

# Converting with care

Status and challenges  
for Danish climate policy

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\* An excerpt of the full report consisting of foreword and main conclusions





## Foreword

Danish society is about to undergo a historic transformation. In order to limit global climate change, we, like the rest of the EU, must seek to reduce CO<sub>2</sub> emissions by 80-95 percent before the year 2050. *Converting with care - status and challenges for Danish climate policy* is the first of a series of reports from the Danish Council on Climate Change which will focus on how Denmark can be converted to a low-carbon society - that is to say a society with significantly lower greenhouse gas emissions than today.

This report provides an overall snapshot of the challenges which are effecting the climate and highlights some of the most pressing issues. It differs from the Danish Council on Climate Change's upcoming reports in that it paints a broad picture of the challenges of transition in order to pave the way for the Council's future work. In forthcoming reports, the Council will go into more depth with regards to the issues described in this report.

The recommendations of *Converting with care - status and challenges for Danish climate policy* highlight the most pressing problems which should be resolved as soon as possible through the necessary policy. The analyses and recommendations of the Danish Council on Climate Change must contribute to ensuring that climate policy be designed cost-effectively and take into consideration growth, competitiveness, employment and any scientific recommendations concerning the necessary climate efforts. In future reports, the Council will analyse specific issues in order to provide recommendations for focused climate policy initiatives in selected areas.

The Danish Council on Climate Change was established in early 2015 and is comprised of an independent body of experts who put forward proposals for cost-effective climate change solutions which aim to help create a low-carbon society while at the same time maintaining standards of welfare and economic development. The Danish Council on Climate Change was established under the Climate Change Act which also laid-out the Council's tasks.

'Act no. 716' of 06.25.2014:"Law concerning the Danish Council on Climate Change, climate policy statement and the setting of national climate-related targets." Section 1 of what is known as "the Climate Act" states: "The law aims to establish an overall strategic framework for national climate policy in order to transition to a low-carbon society by 2050 that is resource-efficient, has an energy supply based on renewable energy and produces significantly lower greenhouse gas emissions from other sectors while at the same time supporting growth and development. Furthermore, the law shall promote transparency and ensure that the public are kept informed about the status, direction and momentum of Denmark's climate policy."

The Climate Change Act stipulates that the Danish Council on Climate Change must:

1. evaluate the status of Denmark's implementation of national climate objectives and international climate commitments,

2. analyse potential means of transitioning to a low-carbon society by 2050 and identify possible measures to achieve greenhouse gas reductions,
3. draw up recommendations to help shape climate policy, including a selection of potential mechanisms and transition scenarios,
4. contribute to the public debate. The Danish Council on Climate Change must, to the extent required in the preparation of its analyses and other work, consult and involve relevant parties, including, among other business interests, social partners and civil society.

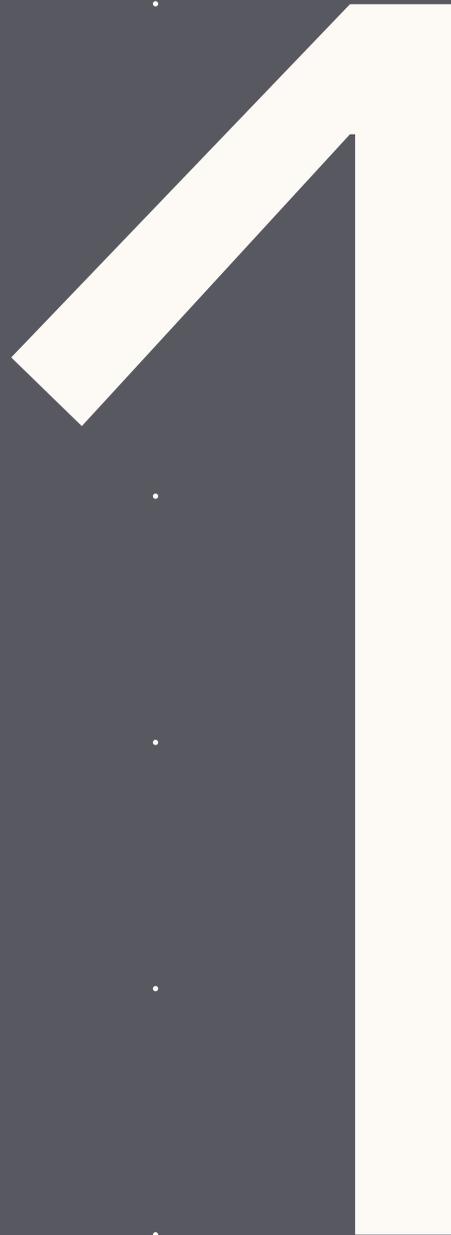
The Danish Council on Climate Change wants to collaborate closely with the International community, and so currently a major part of the Council's work is to engage in dialogue with stakeholders on climate change - both to stay abreast with the latest factual knowledge about the development of, among other things, technologies and climate research, but also to hear stakeholder opinions and suggestions on how progress towards a low-carbon society can best be achieved. Such an inclusive approach helps to ensure that the Danish Council on Climate Change's work is based on solid knowledge of the realities facing all parties in this scenario.

