cost-effective reduction of emissions in Denmark; therefore, the current energy taxes should be replaced with a uniform tax on CO_2e emissions.

Higher prices to be phased in over the period up to 2030

The price of emissions needed to reach the 2030 reduction target is subject to some uncertainty. However, a realistic estimate is a price of around DKK 1,000 per tonne of CO_2e by 2025, increasing to around DKK 1,250 per tonne of CO_2e by 2030.[11] This is a higher price than today, and the taxes would need to be phased in gradually. However, it is important that price increases occur quickly and according to a fixed plan that is laid down in advance, partly to reach the 2030 target and partly so that businesses and households have some certainty about future prices so they can plan accordingly. The level of taxation and the pace of the phase-in would, therefore, need to be set for a number of years, with the proviso that adjustments can be made if new information indicates that the tax needs to be increased in order to meet the objectives or if they were initially set too high and, therefore, that they need to increase at a lower rate than planned.

CO_2e-tax rebate for energy-intensive companies

The CO_2e tax would be imposed on both businesses inside and outside of the EU-ETS quota sector. At the same time, a CO_2e-tax rebate would be introduced for companies in the quota sector that are currently eligible under the free quotas scheme. The CO_2e-tax rebate would also be introduced for businesses outside the quota sector that are entitled to a deduction of the existing CO_2 tax as a result of having energy-intensive production processes that are covered by the Ministry of Taxation's energy-intensive processes list.[12] As agriculture is subject to strong international competition, agricultural holdings would also be granted a CO_2e-tax rebate, cf. the discussion of agriculture in Section 2.2.1. The CO_2e-tax rebate would be calculated in the start year as 80 per cent of the company's historical emissions, e.g., as the average emissions from 2017 to 2019. The CO_2e-tax rebate would prevent the overall tax burden on the very greenhouse-gas-intensive companies from increasing too much and too quickly in relation to the current system, thus limiting greenhouse gas leakage that could result from relocation of production. At the same time, the

the leakage rate in such a situation is 100 per cent. Currently, there is a surplus of quotas in the system and future reductions in quotas will depend on how large this surplus is. Thus, at present, reductions in Denmark in the quota sector would not lead to leakage through the quota system, but would actually contribute to faster reductions inside the EU in the future, cf., the Danish Economic Councils (2019) [in Danish with an English summary].

[10] See the discussion in Climate Council (2018a), in Danish.

[11] The benchmark value of DKK 1,250 per tonne CO_2e is a rough estimate. Ea Energy Analyses (2019) assess, that at that tax rate it will be profitable for households and businesses to implement initiatives, that will result in emission reductions for a combined 63 percentage points. These emission reductions are based solely on current technology. Additionally, agriculture at this tax rate will contribute with emission reductions beyond what is assumed in Ea Energy Analyses (2019), and there will be contributions from new technology and changed behaviour from households and firms (so-called substitution effects). Our analysis assumes, that these additional effects give reductions of the remaining 7 percentage points, such that the reduction target of 70 per cent will be met. The benchmark value of DKK 1,000 per tonne in 2025 is a rough midpoint between the current tax rate and the 2030-rate, cf. the discussion in Section 2.4

[12] Details and background of the process list can be found at https://skat.dk/skat.aspx?oID=2062250&chk=216701.

greenhouse-gas-intensive companies would continue to have the same financial incentives to reduce emissions as other companies, since emissions over the CO_2e-tax rebate limit would be taxed at the full CO_2e price.

CO_2e-tax rebate for new companies

In a new tax system in which companies would receive a CO_2e-tax rebate based on their historical CO_2e emissions, consideration must also be given to how to handle new companies and companies that significantly expand production capacity. An exact model for this would have to be developed, but it is possible to draw inspiration from the quota system, which reserves free quotas for new companies that meet certain criteria, and from the current CO_2 tax deduction scheme.

Subsidies to companies that reduce emissions below the free-emission limit ...

The CO_2e-tax rebate should be phased out linearly over time so that it is zero by 2050 when Denmark must be climate neutral. Over this period, companies that achieve emission reductions that are greater than their full rebate entitlement should be eligible for subsidies of the same value as the CO_2e-tax rate. This would give companies the same incentives to reduce emissions whether they are above or below their CO_2e-tax rebate limit, and therefore, it would contribute to a cost-effective transition. At the same time, eligibility for subsidies would reward companies that introduce technology that can capture and store CO_2e, i.e., the so-called CCS (carbon capture and storage) technology.

... if they meet an activity requirement

Administratively, the system should be arranged so that the CO_2e-tax rebate and subsidy are subject to an activity prerequisite to prevent the subsidy from being paid solely as a result of a company's reduction or relocation of production. The activity of a company would be measured on the basis of its domestic value added, and the CO_2e-tax rebate rate that would be taken as the basis for the payment of taxes or the payment of subsidies should not be able to exceed a company's domestic value added vis-a-vis its historic domestic value added. If, for example, in 2030, the standard rebate for the CO_2e tax was 55 per cent of the company's historical emissions, and the company's value added was only 50 per cent of the value added in the base year, the company could only get a CO_2e-tax rebate for 50 per cent of its historic greenhouse gas emissions. This would give rise to either a tax payment or a subsidy, depending on the emissions.[13]

Rebate for EU quota purchases

Companies in the quota sector would continue to be required to purchase quotas through the EU-ETS quota system. In order to avoid double taxation, full rebates would be available for quota purchases in these companies' annual tax assessments. This means that the companies' total expenditure per tonne of CO_2e above the CO_2e-tax rebate threshold and subsidy per tonne of CO_2e below the CO_2e -tax rebate threshold corresponds to the Danish CO_2e price. As long as this is higher than the quota price, which it is likely to be, the quota price in the EU-ETS system no longer has any bearing on the costs of Danish companies in connection with greenhouse gas emissions.

In the absence of leakage, uniform taxation is optimal

In the absence of leakage, a system with a uniform tax would be optimal as it would lead to a cost-effective transition of the Danish economy. However, this could cause significant leakage if it were carried out without the CO_2e-tax rebate for some companies. Leakage reduces the beneficial climate effects of reducing Danish emissions because emissions increase abroad. Leakage in the form of relocation of production could also cause certain types of employees, businesses or geographical areas to bear a disproportionate share of the transition costs, despite the fact that they are of a moderate size for Denmark overall. Therefore, we propose a tax system that takes into account leakage by giving a CO_2e-tax rebate for greenhouse gas-intensive companies and, during a transitional period, applying lower tax rates for specific sectors, cf. the discussion in Box 2.1. How much weight leakage issues should have in the climate policy is fundamentally a political decision, but the leakage considerations stipulated in the Agreement on the Climate Act are in line with both an ambition that Danish efforts must actually reduce global emissions and that the transition must be carried out taking into account distributional effects.

[13] The domestic value added for each company is included in its VAT statements and constitutes the domestic revenue minus goods purchased and imports plus exports. It is thus based on information already available for all companies. For example, the historical level of domestic value added for a company would be calculated as an average of its 2017 to 2019 domestic value added measured at fixed prices.

Box 2.1 Leakage, CO_2e-tax deduction and differential tax rates

Leakage considerations suggest differentiated tax rates

The extent of greenhouse gas leakage is measured by the leakage rate, which indicates how much foreign emissions rise for each tonne that domestic emissions fall. Thus, a leakage rate of 50 per cent for a particular sector in the economy means that emissions abroad increase by ½ tonne CO_2e for every tonne reduction in the sector's domestic emissions. The leakage rate for a sector will typically be greater the more it is exposed to international competition. Therefore, if climate policy has to take account of leakage, the theoretically optimal tax structure is no longer a uniform tax on emissions, but instead requires differentiated taxes. The analytical basis for this is described in detail in Sørensen (2020), but the intuition is as follows: When leakage problems are of concern in a climate policy, that indicates that society is not only willing to pay to reduce domestic emissions, but it also has a certain willingness to pay to ensure that foreign emissions are not increased. This means that one is willing to pay more to implement extra reductions in sectors of the economy where the leakage rate is low. At the same time, one is willing to live with lower reductions in those sectors of the economy where the leakage rate is high, even if the reductions in those sectors may be relatively cheap to implement. The consequence of this is that industries and sectors where the leakage rate is high, e.g., very energy-intensive companies, should be taxed more leniently than sectors where the leakage rate is low, e.g., households.

In practice, it is difficult to set differentiated taxes

In practice, the theoretically optimal tax structure when leakage is to be considered requires an unrealistically large amount of information to precisely set the taxes. Specifically, it requires fairly precise information of the leakage rates for each of the areas for which one wants to differentiate the taxes. These leakage rates depend, inter alia, on very uncertain estimates of foreign trade elasticities at the sectoral level, which in turn depend on Denmark's future status as a climate-pioneer country. Therefore, trying to fine-tune the tax structure on a very detailed level is not recommended as there is a high risk of differentiating in a way that does more harm than good.

CO_2e-tax rebate for emissions alleviates the problem of leakage

The proposed CO_2e-tax rebate for emissions of energy-intensive companies significantly alleviates the leakage problem. As demonstrated in Sørensen (2020), one should distinguish between leakage on the extensive margin, i.e., closure of businesses and relocation of production, and leakage on the intensive margin, i.e., a decline in domestic production due to reduced competitiveness relative to foreign companies. Leakages on the extensive margin due to relocation give rise to a leakage rate of 100 per cent. A CO_2e-tax rebate of companies' CO_2e taxation is an effective instrument for preventing a large part of the leakage on the extensive margin, as the companies lose the full value of the deduction upon relocation. The CO_2e-tax rebate should be phased out by 2050 following a predetermined time schedule.

Lower marginal taxation for very greenhouse gas intensive companies

However, the leakage rate on the intensive margin can also be high in cases where the greenhouse gas intensity is high, and companies operate in a very price-sensitive international market. Therefore, whether the marginal taxation of CO_2e emissions should also be lower in certain sectors for a period of time should be considered. From a leakage point of view, it is obvious that companies that currently either belong to the quota sector and receive free quotas or are included on the 'process list' should continue to be taxed at a lower tax rate than the rest of the economy during the phase-in of the tax system. However, it is important that all companies have some incentives to reduce their emissions. As noted in Chapter 1, the risk of leakage is expected to decrease over time as more countries adopt binding reduction targets, therefore, after the phase-in period ending in 2025, differentiation should be phased out following a predetermined time schedule. The differential treatment should be eliminated long before 2050, with 2030 being a realistic end year.

