

ENGLISH SUMMARY

Chapter 1: Economy and environment – An overview.

Two annual products focussed on environmental economics

The environment has been a theme in the reports from the Chair of the Economic Council since 1995. With the establishment of the Council of Environmental Economics, these activities have been strengthened substantially. In the future there will be two annual products focussing on environmental economics the report “Economy and Environment” and a conference focussed on environmental economics. The purpose of these activities is to examine the interaction between the economy and the environment as well as the effectiveness of Danish environmental policy.

Objectives, regulation, environmental efforts and the economy

Chapter one of this report gives an overview of the options for environmental regulation. Further, the economic aspects of environmental efforts are examined and public revenue and expenditure in the environmental area are discussed. In addition to this, the interaction between environmental objectives, regulation and the state of the environment within four environmental themes in Denmark is assessed.

The economic scale of environmental efforts

Public receipts and expenditures do not reflect all benefits and costs

From an economic point of view it could be interesting to assess the total economic cost for society of existing environmental policies. Ideally, such an assessment would include the adjustment costs of industries and households as well as the costs related to financing public environmental expenditure. Another approach to examining the economic costs of environmental policies is to look at public revenue and expenditure in the environmental area. Annual public expenditure over time provides an indication of the size, and possibly the prioritisation of environmental expenditure, but in many sectors environmental regulation is based on rules and standards, whose effects on costs are not directly reflected in public expenditure. Therefore, taxes and subsidies give an incomplete indication of the costs in the affected sectors.

Expenditure has increased – but decreased relative to GDP

Danish public expenditure within the environmental area increased until the year 2000. Since then expenditure has been fairly constant and in 2006 it was approximately DKK 26 billion. The major part of this expenditure is on the waste and waste water sectors, which together accounted for approximately 60 percent of the total expenditure in 2006. To a large extent, this expenditure is financed through user charges, resulting in net public expenditure in the environmental area – excluding environmental taxes – of around DKK 9 billion per year. Compared to GDP, public expenditure has decreased by around 15 percent over the past 5 years.

Revenue from environmental taxes has stagnated in relation to GDP

Total public revenue from environmental taxes in Denmark has increased steadily over the past 10 years. In 2006 the revenue was around DKK 78 billion. In particular, revenue from motor vehicle registration has influenced this increase. Total revenue from environmental taxes amounted to approximately 5 percent of GDP in 2006. This corresponds to approximately 10 percent of total taxes in Denmark. Compared to GDP, revenue from environmental taxes has stagnated over the past 5 years.

Environmental targets - Trends and progress

Summing up the development in the state of the Danish environment within four main environmental areas

In this report, the progress of the Danish environmental effort is assessed using 24 indicators; eight for air pollution, three for the nature environment, eight for the aquatic environment, three for chemical pollution and two for waste problems. Most of these indicators have been tracked for the past 15 years, and some even further back. Table 1 summarises the trends in the Danish environmental outcomes and compliance with the objectives. Whether the observed historical achievements and current developments indicate improvement or deterioration in the state of the Danish environment is reported for each indicator.

Table 1 Trends in and progress towards meeting environmental targets

Indicator	Historical trend	Present trend	Expect to meet target
Emission of sulphur dioxide	+	+	Yes
Emission of nitrogen oxides	+	0	Possible
Emission of ammonia	+	+	Possible
Emission of hydrocarbons	+	+	Possible
Concentration of nitrogen dioxide	+	-	Doubtful
Ozone concentration	+	0	Possible
Particle concentration	<i>Na</i>	-	No
Emission of greenhouse gases	0	-	Doubtful
Semi-natural grassland	-	<i>Na</i>	<i>Na</i>
Afforestation	+	+	Possible
Organically cultivated area	+	0	<i>Na</i>
Nitrogen surplus	+	0	<i>Na</i>
Phosphorus surplus	+	0	<i>Na</i>
Secchi depth in lakes	+	+	<i>Na</i>
Danish fauna index for streams	+	+	Possible
Total nitrogen in open and coastal waters	+	0	<i>Na</i>
Total phosphorus in open and coastal waters	+	0	<i>Na</i>
Cod in the North Sea	+	-	<i>Na</i>
Water consumption	+	0	<i>Na</i>
Frequency of pesticide treatments	+	-	Doubtful
Pesticides above limit value	-	+	<i>Na</i>
Imposex in female sea snails	+	+	<i>Na</i>
Total volumes of waste	-	-	Doubtful
Waste relative to GDP	0	0	Doubtful

Note: Historical and present trend: + = improvement, 0 = stagnation, - = deterioration. Fulfilment of objectives: *Yes*: Targets are being met. *Possible*: It is likely that the present trend will lead to targets being met, though this may require strengthened effort. *Doubtful*: There is a likely need for strengthened abatement measures if targets are to be reached within the set time frame. *No*: Thresholds or targets are being exceeded at present. *Not assessed (Na)*: Assessment is not possible due to a lack of data or lack of defined objectives.