At least once a year the Danish Council on Climate Change must submit and publish recommendations to the Government on climate action. The next report will be released in the summer of 2016. The Council is tasked with addressing all aspects of the transition to a low-carbon society. The work therefore includes issues straddling the fields of energy, construction, transport, agriculture, the environment, nature and the economy. In order to tackle this major task, the Danish Council on Climate Change is composed of experts specialised in the various areas which will be involved in the transition.

The Council's work focuses on identifying measures that can reduce Denmark's emission of greenhouse gases. Adapting to climate change is not part of the Council's remit and is therefore not included in its activities.

The Danish Council on Climate Change is comprised of the following:

- Peter Birch Sørensen (Chairman), Professor of Economics at the University of Copenhagen,
- Jørgen Elmeskov, Director General, Statistics Denmark,
- Pia Frederiksen, Section Leader and Senior Researcher at the Institute of Environmental Sciences at the University of Aarhus
- Jette Bredahl Jacobsen, Professor of Environmental and Resource Economics and Deputy Head of Department for Research at the Institute of Food and Resource Economics at the University of Copenhagen,
- Niels Buus Kristensen, Head of Department at DTU Transport,
- Poul Erik Morthorst, Professor of Energy Economics and Head of Department at DTU Management Engineering,
- Katherine Richardson, Professor of Biological Oceanography and Leader of the Sustainability Science Centre at the University of Copenhagen.



Main conclusions  
and recommendations

Denmark has a goal of becoming a low-carbon society by 2050. The transition to a low-carbon society is a large and complex task which will involve all parts of our society. With this report, the Danish Council on Climate Change shall set forth the framework for its future work in advising government and parliament about how this transition can best be implemented. The following offers a summary of the main conclusions of the report's chapters. The Council will ultimately present its recommendations to the government based on this report's analysis.

## Foundations and principles of the Danish Council on Climate Change's work

### **The starting point for the Danish Council on Climate Change is the long-term climate change targets**

Climate science points to an urgent need for reducing the global emission of greenhouse gases. As part of the international community, Denmark is committed to making an active contribution to solving this issue.

Underpinning the Danish Council on Climate Change's recommendations is the goal of making Denmark a low-carbon society by 2050 - that is a society with an energy supply based on renewable energy and significantly lower emissions from other sectors than is the case today. The main challenges in achieving this aim involve ensuring a stable climate-policy framework, making steady progress towards the 2050 target, balancing the transition amongst the different sectors and utilising the most cost-effective technologies while developing new ones. In this context, the transition's effects on the development of employment, wealth and income distribution must also be taken into account.

The Danish Council on Climate Change recommends four fundamental principles for Danish climate policy in the coming decades:

1. Reach unequivocal agreement on the climate policy framework
2. Stay focused on achieving a balanced transition
3. Maintain a steady pace of transition
4. Employ technology-neutral means - taking into account the interaction between sectors

## Denmark's climate objectives and greenhouse gas emissions

### **All sectors must reduce emissions by 2050**

The transition to a low-carbon society requires a significant reduction of Danish greenhouse gas emissions. The Danish Council on Climate Change is therefore tasked with outlining the developmental changes in emissions necessary from 1990 until now and onwards to 2050. Since 1990, Denmark has achieved a reduction of approximately 20 percent in greenhouse gas emissions and there have been reductions in nearly all sectors of society. However, these reductions are not evenly divided across the various sectors of the economy. There have been substantial reductions in the electricity and district heating sector, but reductions in agriculture have been less impressive while emissions from transport are higher today than they were in 1990. Going forward to 2050 there is a need for even greater reductions and, if the goal of a low carbon society is to be achieved, all sectors will have to reduce their emissions significantly in the coming decades.

#### **40-percent goal can be achieved together with socioeconomic gain**

The Danish Council on Climate Change has calculated what the cost will be of reaching the objective of a 40 percent reduction in greenhouse gas emissions in 2020 and it has therefore put together two packages of measures, both of which can reduce emissions by a further 2 million CO<sub>2</sub>e and thereby eliminate the shortfall in 2020.