2.2.1 The agricultural sector

Agriculture accounts for a large share of Danish CO_2e emissions

Agricultural production contributes a large share of greenhouse gas emissions from Danish territory.[14] Therefore, if the objectives of the Climate Act are to be met, it is crucial that greenhouse gas emissions from the agricultural sector are reduced. At the same time, the costs of emission reductions in agriculture are relatively low when the positive externalities for the aquatic environment and reduced air pollution are taken into account, cf. the Danish Economic Councils (2018).

No existing taxes on agricultural emissions

Agriculture differs from other industries in that greenhouse gas emissions consist mainly of methane and nitrous oxide from crop cultivation and livestock production.[15] There are currently no regulations targeting agricultural emissions of methane and nitrous oxide. One of the reasons for this is that, in practice, it is complex to calculate the exact emissions of agricultural holdings, since the emissions depend on many parameters such as the type of animal feed, fertilizer, crops, barn arrangement, etc.

[14] See Nielsen et al. (2019).
[15] See Nielsen et al. (2019).

A tool for calculating emissions at the holding level

In order to be able to impose taxes on agriculture that ensure cost-effectiveness, it is necessary to be able to measure the emissions of individual holdings. We recommend implementing the so-called farm accounts tool, which the Climate Council has previously recommended. This tool measures greenhouse gas emissions at the enterprise level, and it could be implemented using information that is already available.[16] The tool uses, among other things, specific data on the number of animals, the type of livestock and the type of crops, which is information that farmers are already obliged to report. The tool could be further developed on an ongoing basis to improve the accuracy of the emission calculations. For example, it could be improved by taking closer account of variations in the composition of livestock feed.[17]

CO_2e tax imposed on emissions

The CO_2e tax should be imposed on each farm's total emissions on the basis of the tool's calculation of their CO_2e emissions. Thus, the agricultural sector would have incentives to reduce emissions where it is most cost-effective. Regulations in the form of, for example, bans on certain operating practices across all farms, despite differences in their production conditions, would not be cost-effective.

High leakage in the agricultural sector

Leakage from the agricultural sector could be high when it is subject to a CO_2e tax, although there is considerable uncertainty about the extent, cf. the Danish Economic Councils (2019). In order to reduce the likelihood that the CO_2e tax would lead to the closure or relocation of agricultural production, farmers should be compensated with a CO_2e-tax rebate following the same model as the very energy-intensive companies. The rebate would be phased out by 2050 following a predetermined schedule. However, it is recommended that the gradual harmonization of the CO_2e price for agriculture start at a relatively low price. A benchmark could be a CO_2e price in the agricultural sector of DKK 500 per tonne by 2025. The differential tax treatment should be abolished well before 2050, with 2030 being a realistic end year.

The taxes would be reflected in land prices …

Taxes on agriculture would, to a large extent, be reflected in lower land prices, cf. the Ministry of Taxation (2018). Therefore, the introduction of the CO_2e tax would result in capital losses for farmers, both in the form of increased leverage and reduced equity in the agricultural business. However, a CO_2e-tax rebate and a slow phase-in of the full CO_2e price would, to a large extent, mitigate the impacts as they reduce the capitalization effects and thus take into account distributional considerations and reduce possible risks to the financial system of sudden changes in land prices.

… which limits agricultural leakage

When the CO_2e tax is capitalized in the land price, farmers' gains from selling their land and moving production abroad would be limited compared to before the introduction of the tax. Leakages on the extensive margin in agriculture may, therefore, be of minor importance.

2.2.2 The transport sector

High taxes on petrol and diesel …

In Denmark, DKK 4.7 is paid in tax per litre of petrol and DKK 3.6 is paid per litre of diesel, see Figure 2.1. If the tax burden is calculated according to the CO_2e content of petrol and diesel, it implicitly corresponds to a CO_2e tax on petrol and diesel of DKK 1,965 and DKK 1,340 per tonne of CO_2e, respectively.[18] This is significantly higher than other taxes on CO_2e emissions, which is because the taxes are levied to also account for other negative effects of driving, such as congestion, noise pollution and air pollution.

… but still lower than the externalities

In isolation, the tax on motor fuel is significantly lower than the externalities caused by driving as estimated by the Ministry of Transport's 'TERESA' model.[19] This speaks to the need for a higher tax on driving than today. However, motor vehicle transport is also taxed through registration fees, and if these fees are perceived as indirect taxes on driving, the overall taxation is estimated to be

[16] See the Climate Council (2016).
[17] See the Climate Council (2016).
[18] It is assumed that emissions are 2.40 and 2.65 kg of CO_2 per litre of burnt petrol and diesel, respectively. These figures are based on the Danish Energy Agency's Energy Statistics for 2018 as well as the Danish Energy Agency's calculated burn values for petrol and diesel.
[19] See Center for Transport Analytics (2019).

higher than the negative externalities arising from driving.[20] However, registration and the vehicle ownership fees are not very targeted instruments for taxing driving and CO_2e emissions.

Higher CO_2 tax on petrol and diesel

Therefore, we propose that the CO_2 tax on petrol and diesel be raised so that the rate corresponds to the general CO_2e tax. A tax of DKK 1,000 per tonnes of CO_2e by 2025 would increase the tax on petrol and diesel by DKK 2.0 and DKK 2.2 per litre, respectively. The CO_2e tax must take into account the harmful climate effects that the target of a 70 per cent reduction in greenhouse gas emissions reflects.

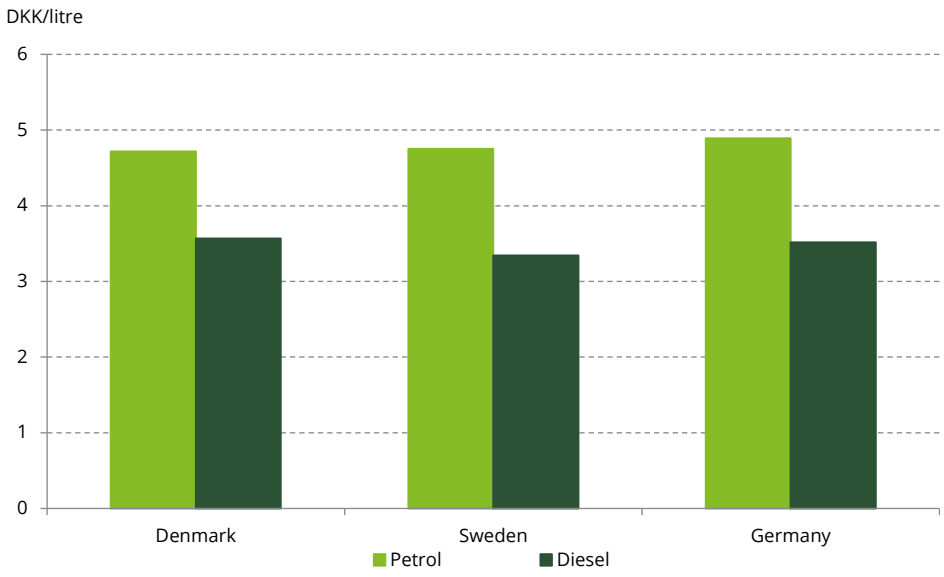
Higher taxes could lead to increased border trade

The current energy taxes on petrol and diesel should be preserved to take into account the other externalities, such as congestion and accidents that result from driving. However, it must be noted that higher petrol and diesel taxes in Denmark relative to the surrounding countries could lead to increased border trade and consequent leakage. At present, the taxes in Denmark are on par with Sweden and Germany, cf. Figure 2.1. If the tax were raised by approximately 2 DKK, it would give an incentive for some drivers to go outside the Danish borders to fill their petrol tanks. The proposed tax increase would be phased in gradually towards 2025, and border trade and the leakage could, therefore, be limited if Sweden and Germany follow suit and also raise their taxes.

Road pricing could counter the other externalities

The instrument that can counter for the other negative eksternalities from driving would be a driving tax or road pricing. That is, a tax on vehicles per kilometre driven, which should ideally be higher when driving in areas with, and at times of, major congestion. However, road pricing does not seem to be politically feasible at the moment, but in the long term it would be appropriate to introduce road pricing to tax the other externalities caused by driving, so that the CO_2e tax is the only tax levied on fuel.

Figure 2.1 Taxes on petrol and diesel, January 2020



Notes: The German tax rates are from December 2019 and the Danish and Swedish ones are from January 2020. For Denmark, lead-free petrol is based on 4.8 per cent biofuels and diesel fuel is based on 6.8 per cent biofuel.
Source: Danish Ministry of Taxation, Swedish Tax Agency and German Federal Ministry of Finance.

International transport should not be forgotten

Denmark's participation in international sea and air traffic is a source of significant CO_2e emissions, but it is not included in the climate accounts or the 70 per cent target. This report does not include suggestions for how Denmark should deal specifically with emissions from international transport,

[20] See Danish Ministry of Taxation (2020. See also answers to committee questions: https://www.ft.dk/samling/20181/almdel/sau/spm/321/svar/1572219/2041795.pdf, in Danish only.

i.e., shipping and air traffic. However, this is not an indication that Denmark should not make an effort in this area, it is merely because this report relates to the official Danish climate targets.

2.2.3 Electricity generating sector

Taxes on electricity are highly differentiated

The taxes on electricity generation and consumption currently depend both on how the electricity is produced and what it is used for. As a result, CO_2e emissions are not taxed uniformly, cf. Section 2.4. On the production side, electricity is not taxed except through the EU-ETS quota system, whereas there are varying subsidies for electricity production based on renewable energy (RE) depending on the RE source. Taxes on electricity are instead imposed on household and business consumption, where the tax on electricity used by business for some processes is significantly reduced compared to ordinary electricity consumption.

Both producers and consumers are subject to the CO_2e tax

In a new tax system, electricity producers should in principle face the same CO_2e tax as other companies. If the electricity producer is covered by the quota sector, it should have a tax deduction for the quota price in order to avoid double taxation. However, if the same high tax as paid by other companies were imposed on Danish electricity producers, it would result in increased imports of foreign-produced electricity at the expense of domestically produced electricity, because foreign electricity would have become cheaper. Therefore, CO_2 leakage would occur to the extent that the imported electricity is produced using fossil fuels. To counteract this, Danish electricity producers should receive a reduction in the tax payment corresponding to the Danish Energy Agency's annual estimate of the CO_2 content of foreign-produced electricity. In turn, electricity consumers, i.e., businesses and households, should be subject to a tax corresponding to the estimated greenhouse gas emissions from imported electricity. For example, if it were estimated that imported electricity has a CO_2 content of 0.25 tonnes per MWh, then electricity consumption would be charged a tax per MWh at a quarter of the CO_2e tax rate. The reason is that increased electricity consumption increases imports of foreign-produced electricity resulting in increased CO_2 emissions abroad. The electricity tax at the consumption level corresponds to the tax reduction received by the domestic producers of fossil-based electricity per MWh. These rules ensure that both electricity producers and consumers are taxed on their net contribution to global emissions and that the leakage effect of taxing domestic fossil-fuelled electricity generation is taken into account.