**Historically:
Positive
development for 17
out of 24 indicators**

Historically, 17 out of the 24 indicators show improvement, two show stagnation, and four indicators show deterioration. In one case, the historical development is not available.

Currently: 12 out of 17 positive indicators stagnated or deteriorated

Of the 17 indicators that show positive historical trends, 12 now show little change or a deteriorating trend. The indicators showing the most pronounced deterioration, both historically and at present, are greenhouse gas emissions, area of semi-natural grassland, cod in the North Sea, and total Danish waste volumes. Particle concentrations also show a current deterioration, but no historical trend is available for this indicator.

A range of reasons for environmental stagnation

There are several possible explanations for the current observed stagnation or deteriorating trends in some of the indicator values that have otherwise shown historical improvement. One such reason could be that a changed pattern is merely a statistical artefact; another could be changes in underlying influencing factors affecting the causality between indicators and objectives. Yet another factor potentially affecting the environmental indicators is the overall growth rate of the Danish economy. Increasing marginal abatement costs of individual actors is another possible explanation for a decreased rate of improvement over time. Finally, the observed development can be a direct effect of changes in political strategy and reallocation of resources within the environmental sector. Further analyses are required in order to identify which of these factors most significantly affect the observed trends.

Fulfilment of objectives not likely for 6 out of 13 indicators

Of the 24 indicators, 13 are directly related to Danish environmental policy objectives. Of these 13 indicators, one target is being met and six are assessed as having the possibility of meeting the targets within the set time frame. However, of the remaining six indicators, one shows that the target will not be met and the remaining five are not likely to be met within the set time frame. For these indicators, it may be necessary to consider further initiatives or a re-assessment of the targets. The six indicators for which the current targets are unlikely to be met are particle and nitrogen dioxide concentrations, greenhouse gas emissions,¹

1) This refers to actual Danish greenhouse gas emissions. The Kyoto Treaty makes it possible to supplement domestic action with use of flexible mechanisms in achieving the target.

frequency of pesticide treatments and growth rate of the volume of waste, in total and in relation to GDP.

Guidelines for when to apply economic analyses to environmental policy initiatives are needed

A review of types of economic analyses carried out in Denmark within each of the four environmental themes show that they cover a range of environmental policy issues, and make use of a variety of economic approaches and methodologies. The analyses are, however, rarely comparable, which makes overall assessments of the environmental efforts in Denmark difficult. Therefore, it is recommended that guidelines be established to stipulate when economic analyses of environmental initiatives are required.

Recommendations

Problems in meeting air quality targets

The assessment of trends in air pollution demonstrates a need for further abatement efforts in this area. It is recommended that:

- Further initiatives limiting emissions of hydrocarbons and oxides of nitrogen, particularly nitrogen dioxide be launched
- Denmark increases efforts to promote the inclusion of emissions from international aviation and shipping in international regulations
- Particle emissions from road traffic in cities be further limited

Need for useful data and objectives for the conservation of nature

The assessment of progress on the conservation of nature shows a need for improvements in the collection of up-to-date data and for more quantifiable and operational targets to be set. It is recommended that:

- The allocation of resources to surveillance and data processing, particularly regarding the quality of nature be made a priority
- Afforestation efforts be increased
- Targets for the conservation of nature be made quantifiable and integrated into an overall strategy for future land use

Aquatic environment improved, further efforts needed

The state of the aquatic environment has improved with the implementation of three Danish Action Plans for the Aquatic Environment. Presently, however, stagnation in the historically positive development in the state of the aquatic environment is observed. It is recommended that:

- A reassessment be made of the extent to which the efforts of the current third Danish Action Plan for the Aquatic Environment are sufficient to meet the targets of the EU Water Framework Directive
- The focus of existing regulation be further enhanced to address phosphorus loads
- Sustainability in fisheries management be made a priority