One package is called the “cost-minimization package”. This package comprises measures that together will guarantee the lowest socioeconomic cost of achieving the 40 percent target. The measures are mainly selected from the so-called “catalogue of climate initiatives”, but the Danish Council on Climate Change has added two new initiatives to encourage the use of heat pumps. Most of the measures in this package relate to agriculture. Overall, the package is estimated to provide an economic gain of around 1.1 billion DKK annually, once all side-effects have been taken into account. Side-effects primarily refer to the realisation of a cleaner aquatic environment due to less nitrogen-leaching and fewer ammonia emissions from agriculture.

Elements of the agricultural sector are under financial pressure at present. Therefore the Danish Council on Climate Change has also calculated what the costs will be if the politicians choose to completely exempt agriculture from contributing with further reductions until 2020. This package is called the “non-agricultural” package. The package includes measures undertaken independent of the agricultural sector which together will ensure the lowest economic cost of reducing emissions by 2 million CO<sub>2</sub>e. The economic cost of this package is estimated to be almost 150 million DKK. annually.

Calculations regarding the impact on employment show that implementing the measures contained in the “cost minimization package” can provide short term employment for about 1,000 people, a figure which rises to up to 3,000 people in short term employment with the implementation of the “non- agricultural” package. The greater positive effect on employment through the implementation of the “non-agricultural” package is due, among other things, to the fact that relatively large investments are made in this package which in the short term generate increased employment. In both packages the investments have to be financed, which in the medium term leads to lower employment. In the long run, the employment situation will be determined by the development of the workforce and in structural unemployment. Neither of these factors are thought to be affected by the two packages in any significant way.

Although the calculations are subject to considerable uncertainty, they do indicate that it is possible to meet the 40 percent goal without incurring major economic costs. The Danish Council on Climate Change’s calculations show that exempting agriculture from contributing to reductions will have expensive socioeconomic repercussions and that there are positive employment effects to be realised from both packages in the short term. If it were preferable to not place too much of a burden on agriculture, measures could still be implemented that would result in emissions reductions in the sector if the financing policy is organised so as to minimise the impacts of these measures on the rural economy. This can be done by promoting initiatives in agriculture through subsidies

rather than tax and regulatory requirements, administering this relief where appropriate as temporary measures. Alternatively, other instruments could be used to compensate agriculture wholly or in part for the costs of the reduction requirements.

Achieving the 40 percent target could strengthen the credibility of the political will to achieve the long-term climate goals for 2050. In assessing the cost of achieving this objective, it is important to keep in mind that there must still be a substantial reduction in emissions from the non-ETS sector in the period leading up to 2030. Under the EU's climate policy objective for 2030, it is expected that Denmark will be required to reduce greenhouse gas emissions from non-ETS sector by 36-40 percent in comparison to the levels recorded in 2005. The additional costs which the agricultural or transport sector, for instance, would incur to fulfil their part of reaching the 40 percent target, will in any event be borne during the period 2020-2030.

### **Denmark's climate efforts are significant, but not unique in an international context**

The historic reduction of Danish greenhouse gas emissions and the national target of a 40 percent reduction of these emissions by 2020 means that Danish progress is frequently held up as an example of best practice in the Danish climate debate. It is often claimed that Denmark has progressed much further than the countries we normally compare ourselves to. To investigate that assertion, the Danish Council on Climate Change analysed how Danish climate initiatives compare to the efforts of our neighbouring countries. The analysis shows that if one looks at the reduction of greenhouse gas emissions in relation to gross domestic product, the Danish effort is not greater than the efforts of other comparable countries in northwestern Europe. Denmark may well have reduced total emissions to a relatively high degree, but this is due in large part to the low economic growth the country has experienced in comparison to most other comparable countries.

Research undertaken by the Danish Productivity Commission has shown that this low growth rate was due in particular to weak productivity development in the domestic part of the service sector, which only consumes a comparatively small amount of energy. It would therefore be wrong to conclude that an ambitious Danish climate policy is the reason behind such low growth. Denmark has undoubtedly made a significant impact on climate change, but we are not alone. It is evident that Denmark is not a solitary maverick in respect of climate change, but rather part of a breakaway group consisting of a number of ambitious countries.

## Long-term challenges for Danish Climate Policy

As a starting point for the Danish Council on Climate Change's future work, this report provides an overview of the long-term challenges to be overcome across the various sectors of electricity and heating, transport, agriculture, buildings and waste. There is a need for further action in all of these areas, and there are barriers that must be overcome if the goal of a low carbon society by 2050 is to be realised. At the same time, any such transition will require closer collaboration between the areas of electricity and heating, agriculture, transport, building mass, waste management and process energy in industry.