The net tax on electricity produced by RE must be zero

Since the tax on electricity consumption must, for practical reasons, be imposed on all electricity consumption, it will involve some taxation of electricity produced with renewable energy. To ensure that the net tax on electricity produced with renewable energy becomes exactly zero, the producers of green electricity should have a subsidy that corresponds exactly to the electricity tax charged at the consumption level, as proposed by the Climate Council (2018a), and the Ministry of Taxation (2018).

Only certified biomass should be tax exempt

In line with the Climate Council, we propose that biomass that cannot be officially certified be subject to the same taxes as other fuels. Denmark's consumption of wood-based biomass for heating and electricity production has been growing rapidly in the past decade, which is largely due to the fact that biomass is exempt from both the energy tax and the CO_2 tax. As pointed out by, among others, the Climate Council,[21] this favourable tax treatment has meant that Danish cogeneration (combined heat and power) plants do not necessarily choose the technologies that are most cost-effective from an economic point of view, for example, electric powered heat pumps. What's more, the Climate Council does not find that the existing voluntary certification scheme in the biomass industry provides sufficient assurances that the biomass used in Denmark forms part of a cycle that ensures that the biomass can be regarded as approximately climate neutral. The Climate Council has thus proposed a tightened and state-regulated official certification scheme that is more focused on ensuring climate neutrality.

[21] See the Climate Council (2018b), available in English.

2.3 A new tax system

The key elements of a new tax system

Based on the arguments above, we recommend a climate tax reform with the following elements:

- All greenhouse gas emissions from Danish territory are to be subject to a tax per tonne of CO_2e. In the medium term, i.e., from approximately 2030, the tax rate should be uniform regardless of the sector responsible for emissions.
- Companies are to have the opportunity to adapt production by, for example, investing in climate-friendly technologies; therefore, taxes should be phased in gradually. Conversely, the 2030 target requires a relatively rapid phase-in. The Climate Council is tasked with recommending the exact tax level needed to realize the Danish objectives, but DKK 1,000 per tonne of CO_2e by 2025, increasing to DKK 1,250 per tonne from 2030 are realistic benchmarks.
- In order to counteract leakage, quota sector companies, which today are entitled to free allocation of CO_2 quotas, as well as non-quota sector companies with production processes on the Ministry of Taxation's energy-intensive processes list, are to be eligible for a standard CO_2e tax rebate of 80 per cent of their historical emissions. Quota-sector companies are also able to deduct their quota payments. The agricultural sector is also to be eligible for the standard tax CO_2e tax rebate of 80 per cent, and the calculation will be based on climate accounts for each individual holding. The rebate is to be phased out according to a predetermined schedule and completely abolished by 2050.
- If a company that is entitled to a rebate claims less than their rebatable limit, the company will be eligible for a subsidy of the same value as the tax rate. This ensures that these companies also have incentives to make further reductions in emissions. The subsidy is linked to an activity prerequisite so that no subsidies are paid for reductions that only reflect declining production, cf. Section 2.2.
- To treat greenhouse gas-intensive businesses fairly and to counteract leakage, the higher level of taxation is to be phased in at different rates so that companies that are also eligible for the above-mentioned tax rebates are subject to a lower tax rate than others in the transitional phase. The differentiation should be phased out following a predetermined schedule and completely abolished long before 2050, with 2030 being a realistic end year.
- In step with the increases in the CO_2e tax, the existing energy taxes, apart from the taxes on petrol and diesel, are to be reduced so that, by 2025, the energy tax rate will be 25 per cent of the current level, after which it is kept constant. However, the phasing-out of energy taxes should not occur faster than required to comply with the EU Energy Saving Directive.
- In the transport sector, the CO_2 tax on petrol and diesel is to be raised to the same level as the standard rate in other areas, i.e., DKK 1,000 by 2025. This entails a tax increase of DKK 2.0 and 2.2 per litre on petrol and diesel, respectively. In order to ensure appropriate taxation of the other negative externalities of driving, such as congestion, noise, accidents, etc., the current energy taxes on petrol and diesel should be preserved until they can be replaced by more targeted driving taxes. However, border trade considerations may require a minor downward adjustment in petrol and diesel energy taxes in step with the increases in the CO_2 tax if our neighbouring countries do not raise their tax rates as well.
- For electricity generation, electricity producers are to be subject to the CO_2e tax. Electricity consumers, i.e., households and businesses, are to be subject to a tax corresponding to the estimated greenhouse gas emissions from imported electricity. The Danish electricity producers are to be eligible for a corresponding rebate. Thus, taxation on consumption of both Danish-produced and imported electricity based on fossil fuels will be taxed with the full CO_2e tax. Furthermore, quota sector electricity producers, like all other companies in the quota sector, are to be entitled to full rebates of quota purchases.
- Biomass for energy purposes that is not officially certified as being sufficiently climate neutral is to be subject to CO_2e tax according to the rules stated above. The certification scheme

should be state-regulated and could follow the guidelines recommended by the Climate Council.[22]

- The Climate Council is tasked with continually assessing the rate of the transition and proposing adjustments to the tax rates.

2.4 Revenue from the tax restructuring

Current taxes and revenue from restructuring

This section first describes the structure of the current tax system. We then calculate the revenue effects of our proposal for a restructuring of the tax system as outlined above. The revenue is calculated for the system as outlined in 2030 and takes into account the feedback and behavioural effects.

Energy tax, CO_2 tax and environmental tax

Energy taxation in Denmark consists of three different types of taxes. First, there is an energy tax on fossil fuels such as coal, oil, petrol and natural gas as well as an energy tax on electricity consumption. Second, there is a CO_2 tax, on the same energy products, depending on their CO_2 content. Third, there are environmental taxes on emissions, e.g., of sulphur (SO_2) and nitrogen oxides (NO_x), from using fossil fuels. We do not describe the environmental taxes in more depth, as our climate plan focuses primarily on a restructuring of the taxes away from energy towards CO_2e.

Energy taxes have many objectives

Current energy taxes reflect many different objects. They must reduce CO_2 emissions, limit environmental pollution, support politically prioritised technologies and contribute to Denmark's compliance with its international climate and energy obligations. In addition, the tax levels are also determined on the basis of revenue considerations.

The energy taxes vary by purpose and type

The energy taxes on fossil fuels and electricity vary according to the purpose of the energy used. For example, electricity for general consumption in a household is taxed far more heavily than electricity for industrial processes, cf. Table 2.1. If the tax burden is calculated according to the CO_2e content of the different types of fuels and uses, and any quota purchases are taken into account, the effective taxation of CO_2e emissions is very uneven. This confirms that the current tax system is only somewhat focused on regulating CO_2e emissions. Meanwhile, fuels from renewable energy sources, such as biomass, are exempt from energy taxes.

Good arguments for reforming energy taxes

The current energy taxes are thus not uniform, hence, energy saving objectives are not handled in a cost-minimizing way. Furthermore, energy taxes are not targeted at CO_2 emissions and other pollution, and revenue raising should not be done with selective taxes but should use taxes imposed on a broad base in the same way as VAT or income tax. Thus, there are good arguments for reducing energy taxes, while at the same time increasing the CO_2e tax significantly.

[22] See the Climate Council (2018b), in English.

Table 2.1 Effective energy tax rates on energy for different uses, 2019 rates

		Energy tax	CO_2-tax	CO_2-quota price (ETS)	Implicit tax on CO_2e
Fossil fuels		---------- DKK / GJ ----------		--------- DKK / tonne CO_2e ---------	
Motor fuel	Fossil petrol	129.6	12.2	0	1965
	Fossil diesel	76.4	12.1	0	1340
Space heating	Heating oil	56.2	13.0	173	1108
	Natural gas	56.2	10.0	173	1337
	Coal	56.2	16.6	173	944
Industrial processes	Heating oil	4.5	13.0[ii]	173[ii]	236[ii]
	Natural gas	4.5	10.0[ii]	173[ii]	255[ii]
	Coal	4.5	16.6[ii]	173[ii]	224[ii]
Fuel for electricity generation	In Quota Sector	0	0	173	173
	Outside Quota Sector	0	10-16.6	0	176
Renewable Energy fuels					
All uses	RE (straw, etc.)	0	0	0	0
Electricity consumption					
General electricity consumption	Electricity other than electric heating	245.6	0	173[iii]	6067
Space heating	Electric heating	71.9	0	173[iii]	1899
Industrial Processes	Electricity	1.1	0	173[iii]	199

Notes: Rates are for 2019. The quota price is from 10 February 2020. 1 GJ equals 277.78 kWh. i) The PSO tax is not included in the table, but is a tax on electricity consumption, which, however, will be phased out by 2022. ii) The CO_2 tax on fossil fuels used for certain industrial processes can be reimbursed if the company has to buy quotas. (iii) Electricity producers pay the quota price, and therefore, consumption is only indirectly taxed. The implicit tax on CO_2e emissions is calculated on the basis of the Danish Energy Agency's and Energinet's emission estimates for energy consumption. No environmental taxes have been included (i.e., SO_2 tax and NO_x tax).

Source: Minestry of Taxation (2020) https://www.skm.dk/skattetal/analyser-og-rapporter/rapporter/2020/januar/skatteoekonomisk-redegoerelse-2019 (in Danish only) and own calculations on the basis of emission estimates from the Danish Energy Agency, Energy Statistics 2018 and Energinet, https://energinet.dk/Om-nyheder/Nyheder/2020/01/16/Rekord-lav-CO2udledning-fra-danskernes-elforbrug-i-2019, (in Danish). The quota price is taken from https://orsted.dk/Erhverv/Mit-oersted/Energimarked/CO2-pris and is the closing price on 10 February 2020.

Tax on electricity consumption is falling up to 2025

Among other things, the 2018 energy agreement included an initiative to reduce taxes on electricity and electric heating by 2025.[23] In addition, the PSO tax will be phased out by 1 January 2022.[24] Therefore, taxes on electricity consumption will be lower in the coming years.

Energy taxes generate DKK 44 billion in yearly revenue

The energy taxes and the CO_2 tax raised approximately DKK 44 billion in total revenue for the Danish Treasury in 2018, cf. Table 2.2. Of this, approximately DKK 17.5 billion came from taxes on petrol and diesel, and DKK 16.1 billion came from taxes on electricity, including the PSO tax.

[23] See Klima-, Energi- og Forsyningsministeriet (2018).
[24] See Klima-, Energi- og Forsyningsministeriet (2016).