Problems with pesticides and increasing waste volumes

In the areas of chemical pollution and waste there are problems with the targets for pesticide use and with the increasing volumes of waste. It is recommended that:

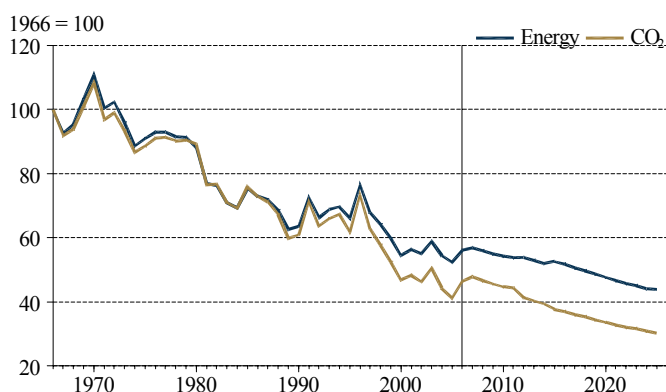
- Targets for the frequency of pesticide treatments be reassessed
- Assessments of chemical substances under the new EU chemicals strategy (REACH) be accelerated
- The focus on and efforts to reduce waste volumes be enhanced

Theme: Danish energy policy, chapters II-IV

Diverging energy consumption and economic growth paths...

The past 40 years have witnessed a divergence in the Danish economic growth and energy consumption paths. Likewise, a divergence in the paths of energy consumption and CO₂ emissions has taken place since the early 1990s. Thus, the Danish CO₂ intensity has declined more steeply than the Danish energy intensity cf. figure A.

Figure A Danish energy and CO₂ intensity



Note: Energy and CO₂ intensity is calculated as the ratio of total primary energy supply and CO₂ emissions, respectively, to GNP.

Source: Statistics Denmark, *National Accounts*, ADAM data bank, EMMA data bank and own estimates.

... is not a specifically Danish phenomenon

The analyses in the report suggest that the historical decline in energy intensity is due primarily to declining energy intensity in individual industries and in households, while no significant effects due to shifts in the demand structure or from structural change in general have been identified. This change in the relationship between energy consumption and economic activity is also observed internationally, and therefore the declining energy intensity should not be seen as a specifically Danish phenomenon.

Declining CO₂ intensity is due to a shift to natural gas and more renewable energy

The historical divergence of CO₂ emissions from energy consumption in Denmark can mainly be attributed to a decline in the use of coal by the energy supply sector in favour of an increase in the use of natural gas and renewable energy. Thus, the share of renewable energy has increased from approximately 2 percent in 1975 to approximately 15 percent of energy consumption in 2006. In a projection towards 2025, the increase in the share of renewable energy is expected to continue.

Projections for energy consumption and CO₂ emissions

Projections for energy and CO₂-emissions until 2025

The report presents a projection for Danish energy consumption and CO₂ emissions to 2025. The projection is based on current regulations, but it does not take into account the Danish government's 2007 energy policy proposal or the broad February 2008 political agreement on Danish energy policy.

The main conclusions from the projection are:

- Danish energy consumption will increase by approximately ten percent by 2025
- Renewable energy will increase to about 30 percent of total Danish energy consumption by 2025
- The use of fossil fuels will decrease by approximately 15 percent by 2025
- The total level of CO₂ emissions will decrease by 15 percent by 2025. The energy supply sector is expected to achieve a reduction in emissions, while households and industry on the other hand are expected to increase emissions

The projection indicates that a number of the central objectives in Danish energy policy are expected to be realised without further initiatives. However, this is not evident in all areas, cf. table B:

Continued divergence of energy consumption and growth

The projection implies that divergence of economic growth and energy consumption as experienced in the past will continue the future. It forecasts an increase in energy consumption of approximately 10 percent by 2025, while GDP is expected to increase by about 30 percent over the same period. These results are based on the assumption that energy efficiency will follow its historical trend. Energy efficiency is determined by technological development and by the efforts to save energy, which are typically implemented through energy saving initiatives. The projection presupposes that this effort will continue on the same scale as in the previous years. If efforts to save energy are strengthened, as proposed in the February 2008 Danish political agreement, growth in total energy consumption can

be reduced. A significant part of the expected future increases in energy consumption come from the transport sector. The February 2008 political agreement contains very few initiatives that reduce the use of energy in the transport sector. However, the issue of whether regulation within the transport sector is generally more desirable compared to other sectors is not discussed in this report.