### **Future heat and electricity will come from wind, solar and biomass**

It is crucial to overhaul the electricity and heat sector if the goal of a low carbon society is to be achieved. Denmark has already reduced CO<sub>2</sub> emissions from these sectors considerably in recent decades, but this momentum must, at the very least, be maintained if the sector is to be independent of fossil fuels by 2050.

A power and heat sector that is independent of fossil fuels will in all likelihood be based on wind, solar and biomass. However, it is important that the regulation of the sector is technologically neutral if possible. This will permit the most socioeconomically efficient energy technologies to come to the fore, as well as making provision for potential new technologies that are as yet unknown. With the technologies expected to be available in 2050, independence from fossil fuels will dictate that electricity is the dominant energy source and must therefore be comprehensively employed in the electrification of transport, process energy and heat supply through heat pumps. In a power system which to a large extent will be based on fluctuating wind and solar energy, it is important to prioritise flexible electricity consumption, energy storage solutions and cable connections abroad.

The EU's quota system has the potential to be an important driving force in the cost-effective conversion of the electricity and heating sectors. It requires, however, that the quota supply be restricted and regulated so that the quota price can reach a significantly higher and more stable level than that which we have witnessed so far. Such action is likely, and would be prudent if the EU is to meet the targets it has set itself for 2050. The timeframe is unclear however, and in the interim there may continue to be a real need for additional support for renewable energies to ensure that the transition does not come to a standstill.

### **Our means of transport must be powered by renewable energy**

The transport sector accounts for around a quarter of total greenhouse gas emissions in Denmark and despite the fact the sector's emissions have been falling since the financial crisis, they are still well above 1990 levels. This means that significant reductions in emissions from transport must be achieved between now and 2050. While in the short term this can be realised through a more energy-efficient use of fossil fuels, in the longer term it will be necessary to switch to fuels based on renewable energy.

In the lead-up to 2050, new, interchangeable sources of fuel will need to be identified. For private cars, electrification will be essential. Electric cars and plug-in hybrid cars will likely be the first forms of electrified road vehicles to make a

genuinely perceptible difference, while hydrogen technology and synthetic fuels produced via electrolysis will also prove relevant in time. We also expect biofuels to play a greater role in the transport sector, particularly in the areas of heavy vehicle transport and maritime and air transport, where electrification is difficult.

Development in this field has not really taken off largely because of the fact that the electric and other transport solutions based on renewable energy are still too expensive, although there are expectations of significant price cuts to come. It is important that the tax system supports the development of new fuels based on renewable energy. This requires that the costs are restructured, not only so that they are more precisely targeted to reflect the harmful collateral effects visited on the climate and environment by the technologies that are being used, but also so they take into account the positive multiplier effect that may result from supporting the initial phase of deployment of new technologies in the transport sector. This multiplier effect is contingent on the simultaneous expansion of the charging infrastructure which is a prerequisite for the promotion of electric cars. An expanded charging infrastructure will increase the incentive to buy an electric car, and more electric cars will make it more profitable to invest in charging infrastructure. Public support and regulation can help to kick-start this virtuous circle.

#### **The way in which agricultural emissions are estimated and reported determines the reduction possibilities**

Emissions from agriculture in Denmark have been declining for several years, but without new climate policy mandating more reduction initiatives a continued decrease in the sector's greenhouse gas emissions is unlikely. As the sector accounts for one fifth of total Danish emissions, it is essential that agriculture contribute to significant reductions in emissions if the goal of a low carbon society is to be met. At the same time, through the production of biomass it is possible for agriculture to contribute to the mitigation of fossil fuels in the sectors where biomass is used for energy and transport purposes.

At present, emissions are not calculated independently for every farm. This means that there is no incentive for the individual farmer to reduce emissions. At this stage, efforts to reduce emissions from agriculture are focused on encouraging the application of specific technologies and farming methods rather than attempting to regulate emissions in a more targeted way. Such measures do not necessarily represent the most cost-effective means of achieving reductions.

Once the climate measures in agriculture have been implemented, the greatest socioeconomic gain will be achieved by tackling climate and the environmental objectives together. It is in this way that the most significant effects can be achieved, as measures that reduce emissions in agriculture can at the same time have an environmentally beneficial effect.