Table 2.2 Revenue from the energy tax and the CO_2 tax by energy type, 2018

	Total revenue	Share of total revenue
	DKK Bn	%
Electricity	16.1	36.7
Diesel and other petroleum products	10.0	22.8
Petrol	7.5	17.1
Direct tax on CO_2	5.0	11.4
Natural gas	3.3	7.6
Coal and lignite, etc.	1.9	4.2
Gas	0.0	0.0
Total energy taxes	**43.9**	**100.0**

Notes: Electricity contains revenue from the PSO tax. Revenue is calculated at 2018 prices. Direct taxation of CO_2 consists of tax on Carbon Dioxide (CO_2) and the CO_2 emissions tax.
Source: Statistics Denmark, www.statistikbanken.dk, table MREG21.

It is primarily households that are taxed

Currently, just under 60% of the revenue from energy taxes and CO_2 taxes comes from households, while both the manufacturing and the public sectors account for little under 10 per cent each, cf. Table 2.3.

Table 2.3 Revenue from the energy tax and the CO_2 tax by sector, 2018

	Total revenue	Share of total revenue
	DKK Bn	%
Households	25.1	57.3
Manufacturing	3.9	8.8
Public sector, education & health	3.5	7.9
Retail, hotels and restaurants	2.8	6.4
Transport	2.7	6.2
Other	1.8	4.1
Construction	1.4	3.2
Agriculture	1.1	2.4
Utilities	0.9	2.1
Information services	0.6	1.4
Mining	0.1	0.1
Total	**43.9**	**100.0**

Notes: Other includes the following sectors: Culture and Leisure, Travel Agencies, Cleaning and other operational services, Information and communication, Finance and insurance and Other services. Revenue is calculated at 2018 prices.
Source: Statistics Denmark, www.statistikbanken.dk, table MRS1.

2.4.1 Revenue effect of our tax reform

Reform is approx. revenue neutral in 2030

The tax reform we propose is approximately revenue neutral in 2030, taking into account behavioural and feedback effects. The estimated direct effects of the reform result in additional revenue (before feedback and behavioural effects are included) of just under DKK 16 billion; however, there is expected to be a major behavioural effect from the falling greenhouse gas emissions, which means that the overall effect would be a reduction in revenue of approximately DKK 1 billion, cf. Table 2.4. The estimates do not take into account that the public sector itself would have to pay a share of the higher tax on greenhouse gas emissions but should pay less tax as a result of the reduced energy taxes. The total revenue would be improved if this effect were taken into account, as a greater share of the public sector's emissions come under energy taxes than CO_2e taxes. Our calculations show a very small overall reduction in revenue, given the uncertainty in the calculations and the total room for manoeuvre in public spending. Our assessment, therefore, is that the reform would be approximately revenue-neutral by 2030.

Table 2.4 Impact on public finances in 2030

	Impact in DKK Bn
Higher tax on CO_2e	48.4
CO_2e-tax rebate	-14.9
Reduction in energy taxes	-17.6
Direct effect on revenue	**15.9**
Behavioural effects	-17.3
Feedback effects	0.4
Total revenue effect	**-1.0**

Notes: All amounts are given in 2020 prices. The tax rate in 2030 is set at DKK 1,250 per tonne CO_2e. The CO_2e-tax rebate amounts to approximately 55 per cent of the historical emissions. The revenue calculations include behavioural effects. Greenhouse gas emissions are assumed to fall to DKK 22.2 million tonnes, which corresponds to the 70 per cent reduction target. The behavioural effect of reducing energy taxes is calculated in REFORM.

Source: Statistics Denmark, www.statistikbanken.dk, table DRIVHUS and MREG21, Danish Energy Agency and own calculations.

Direct tax burden on different sectors in 2025

Below we have calculated the direct effects of the tax reform on the 2025 tax payments of the different sectors. This is a calculated without behavioural effects, and it takes no account of sectoral shifts, or the extent to which one sector passes its tax burden on to other sectors.

Greatest tax relief on households and the public sector

The tax restructure means that households and the public sector both have their total tax payments reduced by DKK 0.9 bn. This corresponds to a decrease of 4 per cent and 25 per cent, respectively, cf. Table 2.5.

Table 2.5 Overview of the effects of the tax reform in 2025 by sector

	Higher CO_2e-tax	CO_2e-tax rebate	Reduction of energy taxes	Change in tax burden
	---------- DKK Bn ----------			
Households	10.7	0.0	-11.6	-0.9
Public sector. education, health	1.5	0.0	-2.3	-0.9
Information services	0.3	0.0	-0.3	-0.1
Other	1.1	0.0	-0.8	0.3
Mining	1.7	-1.0	0.0	0.6
Retail, hotels and restaurants	2.4	0.0	-1.2	1.2
Manufacturing	8.0	-3.9	-2.5	1.5
Construction	1.9	0.0	0.0	1.9
Agriculture	6.8	-4.4	-0.5	1.9
Utilities	5.3	-1.8	-0.5	3.0
Transport	4.8	0.0	0.0	4.8
Total direct revenue effects	**44.4**	**-11.1**	**-19.9**	**13.4**

Notes: Revenue effects are calculated on the basis of tax rates for 2025, a CO_2e-tax rebate of 69 per cent, which is the level in 2025, and emissions of greenhouse gases for 2018. Behavioural effects, including reductions in greenhouse gas emissions, have not been included in the estimates.
Other covers the following sectors: Culture and Leisure, Travel Agencies, Cleaning and Other Operations, Information and Communication, Finance and Insurance and Other Services. Calculated in 2020 prices.

Source: Statistics Denmark, www.statistikbanken.dk, table DRIVHUS and MREG21, Danish Energy Agency and own calculations.

Several sectors must pay higher taxes

The transport sector would have to pay DKK 4.8 billion after the tax reform, which is mainly due to the tax on CO_2e emissions increasing, while the energy taxes on petrol and diesel would be maintained. Utilities would have to pay DKK 3.0 billion more in taxes. The construction and agricultural sectors would both have to pay DKK 1.9 billion more in taxes, while the manufacturing sector would have to pay DKK 1.5 billion more in taxes after the reform.

Part of the burden on business would be passed on to households

It is important to emphasize that these are the direct effects on sectors and do not take into account behavioural changes in the form of substitution towards products with lower CO_2e emissions, or sectoral shifts in CO_2e emissions. CO_2e emissions are thus maintained at the 2018 level for all sectors. The direct effects also do not take into account the fact that the sectors typically pass on part of the tax burden to their customers. Therefore, the actual effect on companies would be less, both because production will be made more climate friendly, and part of the tax burden will be passed on to consumers.

Box 2.2 Calculation of the effects of our tax restructuring

Total revenue effects

The revenue from the tax reform in 2030 is estimated using a uniform CO_2e tax of DKK 1,250 per tonne and a CO_2e-tax rebate rate of 55 per cent. We assume that 45 per cent of the historical emissions are eligible for the CO_2e-tax rebate of 55 per cent. Excluding the tax on petrol and diesel, energy taxes are reduced by 75 per cent. As a result of the reform, it is assumed that greenhouse gas emissions fall to 22.2 million tonnes of CO_2e, which corresponds to the reduction target of 70 per cent relative to the 1990 level. The restructuring, which would result in lower greenhouse gas emissions, also reduces costs by reducing energy taxes. This effect is calculated in the general equilibrium model REFORM, cf. Chapter 3.

The calculation does not take into account that the public sector itself is affected by the tax reforms. For example, the public sector would have to pay less in energy taxes but would instead have to pay a CO_2e tax. This, in isolation, would improve revenue, as the public sector pays approximately 8% of the energy taxes, but only emits approximately 1% of CO_2e emissions in Denmark.

Nor does the calculation take into account that Denmark is a net importer of electricity. This means that the revenue would be slightly higher than in our calculation, as consumers would also pay the tax on imported electricity.

Direct tax burden on sectors

We calculate the effects of our tax restructuring for sector *i* using the following method:

$$Revenue_{it} = Reduced\ energy\ tax_{it} - (Tax_{it} * Emissions_{it} - Rebatable\ emissions_i * Rebate_t * Tax_{it})$$

- *Reduced energy tax*$_{it}$ is the sector's gain as a result of the reduced energy tax.
- *Tax*$_{it}$ is the tax per tonne of CO_2e in year *t* in sector *i*.
- *Emissions*$_{it}$ is the total emissions of CO_2e in year *t* in sector *i*.
- *Rebatable emissions*$_i$ is the part of sector *i*'s emissions that is eligible for the CO_2e-tax rebate
- *Rebate*$_t$ is the size of the CO_2e-tax rebate in year *t*.

We have calculated CO_2e emissions across different sectors in Denmark based on Statistics Denmark's estimates of CO_2e emissions excluding biomass in 2018. The estimates from Statistics Denmark do not include emissions from LULUCF or international traffic, which are, therefore, not included in the tax base. The CO_2e-tax rebate is set at 80 per cent in 2021 and decreases linearly until 2050, when the base deduction will have been completely phased out.

In the quota sector we have calculated rebatable emissions as the entire amount of CO_2e emitted by Danish companies that had free allowances allocated in 2018, which follows from the companies being on the EU leakage list. In the utilities sector, however, we have set the rebatable emissions to include only the CO_2e emissions covered by free quotas in 2018. This is because it is not possible to separate the CO_2e emissions and the number of free quotas allocated in sufficient detail at the utilities sector level, which we consider would result in large amounts of CO_2e emissions being erroneously deemed to be rebatable.

Outside the quota sector our calculated rebatable emissions are based on an estimate. This estimate represents five per cent of the manufacturing sector's total emissions and has to include the emissions resulting from production processes on the Ministry of Taxation's energy-intensive process list. In total, more than 90 per cent of the CO_2e emissions from the manufacturing sector are thus deductible. Our results for the revenue in the manufacturing sector is, of course, more uncertain than in other sectors, since it is based on an estimate. We calculate that the estimate would, at most, lead to a change in the tax burden of +/- DKK 0.5 billion for manufacturing.

According to the above-mentioned criteria, the rebatable emissions amount to a total of approximately one third of the utilities sector's emissions, while for the mining sector it represents 93 per cent. In addition, the entire emissions in the agricultural sector are deductible as a result of the exceptionally high risk of leakage. Overall, 45 per cent of Denmark's emissions of CO_2e were rebatable in 2018. This means that, in 2025, the full CO_2e-tax rate would only be paid on approximately 31% of these emissions, as these sectors would be entitled to a CO_2e-tax rebate of 69 per cent in 2025. The value of the CO_2e-tax rebate in 2025 would amount to a total of DKK 11.1 billion in 2020 prices.