Table B Total Danish energy consumption and CO₂ emissions

	1975	1990	2006	2015	2025	2006-2025
	----- PJ -----					Rate of increase
Final energy consumption ^{a)}	562	565	654	692	728	11.3
Consumption of primary fuels ^{b)}	713	701	886	920	908	2.5
Net exports of electrical power	-3	-25	25	65	42	
Net energy consumption ^{c)}	722	759	834	795	830	-0.4
Total consumption of fossil fuels	698	655	755	671	644	-14.4
	----- Percentage -----					Percentage point increase
Renewable energy share ^{d)}	2.1	6.5	14.8	27.0	29.1	14.3
	----- Million ton -----					Rate of increase
Total CO ₂ -emissions	54.3	52.5	57.3	51.5	49.0	-14.4
Consisting of						
Energy supply sector	19.5	24.4	27.5	21.3	17.3	-37.0
Households and industry	34.7	28.0	29.8	30.2	31.7	6.4

- a) Includes electricity and district heating and primary fuels in households and the non-energy converting industry.
- b) Primary fuels include fossil fuels and renewable energy.
- c) The so called net energy consumption is the total primary energy supply adjusted for the net export of electricity. Alternatively, net energy consumption can be assessed as the final energy consumption, including the loss of energy when converting and distributing electricity, and district heating.
- d) The share of renewable energy is calculated as the use of biomass in energy production and production of electricity using wind power relative to the total primary energy supply.

A need for new initiatives to achieve a reduction in energy consumption

As a consequence of the changed composition of the energy supply, net energy consumption has been roughly constant, despite the fact that final energy consumption has increased by 10 percent.² The target of reducing net energy consumption by 4 percent by 2020 is not met in the projection. Hence, there is a need for new initiatives if this target is to be achieved. An increased CO₂ tax for the sectors of the economy not covered by the quota system is included in the February 2008 energy agreement. This will contribute to a reduction in the consumption of energy. A strengthening of the requirements for energy savings will further contribute positively to reducing energy consumption. The most obvious instrument to achieve the aim of lower energy consumption is higher general energy taxes.

The obvious instrument is higher energy taxes

Reorganisation of the energy supply sector ...

The projection forecasts an increase in the share of renewable energy to 30 percent of the total energy consumption by 2025. The increasing share of renewable energy is entirely attributed to an increase in the use of biomass and wind power and a phase-out of coal. It is projected that around half of the production in the Danish energy supply sector in 2025 will come from plants that have not yet been built. This expected shift indicates that incentives to reorganise the energy supply sector towards renewable energy already exist. The recently introduced EU quota system, which increased markedly the incentives for using renewable energy, is a primary factor behind the expected future reorganisation of the energy producing sector. The current production structure in the energy supply sector, therefore, does not fully reflect current relative prices. The projection also indicates that the expected considerable expansion of the Danish energy supply sector is likely to lead to substantial net exports of electricity.

... indicates that incentives for renewable energy production already exist

- 2) The difference between net energy consumption and final energy consumption is due to corrections for conversion losses in production and distribution of electricity and district heating.

<p>Overall CO₂ emissions decrease...</p> <p>... but emissions in the sectors not regulated by quota system increase</p>	<p>The anticipated reorganisation of the energy supply sector is expected to result in an overall decline in Danish CO₂. The CO₂ emissions will be approximately 15 percent lower in 2025 compared to 2006 (and 7 percent lower than 1990 levels). However, increasing CO₂ emissions from households and industry are expected. It is not possible in the projection to distinguish between sectors that are regulated through the quota system, and sectors that are not. Increasing emissions from households and industry implies, that Denmark cannot expect to fulfil the EU-Commission's proposal of a 20 percent decline in emissions by 2020 from sectors not covered by the quota system if no further initiatives are directed at these sectors.</p>
<p>The projection is based on a number of assumptions</p>	<p>The result of the projection depends on a number of assumptions such as fuel prices on the world market, underlying Danish economic growth, the development of energy efficient technology and future energy policy. The projected changed structure of the energy supply sector depends on assumptions of considerable flexibility in this sector.</p>
<p>Differences compared to the Danish Energy Authority: larger increase in final energy consumption</p>	<p>There are a number of differences between the projections for energy consumption and CO₂ emissions in this report and the most current projections by the Danish Energy Authority. Final energy consumption increases somewhat more in the projections in this report than in the Danish Energy Authority's projections. This can, in particular, be attributed to the more conservative assumptions about energy efficiency made in this report. The projection in this report does not take into account the effects of any increased efforts related to energy saving, nor the effects of increased CO₂ taxes introduced in the February 2008 political agreement on energy.</p>
<p>Expanded use of renewable energy</p>	<p>The projection by the Danish Energy Authority results in a relatively limited expansion of renewable energy. The difference between the two projections on this matter can be largely attributed to the different assessments of the incentives and barriers in relation to the expected changed structure of fuel use in the energy supply sector. It will require substantial investments in renewable energy to implement the results of the projection in practice. If such restructuring</p>

does not materialise in the coming years, it is doubtful that the projected lower CO₂ emissions and higher share of renewable energy can be delivered. There are further reasons why a more limited restructuring of the production capacity in the energy supply sector than projected could happen in practice. First, there are a number of administrative barriers that can obstruct a restructuring. Second, a lack of sufficient competition in the electricity market can lead to lower than projected investment in renewable energy. Third, uncertainty with respect to future energy policies can lead to caution on the behalf of investors with respect to renewable energy. On the other hand, the February 2008 Danish political agreement includes higher subsidies for renewable energy, which should provide incentives for future expansions in investment in renewable energy.

CO₂ reduction costs in the energy supply sector

Total CO₂ emissions in the energy supply sector determined by the EU

It is a core assumption behind the forecasts for energy consumption and CO₂ emissions in this report that Danish CO₂ policy is determined by the EU. In the projection it is assumed that the EU CO₂ quota system will be maintained and that the real quota price will be 150 DKK per tonne CO₂ (2006 prices). The quota price is likely to increase if the EU decides to reduce CO₂ emissions by supplying fewer quotas. This will further increase the incentives for industries to redirect production towards sustainable energy.

Reduction of CO₂ emissions by 50 percent is achievable at low cost ...

Model simulations that illustrate the effect of reducing emissions in the energy supply sector by 50 percent by 2025 indicate that the extra costs to the Danish society of achieving a 50 percent emission reduction instead of keeping emissions unchanged is DKK 15 billion (net present value), if it is assumed that quotas are allocated freely to industries (grandfathering). This should be viewed as a relatively low cost. The simulations also indicate that the extra cost to the society is reduced to 2 billion DKK (net present value) if quotas are sold instead of granted. The costs to society are reduced as the loss from the tax distortion is reduced because of the public revenue generated by the sale of quotas.

... but electricity and district heating consumer prices increase

However, quotas increase prices of electricity and district heating, regardless of whether they are sold or granted. This implies that CO₂ reductions may cause substantial cost increases for consumers. Consumers' costs largely correspond to the public gain (if quotas are sold) or the gain for the electricity supply industries (if quotas are granted). CO₂ reductions are achieved through changes in the fuels used in the electricity and district heating supply industries and by reductions in net export of electricity in both cases.

Danish energy policy

Energy policy plans and comprehensive regulation

Over the past 30 years Danish energy policy has been broadly defined by a series of energy plans. The plans have resulted in political agreements and the comprehensive regulation of, e.g., the energy supply sector, recurrent changes in taxation and subsidies, requirements for building standards and energy rating.

Focus on security of supply, the environment ...

The focus of Danish energy policy has varied during the past 30 years, however, security of supply and environmental concerns have been central. Security of supply has been targeted at reducing dependence on fossil fuels, partly from a long term perspective and from a desire to reduce imports from areas that are politically less stable. Concerns for the environment, particularly in more recent years, have been directed at climate change issues, which naturally puts the focus on CO₂ emissions. Energy policy has furthermore contributed to substantial public revenue from energy taxation.

... and public revenue

CO₂-reductions are achieved through quota markets and CO₂ taxation

Reducing CO₂ emissions is a crucial part of Danish and EU energy policy. As CO₂ emissions are closely connected to the use of fossil fuels, reductions in the consumption of fossil fuels simultaneously reduces problems related to climate change and increases security of supply. CO₂ emission reductions are achieved in two ways: Industries within the European CO₂ quota system are regulated by the supply of quotas, while CO₂ emissions from the rest of the economy can be influenced by CO₂ taxation. Total energy consumption, and thereby CO₂ emissions, are further reduced by general energy taxation.