In the revenue calculations we have set CO_2e taxes at DKK 1,000 per tonne across all sectors in 2025 except agriculture, where the tax is set at DKK 500 per tonne. The reduced tax rate for agriculture is primarily due to leakage risks.

To calculate the total tax revenue from each sector as a result of the tax restructuring, we calculate the savings for each sector that result from reducing energy taxes by 75 per cent. From there, we deduct the sum of the CO_2e tax rate multiplied by the sector's CO_2e emissions in 2018 and add the value of the sector's CO_2e-tax rebate in 2025. In addition, we correct the increased CO_2e taxation of electricity generation in the utilities sector so that it follows our model for the electricity sector. The distribution of the tax burden between electricity suppliers and electricity consumers depends on the CO_2e content of the imported electricity. The calculations assume that the CO_2e content of domestic and imported electricity is the same. This means that consumers would pay for the entire higher CO_2e tax. If the CO_2e content is higher in the imported electricity, the tax burden on consumers will increase.

The revenue is calculated for each sector, but the calculations do not take into account feedback or behavioural effects. The revenue is calculated at 2020 prices.

3. Distributional effects of a green tax reform

Concerns that taxes are bottom heavy

A common argument against higher taxes on greenhouse gas emissions is that the taxes are bottom heavy, i.e., citizens with low incomes have to bear relatively greater burdens than those with high incomes. This may be the case, for example, if those with low incomes are more likely to consume the goods that increase most in price due to the taxes.

We analyse distributional effects of the reform for 2030...

In this section we investigate the distributional consequences of our tax reform in 2030. We calculate the expected welfare loss for the different groups in the income distribution due to the introduction of a higher tax on greenhouse gas emissions in Denmark, where the revenue is used for CO_2e-tax rebates for companies and to reduce energy taxes.

... as well as three alternative revenue uses

We also calculate the distribution effects of three other options for how the revenue from the higher tax on greenhouse gas emissions could be used. In the first alternative, some revenue is used to phase out the existing energy taxes and the remaining revenue is fully used for a climate bonus for all Danes. In the second alternative, the existing energy taxes are phased out and the remaining revenue is used to reduce the bottom tax rate. In the final alternative, the entire revenue is used for a climate bonus for all Danes.

Increase of DKK 1,000 in taxes on greenhouse gas emissions

Specifically, we analyse the effect of a tax increase of DKK 1,000 per tonne of CO_2e on emissions from activities in Denmark. This increase is on top of the existing CO_2 tax of DKK 170 per tonne,[25] which is roughly equivalent to the quota price. Thus, the total tax amounts to approximately DKK 1,170 per tonne, which is close to the DKK 1,250 per tonne that we consider to be the appropriate benchmark for 2030, cf. Chapter 2. We impose the tax on all activities in Denmark regardless of whether the emissions are related to the use of fossil fuels, such as in industry, or to other processes, such as in agriculture.[26] However, the tax is not imposed on international air and sea traffic.

REFORM combined with the Consumer Survey

The economic model REFORM is used to calculate the effects of the tax increase and use of the revenue. Among other things, the model takes into account the behavioural changes of businesses and households. However, it is not possible to analyse effects across income groups using REFORM. Therefore, we combine the model simulations with register data from various sources, including, e.g., Statistics Denmark's Consumer Survey, to see how welfare losses and welfare benefits vary across income groups. The procedure for the calculations is described in Box 3.1.

Focus on the long-run costs in this analysis

In this analysis we focus on how the green transition affects the welfare of different income groups in the long run.[27] However, we do not include the climate benefits themselves, nor the benefits that may result from lower fossil fuel consumption in the form of better air and water quality. The long-term perspective means that we disregard a number of restructuring costs, such as the cost of many displaced workers having to find employment in other sectors.

[25] The tax of DKK 170 per tonne of CO2 is imposed on the non-quota sectors.
[26] The specific model for the inclusion of a tax on greenhouse gas emissions is described in more detail in Chapter 2.
[27] The analysis is based on model simulations carried out in REFORM, which is a general equilibrium model. The model thus compares the pre-tax economy with a post-tax situation where the economy has adapted to the new equilibrium. The model cannot analyse how or how quickly the adaptation takes place.

3.1 Our overall tax restructure maintains the current distribution

Distributional effects of our green tax reform proposal in 2030

In this section, we analyse the distributional consequences of our proposal for a green tax restructure. The tax restructuring, which is presented in detail in the previous two chapters, includes a gradual increase in the tax on greenhouse gas emissions. In addition, the most energy-intensive companies are entitled to a CO_2e-tax rebate, and the existing energy taxes are reduced by 75 per cent.

Assumptions behind the calculations

We have calculated distributional effects of a tax increase of DKK 1,000 per tonne of CO_2e, which is added to the existing CO_2 tax of DKK 170 per tonne. We assume that the base deduction does not affect commodity prices as it does not affect the marginal production costs of the companies. 55 per cent of the revenue from the tax increase is used to lower energy taxes by 75 per cent, excluding taxes on petrol and diesel. The remaining 45 per cent of the proceeds is used for a CO_2e-tax rebate of 55 per cent to the energy-intensive companies, which are assumed to account for 45 per cent of total emissions. The 55 per cent CO_2e-tax rebate is calculated on the basis of a CO_2e-tax rebate of 80 per cent in 2021, which is linearly phased out by 2050.

The lower income groups would not experience a welfare loss

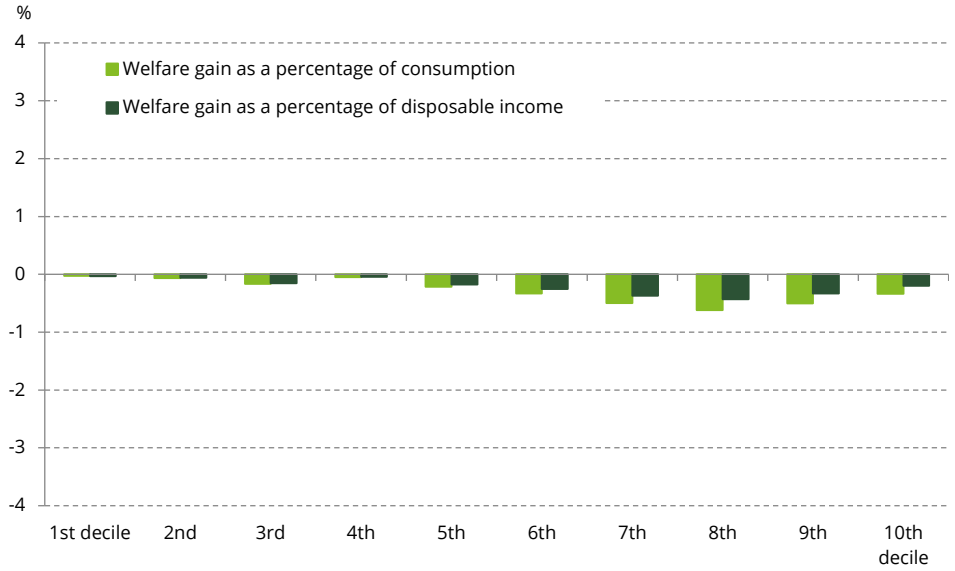
The four lower deciles in the income distribution would not experience welfare losses under our proposal for a restructured green tax, cf. Figure 3.1. In isolation, an increase in the tax on greenhouse gas emissions would affect the lower income groups to a greater extent, cf. Section 3.2. However, this distributional effect is more than offset by the lower energy taxes. This is due to the fact that the energy taxes that are being reduced currently have a large effect on the lower income groups.

Very limited welfare loss for the other income groups

The income groups in the middle and top of the income distribution would experience very limited welfare losses, cf. Figure 3.1. Income groups in deciles 7 to 9 would have the largest relative loss of approximately 0.5 per cent of their consumption. The reason they would be most severely affected is because people in this group spend a relatively large portion of their income on transport, which increases most in price as a result of the transition. However, it should be noted that the welfare losses for all income groups are modest relative to the expected increases in incomes in Denmark over the next decade. That means, that there would be no absolute losses compared to today, just slightly lower improvements than would otherwise have been the case.[28] Overall, the lower income groups would be unaffected, and the overall income distribution would become more equal.

[28] Although the average person in an income group would experience a welfare gain, there may be people in the same income group who experience significant welfare losses. This may be the case, for example, if the person commutes very far in their own car and thus has high fuel costs compared to others in the same income group. Conversely, there would also be people who experience greater gains.

Figure 3.1 Distributional effects of our proposal for restructuring green taxes



Notes: In the calculation, the tax on greenhouse gas emissions increases by DKK 1,000 per tonne to DKK 1,170 per tonne. In total, energy taxes, excluding taxes on petrol and diesel, are reduced by 75 per cent, and energy-intensive companies receive a CO_2e-tax rebate of 55 per cent of their historical emissions. The welfare gain is calculated for an average person in each income decile. A negative welfare gain corresponds to a welfare loss.
Source: Statistics Denmark, REFORM and own calculations

Prioritization of distribution, labour supply and leakage considerations

Hence it would be possible to increase the taxes on greenhouse gas emissions, ensure virtually unchanged distribution and introduce a CO_2e-tax rebate for highly competitive industries with the aim of reducing the risk of greenhouse gas leakage and reducing transition costs. However, the tax reform would have a negative labour supply effect on approximately 5,300 people as a result of their real disposable income being eroded by the higher net tax on fossil fuels. What's more, it is not possible to limit this negative labour supply effect by, e.g., reducing the bottom tax rate, without requiring additional funding through other reforms.

The energy taxes are, to a lesser extent, targeted a climate effect

Despite reducing existing energy taxes in connection with the transition to a tax on greenhouse gas emissions, the climate effect of the transition would still be considerable. This is because the new CO_2e tax targets a reduction in greenhouse gases, unlike the energy taxes, cf. Table 2.1 in Chapter 2. In isolation, a reduction in energy taxes would increase consumption of fossil fuels and, thereby, increase greenhouse gas emissions, but only to a limited extent. The modest climate effect would be partly due to the fact that a large part of the tax reduction consists of a reduction of the energy tax on electricity, which is largely produced with renewable energy, and that the total tax burden on the transport emissions continues to increase as a result of the tax reform.

A higher tax also effects the return on capital …

A higher tax on greenhouse gas emissions would be partly passed on in consumer prices, but it would also affect business owners in the form of lower profits. We have assumed that the effects of lower profits in the business sector are distributionally neutral, even though the distributional effects of lower profits must be expected to impact the upper income groups to a greater extent because they are over-represented among business owners. However, the REFORM modelling indicates that the effect via the business profits is substantially smaller than the effect via consumer prices.