Other targets are renewable energy and energy reductions

Other targets also play an important role in the overall energy policy. These include targets for renewable energy and targets for future total energy consumption, which often require a specific “energy saving effort”. The targets in both areas and a target for reduced consumption of fossil fuels are core elements in the February 2008 Danish political energy agreement.

A tight CO₂ emission policy ensures use of renewable energy and energy savings

There is a clear connection between the various energy policy targets. A tighter CO₂ target achieved by fewer quotas in the European quota system and by increased CO₂ taxation of the sectors outside the quota system will increase the price of energy derived from fossil fuels. This will in turn give incentives for increasing the use of renewable energy.

Difficult to justify a separate Danish target for renewable energy

A tight CO₂ policy can make renewable energy profitable and thereby ensure a high share of renewable energy sources. Higher prices of energy from fossil fuels will also contribute to increasing research and development in renewable energy sources and, at the same time, increase the incentives to reduce energy consumption. In light of this, it is hard to justify a separate Danish target for renewable energy. As CO₂ policy directly addresses the two central concerns of the energy policy, namely security of supply and climate change, any separate targets for renewable energy would require an explicit justification that is not related to these two issues.

CO₂ targets may not be achieved in the most cost efficient way

If independent targets are set for renewable energy and for energy savings, there is a risk that the main targets of the Danish energy policy might not be achieved in the most cost efficient way. By setting individual targets for energy savings and renewable energy, politicians implicitly determine the weight that these should be given in achieving an overall target for reduced fossil fuel use. This does not necessarily minimize total costs. If, instead, the EU quota system and CO₂ taxation is used, the price of using fossil fuels is increased and the market, through the mechanism of relative prices, should find the combination of renewable energy and energy savings that minimizes total costs.

Let the market, not politicians ensure cost efficiency

Current energy policy efforts

Energy policy targets:

Fossil fuels reduced by 15 percent by 2025

Renewable energy share of 20 percent by 2011 and 30 percent by 2025

Energy consumption reduced by 4 percent by 2020

Instruments in the energy agreement:

The February 2008 Danish political energy agreement is based on a proposal put forward by the Danish government from January 2007, which contained a range of core targets for Danish energy policy up to 2025. The targets in this proposal were: A reduction in the use of fossil fuels of 15 percent compared to the present use, no change in the total energy consumption up to 2025, and renewable energy to comprise 30 percent of total energy consumption by 2025. The February 2008 energy agreement supplemented the long-term target for the share of renewable energy by adding a target of 20 percent renewable energy by 2011. In addition, the requirement for energy savings was increased, and rather than remaining constant, energy consumption should now be reduced by 4 percent by 2020 compared with the 2006 level.

The February 2008 energy agreement contains a series of measures for achieving the targets set by Danish energy policy. The agreement also contains measures that seek to adapt the Danish energy policy to the new situation where the CO₂ emissions of a large section of Danish industry are now regulated by the EU tradable emission quota system. The most important elements in the agreement are:

- CO₂ taxation for industries and services not included in the quota system to be increased to a level that corresponds to the expected quota price
- Continued and increased subsidies to electricity generation that uses renewable energy
- Increased requirements for energy saving efforts
- Increased support for energy-related research and development

CO₂ taxation increased to adapt to the EU quota system

CO₂ taxation for industries and services not included in the quota system is increased in order to adapt to the EU quota system. The increase in taxes aims to ensure that the tax corresponds to the expected price of quotas, which is approximately 150 DKK per tonne CO₂. Redistribution of the revenue is planned. This, therefore, corresponds to grandfathering of quotas taking place for industries included in the quota system. The fact that the total revenue will be redistributed implies that industries and services not included in the quota system are overcompensated compared to industries inside the quota system (as the latter are only granted quotas that correspond to their historical emissions). Therefore, only a fraction of the total revenue from taxes should be redistributed. The redistribution of revenue should be phased out, if the EU Commission proposal to reduce free allocation of quotas is implemented.

Redistribution of revenue should be phased out

Increased subsidies for renewable energy do not reduce CO₂ emissions

The Danish energy agreement includes increased subsidies for electricity generation that uses renewable energy. Since CO₂ emissions in the energy supply sector are regulated by the EU, increased subsidies for renewable energy in the energy supply sector do not affect total EU CO₂ emissions. Further, it is likely that even Danish emissions would be unaffected, as Danish exports of electricity is likely to increase if subsidies for renewable energy are increased. However, an argument in favour of Danish subsidies for renewable energy production could be that increased renewable energy production in Denmark may lead the EU to reduce the total number of quotas for the period 2013-20. The projection presented in this report indicates that the incentives to redirect electricity and district heating production towards increased use of renewable energy are already strong today. Hence, there is no need to increase subsidies for renewable energy.

Increased subsidies for renewable energy should be avoided

Recommendations for Danish energy policy

Climate considerations are handled at EU level and by taxes on CO₂ emissions

In light of the new institutional framework following the introduction of the EU quota system, a very clear division of responsibility in relation to energy policy has been established. The general targets related to climate policy are now determined by the EU quota system in combination

with taxes on CO₂ emissions for the sectors of the economy not included in the quota system. In addition to these measures, Danish energy consumption can be influenced by general taxes on energy.

General taxes on energy should contribute to public finance

A relatively high taxation level of energy consumption combined with the sale of CO₂ quotas can contribute to the general financing of public expenditure. Public revenue generated from taxes on CO₂ emissions and energy should at least keep pace with the growth in GDP, if it is to contribute to permanently financing a reorganisation of the Danish tax system. Because of divergence of energy consumption from GDP, this means that these taxes would need to be increased over time.

Regulation of CO₂ emissions should happen on input ...

Regulation of negative externalities (e.g. CO₂ emissions or particles) is best achieved by imposing taxes on fuel that reflect the negative effects on the environment. Alternatively, the negative externalities can be regulated by a quota system such as the EU CO₂ quota system. The size of the tax should be set such that it reflects corresponding taxes outside Denmark. The price signals in the quota price should freely determine the choice of fuel, and restrictions on this choice, which are not well founded by other considerations, should be avoided.

... and there ought to be free choice of fuel

General taxes on energy should secure public revenue without distorting input

Conversely, taxes on energy should be imposed on energy consumption independently of the fuel input. Thereby avoiding further distortions on the choice of fuel over and above what is intended by e.g. the tax on CO₂, or by the price of quotas. Hence, the purpose of taxing energy is primarily to provide public revenue, which should be generated in the least distortionary manner. This means, for example, that taxes on energy should not be differentiated by CO₂ content and the current exemption from tax of biofuels for heating in Denmark should be abolished.

Equal reduction cost should be sought:	The marginal cost of reducing CO ₂ should be equal across countries and sectors. The European quota system, which allows CO ₂ quotas to be traded across countries, contributes to a levelling out of the reduction costs across countries in the EU. The EU directive on minimum taxes on fossil fuels ought to be strengthened so that common minimum rates are attained in the sectors of the economy covered by the quota system. The tax on CO ₂ in the sectors of the economy not covered by the quota system should be determined as the sum of the expected price on quotas and the minimum rate for the tax on CO ₂ in the sectors of the economy covered by the quota system.
Taxes on CO₂ should go with the price on quotas	
Free CO₂ quotas are a business subsidy	The effect of the quota system on CO ₂ emissions is the same independent of whether the quotas are distributed for free or whether they are sold. A free distribution of the quotas corresponds to a subsidy to business. Denmark should, therefore, support the recent EU Commission proposal not to distribute free quotas in the future. By selling the quotas the government can gain revenue that can be used to lowering other taxes. Alongside an increased use of auctioning instead of free allocation of quotas, the redistribution of revenue from the tax on CO ₂ should cease. For sectors that are exposed to considerable competition from countries outside the quota system or that do not have no taxes on CO ₂ at the same level as the EU, a partly free allocation (along with a partial redistribution of the revenue from the tax) can be well founded.
No return of the tax on CO₂	
The purpose of a separate target for renewable energy should be clear	The purpose of current Danish subsidies for renewable energy – except the so called “CO ₂ cent” ³⁾ – is not directly related to reducing CO ₂ emissions. This is because an increase in the use of renewable energy in the energy supply sector reduces the demand for CO ₂ quotas and thereby the price of quotas. Consequently, the demand for fossil fuels increases in other areas. Furthermore, simulations show that the current subsidies are sufficient to increase the share of renewable energy in energy production substantially. This
	3) The “CO ₂ cent” (1,3 cent) can be seen as a correction for the general CO ₂ tax on electricity consumption independent of the CO ₂ content of the fuel, i.e., the CO ₂ -tax is also paid for electricity produced by renewable energy.

makes it difficult to argue for increased subsidies and maintaining a separate target for renewable energy, that goes beyond what automatically follows from direct CO₂ regulation would need a specific and very strong argument.