… which is offset by CO_2e-tax rebates and lower energy taxes

A CO_2e-tax rebate for the most energy-intensive companies would reduce the leakage risks, cf. Chapter 2, but it reduces the revenue from the CO_2e tax. At the same time, the CO_2e-tax rebate and lower energy taxes would also reduce the fall in business profits, and thus, benefit the business owners.

The new tax, and thus, the revenue, is completely phased out by 2050

By 2050, when Denmark must be climate neutral, tax on greenhouse gas emissions, and hence the revenue, would have been completely phased out. Therefore, there would be no revenue to offset undesirable distributional effects of the altered prices in 2050. However, in the very long term, new technological advances would likely reduce the costs associated with the green transition, so the need for funding to counteract undesirable distribution effects would also fall.

3.2 In isolation, a higher CO_2e tax is bottom heavy

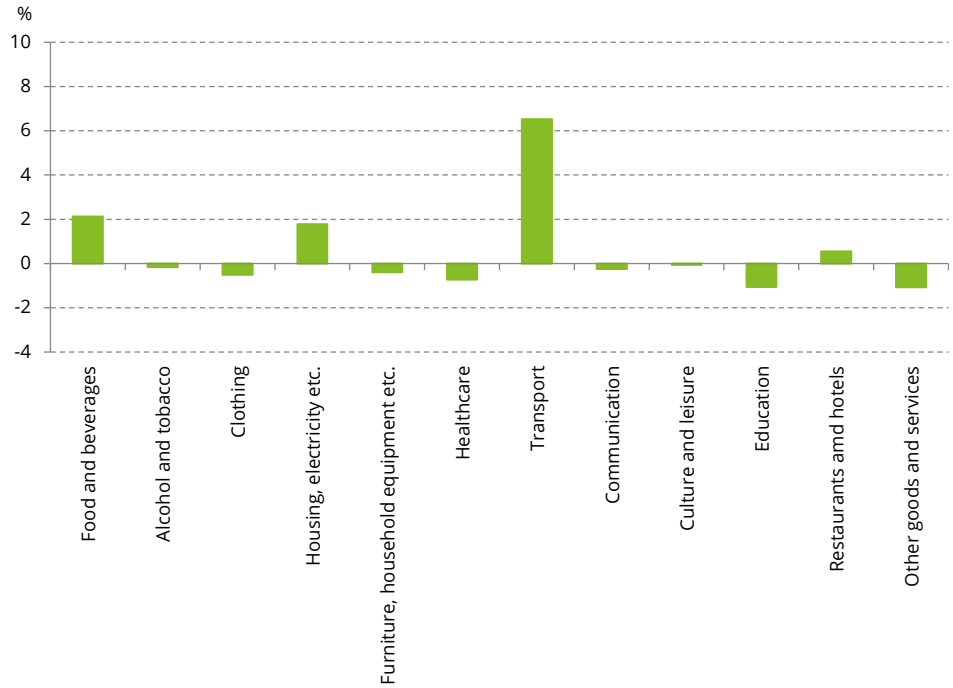
Products with high CO_2e content increase greatly in price

Seen in isolation, a higher tax on greenhouse gas emissions means that it would be more expensive to produce goods and services with a high content of CO_2e. This means that the price of driving a car, home heating and meat, for example, would rise relatively more. Conversely, goods and services with a low content of CO_2e would, to a large extent, not increase in price and may even fall in price.

... e.g., fuel for transport and home heating

Figure 3.2 shows the relative price changes for different product groups with an increase in the CO_2e tax of DKK 1,000 per tonne. Note that, in particular, transport, food and beverages, and housing, including electricity, heating and gas, increase in price, while most services fall in price. When a commodity group does not rise in price, it is primarily because it has a low CO_2e content, which is why the tax increase does not affect it directly. The higher prices of some goods reduce real wages. This results in small relative price falls in a number of product groups, including services, because production costs are lower. Product groups that have a high import share would experience smaller price increases, as a CO_2e tax on emissions in Denmark would not be imposed on goods produced abroad.

Figure 3.2 Relative price changes for product groups from a CO_2e tax increase of DKK 1,000 per tonne



Notes: Prices are affected by a variety of conditions. First, they are directly affected by the CO_2e content of the product. Second, they are affected by changes in demand, which in turn come from changes in income and changes in relative prices. Third, the import share of goods is important, as goods produced abroad do not increase in price following from higher Danish taxes.
Source: Statistics Denmark, REFORM and own calculations.

Consumption varies across income groups

When prices of different goods and services develop differently, it affects the income groups differently. This is because the consumption composition varies across income groups. For example, people at the bottom of the income distribution spend a greater proportion of their income on home heating, while people at the top of the income distribution spend relatively more money on transport.

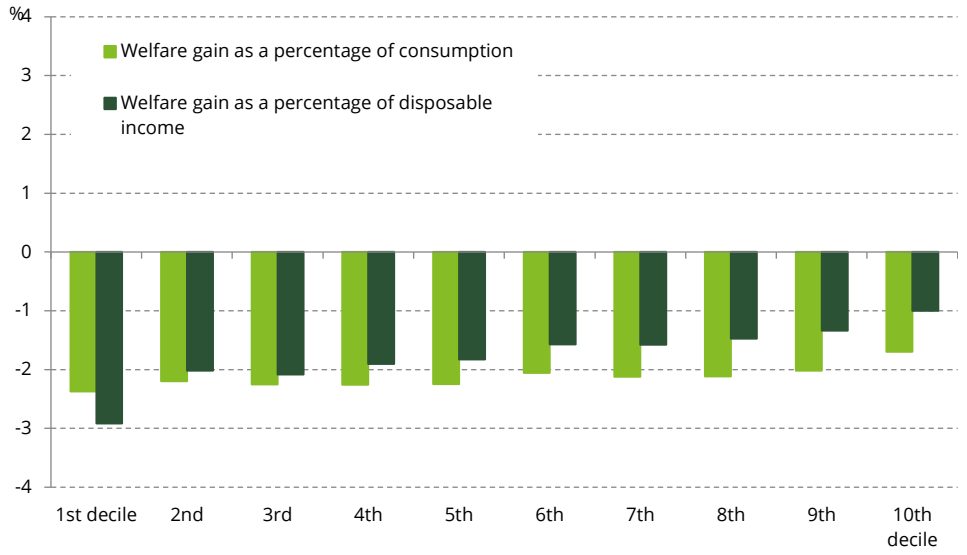
Higher prices reduce consumption and labour supply

Rising prices, all else being equal, result in a loss of welfare for consumers because they have to reduce their consumption. They simply cannot afford as many goods as before the price increase. The falling real wages due to increasing prices also cause households to reduce their labour supply. Thus, their income declines and they consume less.[29]

Greatest welfare loss at the bottom of the income distribution

We analyse the direct distributional effects of a higher CO_2e tax by considering a tax increase of DKK 1,000 per tonne of CO_2e, where we assume that the tax revenue is simply "set aside" and not used in a way that will affect the distribution of income. The light green bars in Figure 3.3 show the welfare loss of such a tax increase for each income decile and are calculated according to the average consumption of persons in the income group concerned. The loss of welfare is greatest in the 1st to 5th deciles, while it is least in the 10th decile. In general, there is a greater loss of welfare for the income groups at the bottom of the income distribution. If one instead looks at the welfare loss in terms of disposable income, shown by the dark green bars in Figure 3.3, then the trend is even more evident. The welfare loss is clearly greatest in the 1st decile and then gradually decreases as one moves up the income distribution. This difference between the welfare loss in terms of consumption and the welfare loss in terms of disposable income is due to the fact that people with lower incomes spend a greater fraction of their income on consumption. However, since consumption is usually a better indicator of an individual's expected lifetime income than his or her current annual income, it is the welfare loss measured by consumption that is of particular interest when assessing the long-term distributional effects of a CO_2e tax.

Figure 3.3 The isolated distributional effects of a tax increase of DKK 1,000 per tonne of CO_2e



Notes: The welfare gain is calculated for an average person in each income decile. A negative welfare gain corresponds to a welfare loss
Source: Statistics Denmark, REFORM and own calculations

Comparison with other Danish studies

The profile of the distributional effects is consistent with the results in Wier *et al*. (2005) who analyse the distributional effects of the CO_2 tax on energy consumption in Denmark in 1996. The Danish Ministry of Taxation (2017) finds that direct consumption taxes on electricity and fuel are regressive, i.e., they are paid for to a greater extent by people with low-incomes, while direct

[29] However, the reduced labour supply also means more leisure time, which, in isolation, gives a welfare gain.

consumption taxes on cars and fuel are progressive, i.e., they are paid for to a greater extent by people with high incomes, which is also in line with our results. The Danish Ministry of Taxation (2020) finds that the electricity tax is regressive, while the tax on electric heating is close to neutral. The Danish Ministry of Finance (2002) finds that energy and environmental taxes are regressive, while transport taxes are progressive.

3.3 Distribution effects of other revenue uses

Three alternative scenarios for using the revenue

In this section, we analyse the distributional effects of three other possible uses of the additional revenue provided by the tax increase. In all three alternative uses of the revenue, we continue to assume that the tax on greenhouse gas emissions is approximately DKK 1,170 per tonne of CO_2e, corresponding to an increase of DKK 1,000 per tonne on top of the existing CO_2 tax. As mentioned, this largely corresponds to our recommendation to apply a tax of DKK 1,250 per tonne of CO_2e as a benchmark for 2030. All the alternative revenue uses considered are shown to be revenue neutral in 2030.

3.3.1 Higher tax on greenhouse gas emissions, phasing out of existing energy taxes, and climate bonus for all citizens

Tax restructure and climate bonus for all citizens

If one does not want to focus on the leakage problem, then instead of a CO_2e-tax rebate some of the revenue could be used for a climate bonus in the form of a fixed amount paid to all taxable citizens - young as well as old and regardless of income. In our first alternative scenario we calculate the distributional effects of phasing out existing energy taxes, excluding the taxes on petrol and diesel, and applying the remaining proceeds to a climate bonus. The arguments that are often put forward for a climate bonus are that it can counteract undesirable distributional effects, it is simple to administer, and makes it clear that the purpose of the tax is not simply to raise more revenue for the state. A climate tax that addresses these arguments could help make it politically acceptable.[30]

Restructuring makes those with low incomes better off

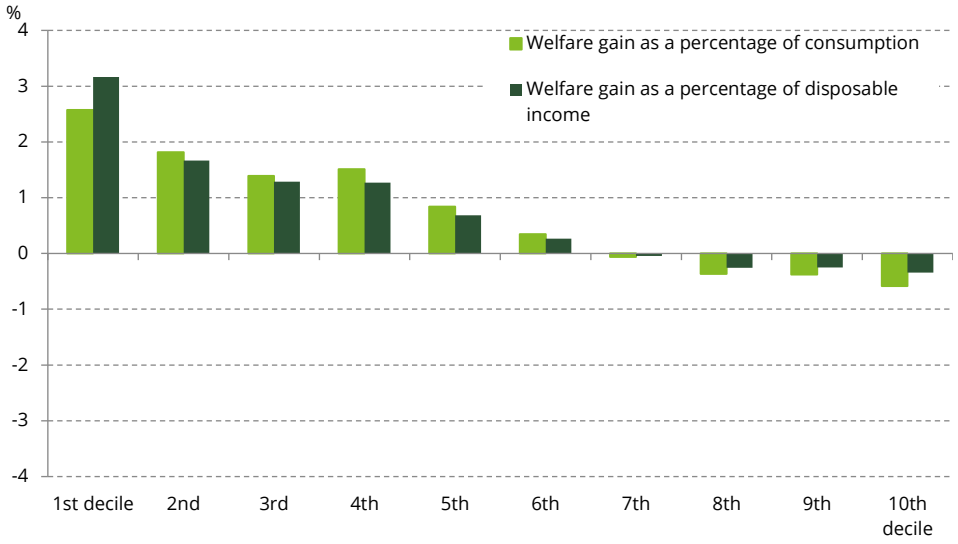
A revenue-neutral tax restructure in which the higher CO_2e tax finances a reduction in energy taxes and pays a climate bonus to all tax payers would mean that people at the bottom of the income distribution would experience a welfare gain, while people at the top of the income distribution would experience a smaller welfare loss, cf. Figure 3.4. This distribution profile is partly due to the fact that the climate bonus would constitute a larger share of consumption at the bottom of the income distribution and that the taxes on fossil fuels for transport increase significantly, which disproportionately impacts those at the top of the income distribution because transport constitutes a greater share of their budgets.

Takes no account of leakage

However, if the revenue were not used for a CO_2e-tax rebate, the risk of leakage would not have been taken into account, so reductions in greenhouse gas emissions in Denmark would not have the same global impact as in our proposal for a tax reform. In addition, it would incur greater transitions costs because employment in several industries would fall sharply, and it would take time for the people affected to find employment in other sectors.

[30] See Fremstad and Paul (2019), Klenert *et al*. (2018) and Carattini *et al*. (2017)

Figure 3.4 Distributional effects of a higher tax on greenhouse gas emissions with the revenue used to reduce energy taxes and deliver a climate bonus



Note: The welfare gain is calculated for an average person in each income decile. A negative welfare gain corresponds to a welfare loss.
Source: Statistics Denmark, REFORM and own calculations.

Room for CO_2e-tax rebate or a lower bottom tax rate

As illustrated in Figure 3.4, the results of our analysis of the distributional effects show that part of the revenue could alternatively be used for other purposes without the lower income groups being disadvantaged. For example, if one wanted to reduce the negative labour supply effects, the bottom tax rate could be lowered (see the next alternative revenue application), or a CO_2e-tax rebate for energy-intensive companies could be introduced, which would limit the relocation of Danish companies and jobs, as proposed in our tax reform.

3.3.2 Higher tax on greenhouse gas emissions, phasing out of existing energy taxes, and a reduced bottom tax

A share of the revenue could be used to reduce the bottom tax rate

If one wants to avoid negative effects on both labour supply and income distribution, a share of the revenue could instead be used to reduce the bottom tax rate.[31] An increase in the CO_2e tax of DKK 1,000 per tonne, in isolation, results in a reduction of the labour supply of just under 0.4 per cent, which corresponds to approximately 10,500 employees. If the revenue were used to reduce energy taxes and for a CO_2e-tax rebate for companies, which we propose in our green tax restructuring, the negative labour supply effect would be halved to just under 0.2 per cent, which corresponds to approximately 5,300 people.[32]

This almost neutralises negative labour supply effects

If, instead, the revenue were to be used to reduce energy taxes and the bottom tax rate, labour supply would only be reduced by 0.03 per cent, which corresponds to approximately 700 people. This would thus largely neutralise the negative labour-supply effect that the higher tax on greenhouse gas emissions would lead to. Lowering energy taxes would be nearly as effective an instrument for increasing labour supply as a reduction in bottom tax rate, but it would benefit the lower income distribution groups to a greater extent. If the entire revenue were instead spent on a reduction in the bottom tax rate, the labour supply effect of the higher CO_2e tax would be completely neutralised.

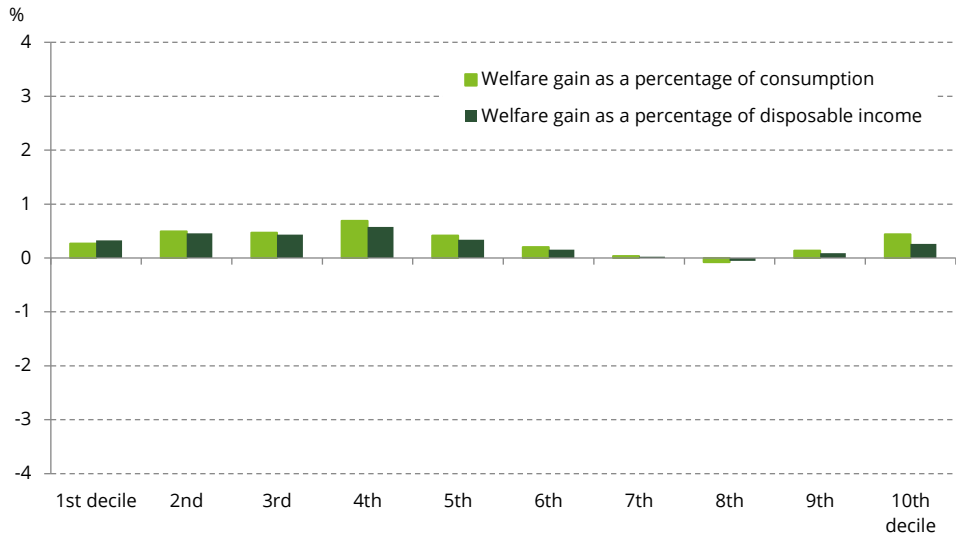
Small welfare gains for almost all income groups

An increase in the CO_2e tax with the revenue used to reduce energy taxes[33] and to reduce the bottom tax would lead to small welfare gains for almost all income deciles, cf. Figure 3.5. However,

[31] If one is only interested in the labour supply and not the distributional consequences, the top tax could be lowered instead.
[32] The estimated labour supply effects are based on calculations conducted in REFORM.
[33] Excluding taxes on petrol and diesel.

this revenue utilization does not take leakage into account, and therefore, the Danish reductions would not have the same global impact as under our tax reform.

Figure 3.5 Distribution effects of a higher tax on greenhouse gas emissions, with revenue used to reduce energy taxes and the bottom tax rate



Notes: The welfare gain is calculated for an average person in each income decile. A negative welfare gain corresponds to a welfare loss.
Source: Statistics Denmark, REFORM and own calculations.

3.3.3 Climate bonus for all Danes

Climate bonus only gives small welfare gains ...

If the revenue from the higher tax on greenhouse gas emissions were used solely to deliver a climate bonus, the lower two income deciles would experience a welfare gain, cf. Figure 3.6. However, the gain would be a lower percentage than if part of the revenue were used to lower energy taxes and the remaining revenue used for a climate bonus, cf. Section 3.3.1. This is because it is more welfare-enhancing to lower the tax on electricity and gas than to use the revenue for a climate bonus - even for the lower deciles. This is due to the very large home heating price increases and the lower labour supply. The 3rd and 4th deciles would be virtually unaffected if the entire revenue were used for a climate bonus, whereas they would gain from our tax reform.

... especially for the top of the income distribution

Those in the 5th to 10th deciles would, on average, experience a welfare loss of between 1 and 3 per cent of their consumption, cf. Figure 3.6. This would leave them significantly worse off than under our proposed tax reform as well as under the other alternative revenue allocations, which reflects that a fixed-sum climate bonus would only constitute a relatively small proportion of their consumption.

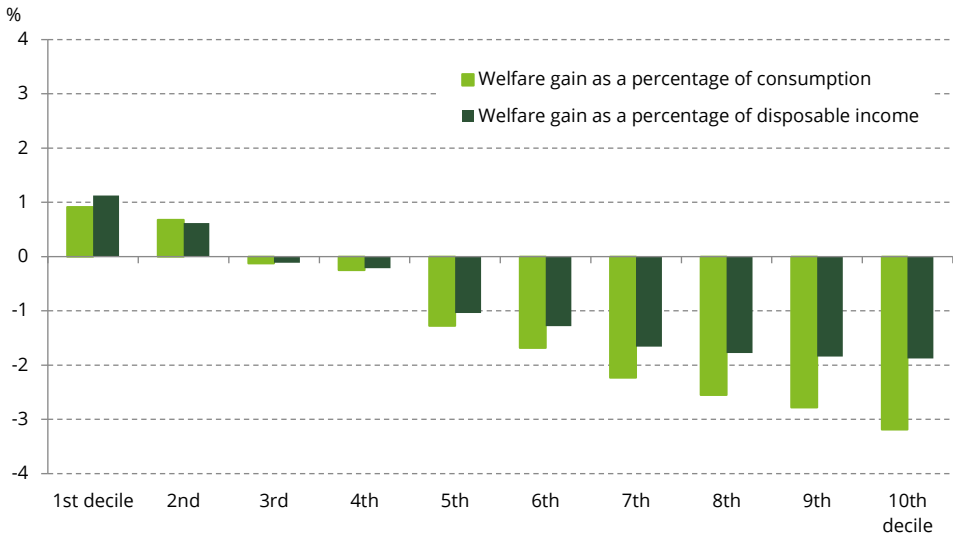
Large negative labour supply effect

However, if all the revenue were used for a climate bonus, there would be a markedly negative labour supply effect of approximately 10,500 people, which would reduce overall Danish prosperity. This is due, among other things, to a decrease in real wages as a result of the higher prices.

The climate effect in Denmark is a slightly greater

However, the climate effect calculated as the total reductions in greenhouse gas emissions in Denmark would be slightly greater if the revenue were used exclusively for a climate bonus. This is because energy taxes would be maintained, and while not a particularly effective instrument for reducing greenhouse gas emissions, they provide a slightly greater incentive to shift away from fossil fuels. However, leakage is not taken into account when the entire revenue is allocated to a climate bonus.

Figure 3.6 Distribution effects of higher taxes on greenhouse gas emissions, with revenue used exclusively for a climate bonus



Notes: The welfare gain is calculated for an average person in each income decile. A negative welfare gain corresponds to a welfare loss.
Source: Statistics Denmark, REFORM and own calculations.