Subsidies for wind power and other mature technologies should be reduced

Renewable energy capable of competing on market terms should not receive subsidies. This applies to wind power, for example, and therefore, Danish subsidies for wind power should be abolished. Temporarily, other kinds of renewable energy might need subsidies to survive. These subsidies should be provided as guaranteed minimum prices or a fixed subsidy per unit produced.

Subsidies for research is good, but business support is not

It is prudent to subsidize energy research, as the latest Danish political energy agreement suggests. However, there is a risk that subsidies to pre-selected technologies may be wasted. Furthermore, there is a considerable risk that government subsidies function as hidden business support. Decisions about what energy technologies to subsidize should not be made by politicians alone, but should be based on expert knowledge of each specific project or technology.

Need for keeping an arm's length principle

Wanted: thorough evaluations of Danish "energy saving initiatives"

Energy saving initiatives are important elements of Danish energy policy. These initiatives consist of many administrative instruments. Due to the way the targets are established, it is very difficult to determine whether the initiatives actually result in energy savings that would not have occurred otherwise. Therefore, it is positive that, under the new agreement, the effects of Danish energy saving initiatives are to be evaluated. As a starting point, this evaluation should make a clear argument for what role a separate target for energy savings plays. Second, the evaluation ought to examine the extent to which administrative energy savings regulation can appropriately be replaced by or supplemented with energy taxation.

A general energy tax is an obvious alternative

A new framework for energy policy – examples of the effects of political initiatives

Division of tasks between EU and member states

The new EU quota trading system means that the institutional framework within which energy policy at the EU level as well as in member states take place is changing. The changes establish a clear division of responsibilities. The EU now determines the overall targets for the sectors of the economy covered by the quota system. Consequently, the purpose of national energy policy is first and foremost to set targets and regulate the sectors of the economy not covered by the quota system. In addition, energy policy can contribute to financing a member state's public expenditure through general energy taxes.

Some initiatives work differently under the new framework

As the economy is at present divided into sectors covered by the quota system and sectors not covered, the traditional regulatory instruments used in energy policy no longer work as they used to, cf. table C.

One instrument works: Higher energy taxes

Energy savings in the sectors of the economy not covered by the quota system reduce CO₂ emissions internationally, increase the share of renewable energy, and reduce total energy consumption. Consequently, energy savings affect all overall targets of Danish energy policy, such as security of supply and reduced CO₂ emissions. One regulatory instrument that leads to energy savings both in general and in the sectors of the economy not covered by the quota system is higher energy taxes.

Another instrument that works: acquisition and non-use of CO₂ quotas

Another way to achieve the goals of Danish energy policy is by acquisition and consequent non-use of CO₂ quotas. This will affect energy consumption the same way as if the total number of quotas was reduced.

Table C Activities and their effect on energy policy targets

	Reduced CO₂ emissions in the EU	Increased share of renewables	Energy Savings
Increased share of renewables in the sectors of the economy covered by the quota system, e.g. increased use of biogas	No	Yes	No
Increased share of renewables in the sectors of the economy not covered by the quota system, e.g. biomass (straw) replaces oil or more biofuels in the transport sector	Yes	Yes	No
Energy savings in the sectors of the economy covered by the quota system, e.g. insulation of buildings connected to district heating	No	Yes ^{a)}	Yes
Energy savings in the sectors of the economy not covered by the quota system, e.g. insulation of buildings heated with oil	Yes	Yes ^{a)}	Yes
Acquisition and consequent no-use of CO ₂ quotas	Yes	Yes ^{b)}	Yes ^{b)}

a) This is provided that the existing capacity of renewable energy is fully exploited such that the reduction in energy consumption is achieved via reduced use of fossil fuels. This increases the share of renewables, but it will not increase the absolute production of renewable energy.

b) As the price of fossil fuels and the general energy price increase.

Note: *Yes* means that the activity affects the target positively.