Box 3.1 Calculation of welfare effects

Calculations in REFORM

The consequences of the tax reform and the alternative uses of the revenue are calculated in DREAM's general equilibrium model REFORM. REFORM is a static, multi-sector, general equilibrium model for Denmark. For the simulations, we have included the 2017 greenhouse gas emissions from different sectors divided into 48 energy types (oil, petrol, solar heating, wood chips, etc.) in the model.

There are two representative consumers in REFORM - one in the labour force and one outside the labour force. Consumers in the labour force receive wages and capital returns, and consumers outside the labour force receive transfer payments and capital returns. Consumers have identical utility functions, and therefore, the composition of their consumption does not differ. Therefore, REFORM cannot be used to calculate distributional effects.

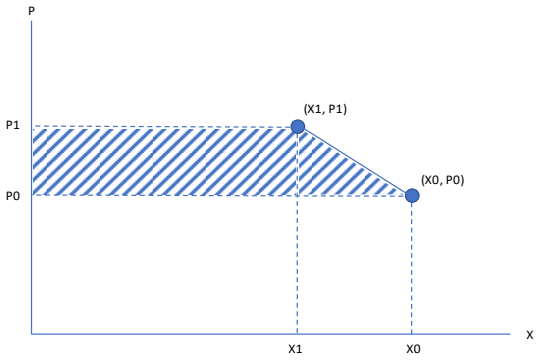
The outcome variables from REFORM are, among other things, changes in prices and quantitates of different goods, changes in income, wages and the supply of labour under the various revenue allocations. We link the REFORM output with register data, including the Consumer Survey, which contains detailed information on household consumption. This allows us to calculate the welfare changes for different income groups.

Welfare changes

For each household in the consumer survey we calculate the welfare change that results from changes in consumption of all goods. The change in welfare from changing consumption of good *n* is calculated as:

$$\Delta CS_n = X_{n,1} * (P_{n,1} - P_{n,0}) + (X_{n,0} - X_{n,1}) * (P_{n,1} - P_{n,0}) * 1/2.$$

As the household's utility function is unknown, the 'rule of a half' is used to calculate the welfare change. The welfare loss corresponds to the shaded area in the figure:



If the consumption of a specific product increases and the price falls, there is a welfare gain.

In a few cases, the quantity of a good increases as the price increases. This may be due, for example, to the fact that the good experiences a small price rise, but as it is complementary to a number of other goods for which consumption increases, the quantity of the good nevertheless increases too. In that case, the welfare loss is calculated simply as:

$$\Delta CS_n = X_{n,0} * (P_{n,1} - P_{n,0}).$$

The total relative welfare effect as a result of changed consumption for a household is calculated as the sum of welfare changes for each good relative to the household's total consumption (or disposable income):

$$\Delta CS_i = \frac{\sum_{n=1}^{N} \Delta CS_{n,i}}{C_i},$$

where:

- C_i is household *i*'s total consumption

The distributional effects are calculated as the average welfare change compared to the average consumption of all individuals belonging to a particular income group.

Changes in leisure

A CO_2e tax increases production costs for Danish companies and raises consumer prices. Households also choose to work less because their real wages have decreased. Thus, households receive less income, which also leads to lower consumption. The welfare changes as a result of changed consumption are described above.

When households work less, they also have more leisure time, which, in isolation, has a positive impact on welfare.

The welfare gain from increased leisure time is calculated for individual *i*, who is in employment, as the change in leisure multiplied by the hourly wage after tax:

$$\Delta CS_i = \Delta F_i \cdot w_i \cdot (1 - t_i) = -\Delta L \cdot L_i \cdot w_i \cdot (1 - t_i),$$

where:

- ΔF_i is the change in leisure for individual *i*
- ΔL is the average percentage change in labour supply for individuals in employment from REFORM
- L_i is individual *i*'s initial labour supply
- w_i is individual *i*'s hourly wage before tax
- t_i is individual *i*'s marginal tax rate on wage income

We do not calculate a leisure gain for individuals who are not employed. An individual's initial labour supply and hourly wage after tax are calculated using employee data from the e-income register (Employment of wage earners register - BFL) for the period 2016 up to and including the second quarter of 2018. The labour supply is measured as the average annual number of paid hours worked. The hourly wage is calculated as the sum of all taxable wage income in the period 2016 up to and including the second quarter of 2018 divided by the total number of paid hours in the same period. Hourly wages are measured after tax, i.e., the hourly wage is increased by one minus the marginal tax rate. The marginal tax rate for an individual is either 41.8 per cent or 55.7 per cent depending on whether the individual pays the top tax rate or not. It includes church tax, and municipal tax, which is calculated as a simple average of all the municipal tax rates.

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5. Fact Sheet on Tax Reform

Box 5.1 The reform's central elements

Our proposal for a tax reform that ensures a cost-effective green transition taking into account the business sector and income distribution contains the following key elements:

- Uniform tax on greenhouse gas emissions. Tax rates of DKK 1,000 per tonne of CO_2e by 2025 and DKK 1,250 per tonne of CO_2e by 2030 are used as benchmarks. Agriculture and a few other sectors with a particular risk of greenhouse gas leakage to be taxed at a reduced tax rate in the transitional phase.
- A CO_2e-tax rebate of 80 per cent of the historic emissions to energy-intensive companies, which should counteract leakage. The CO_2e-tax rebate to be phased out linearly by 2050.
- Gradual but rapid phasing in that ensures that businesses and households have time to adapt but that also ensures the target of a 70 per cent reduction will be met.
- The Climate Council is to monitor developments and continually recommend tax adjustments needed to achieve the Danish targets.
- Reduction of existing energy taxes by 75 per cent of the current level by 2025 because energy taxes do not target climate effects. However, taxes on petrol and diesel are maintained.

Reform is approximately revenue neutral by 2030

The reform is approximately revenue neutral in 2030, taking into account behavioural and feedback effects. The direct effects (excluding behaviour and feedback effects) of the reform result in revenue of just under DKK 16 billion. However, the major behavioural effects from the falling greenhouse gas emissions result in an overall reduction in revenue of approximately 1 billion, see Table 5.1. However, given the uncertainty in the estimations and the overall room for manoeuvre, the reduction in revenue is very limited. Our assessment, therefore, is that the reform is approximately revenue-neutral by 2030.

Table 5.1 Impact on the public finances in 2030

	Effect in DKK bn
Higher tax on CO_2e	48.4
CO_2e-tax rebate	-14.9
Reduction in energy taxes	-17.6
Direct effect on revenue	**15.9**
Behavioural effect	-17.3
Feedback effect	0.4
Total effect on revenue	**-1.0**

Notes: All amounts are given in 2020 prices. The revenue calculations include behavioural effects. Greenhouse gas emissions are assumed to fall to DKK 22.2 million tonnes, which corresponds to the 70 per cent reduction target. The behavioural effect of reducing energy taxes is calculated in REFORM.
Source: Statistics Denmark, www.statistikbanken.dk, table DRIVHUS and MREG21, Danish Energy Agency and own calculations.

The proposed reform maintains current distribution

Our tax reform does not entail any loss of welfare for those at the bottom of the income distribution, while there are limited welfare losses at the top of the income distribution, see Figure 5.1. However, relative to total income growth up to 2030, welfare losses are limited. Overall, therefore, the reform is assessed to maintain the current income distribution.

Direct tax burden on various sectors

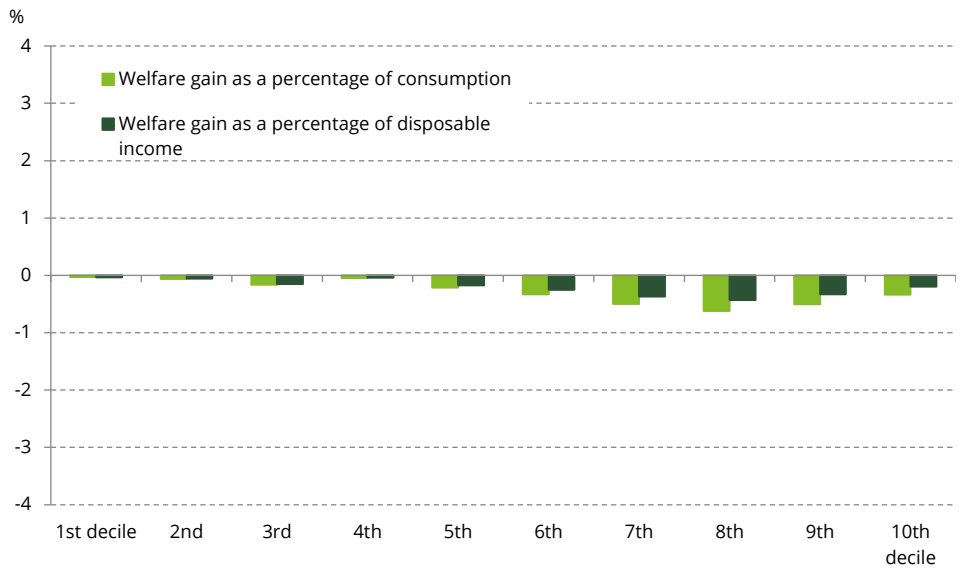
The reform directly increases the tax burden on the utilities, manufacturing, transport, construction, agricultural and mining sectors, while households and the public sector, etc. experience a lower tax burden, see Table 5.2. However, the various sectors pass part of the increase in the tax on to consumers of their products. For example, utilities are likely to raise prices for their consumers, and thus households and other businesses also bear part of the loss.

Table 5.2 Overview of the immediate effects of the 2025 tax restructuring by sector

	Higher CO_2e tax	CO_2e tax rebate	Energy tax reduction	Change in tax burden
		DKK Bn		
Households	10.7	0.0	-11.6	-0.9
Public. sector, education and health	1.5	0.0	-2.3	-0.9
Information services	0.3	0.0	-0.3	-0.1
Other	1.1	0.0	-0.8	0.3
Mining	1.7	-1.0	-0.0	0.6
Retail, hotels and restaurants	2.4	0.0	-1.2	1.2
Manufacturing	8.0	-3.9	-2.5	1.5
Construction	1.9	0.0	-0.0	1.9
Agriculture	6.8	-4.4	-0.5	1.9
Utilities	5.3	-1.8	-0.5	3.0
Transport	4.8	0.0	-0.0	4.8
Total	**44.4**	**-11.1**	**-19.9**	**13.4**

Source: Statistics Denmark, www.statistikbanken.dk, table DRIVHUS and MREG21, Energy Agency and own calculations.

Figure 5.1 Distributional effects of our tax reform



Source Statistics Denmark, REFORM and own calculations.

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