#### **Buildings play many roles in the transition**

Between now and 2050 it will likely be necessary to reduce energy consumption to ensure a cost-effective transition. In this respect buildings will play a central role as they are responsible for a large proportion of energy consumption - both households and businesses. First and foremost, there must be an appropriate

balance between the development of renewable energy and the reduction of energy consumption. It is crucial that the right incentives are provided so that citizens and businesses implement energy conservation measures for buildings that are cost-effective for society.

In the future, buildings will have a much more interactive relationship with energy production. This applies both in terms of the production of renewable energy in relation to buildings as well as through opportunities for flexible energy consumption in buildings in an energy system with a high proportion of fluctuating energy.

Firstly, in order to facilitate this a cost-effective balance between the expansion of household-related production of renewable energy and an expansion of the central distribution network needs to be undertaken. Secondly, the opportunities for flexible energy consumption in buildings must be developed and encouraged.

#### **The future role of waste as an energy source needs to be clarified**

Waste has its own part to play in the transition to a low-carbon society. A significant proportion of Denmark's waste is combusted for the purposes of electricity and heat production and, as much of the waste has a low fossil fuel content, incineration of it in this fashion contributes to reducing CO<sub>2</sub> emissions by displacing fossil fuels in the power and heating sector.

There has been an increased focus on recycling waste to ensure the optimum use of resources. However each municipality typically does not generate sufficient quantities of waste to make using the most effective technologies for waste management profitable for them. There may therefore be a need for increased cooperation in waste management across municipalities. There is also an increasing overcapacity in Danish incineration plants which has led to non-organic waste being imported. This could result in a rise in national greenhouse gas emissions as we proceed with phasing out fossil fuels in the rest of the energy system with the result that this waste is no longer replacing fossil fuels.

## Urgent problem areas for the transition

The Danish Council on Climate Change has identified four areas where there needs to be immediate action if the progress towards a low-carbon economy is to be maintained. They all relate to the direction in which the Danish energy system should evolve in the coming years, and how the various energy taxes play a central role. The tax and subsidy system expects the Danish Council on Climate Change to address these issues in its next report which is due to be published in the summer of 2016.

### **1. Preferential tax breaks for biomass are problematic**

In recent years there has been a rapid growth in the utilisation of biomass in the energy system, a development which the Danish Council on Climate Change finds problematic. Although biomass will admittedly play an important role in the future energy system as a source of supply when production from wind turbines and solar cells is low, as well as in the production of biofuels, current developments reflect a bias in the tax system that favours biomass by exempting it from energy taxation. This makes it profitable for both private citizens and companies alike to use biomass to meet their energy needs even though there are other, less socioeconomically expensive, renewable alternatives available.

Under current greenhouse gas accounting methods, the use of biomass is assumed to be CO<sub>2</sub>-neutral. In practice, this CO<sub>2</sub> neutrality depends on the type of biomass, the alternative uses of the biomass and the management of the agricultural and forestry land upon which it is cultivated, including reforestation. The impact on the climate of the use of these different types of biomass is not reflected in the current greenhouse accounts. There should therefore be a concerted move towards the regulation of biomass at the international level to better reflect its true climate impact. Irrespective of whether such regulations are introduced, in the future it is anticipated that biomass will become a scarcer resource worldwide. The Danish energy supply of the future must contain a certain amount of biomass as, in the short term, it has a role to play as a bridging technology for supplying electricity and heat. In the long term, it hardly makes economic sense to commit a large part of the electricity and heat supply to a single resource that could prove to be both scarce and expensive.

### **2. The pace of development of renewable energy must be increased in the lead-up to 2050**

As part of the green transition it is necessary that a large portion of the nation's energy consumption be changed over to electricity through the significant electrification of, among other things, heating and transportation. In order to deliver the required amount of electricity from renewable energy sources there must be a massive expansion of renewable electricity production in the period up to 2050. Between 2020 and 2050 there is a need for an expansion of renewable electricity production to a significantly greater degree than has been seen to date. This means that a pause in the development of renewable energy can make the overall transition more expensive than necessary as development would then need to be increased at an even faster pace later on.

### **3. Energy taxes are standing in the way of electrification**

Without electrification society will not be able to realise the full value of renewable electricity production. Energy taxes stand in the way of socioeconomically sound electrification. There is currently more than three times as much tax on electricity as there is on other fuels. Even the electricity which is used for heating, and therefore eligible for a reduced rate, has a tax rate of almost twice that of heating oil and natural gas. These high taxes hinder the electrification of both individual heating as well as district heating where heat pump technology is both energy-efficient and socioeconomically cost-effective. If charges are not made, heating will either continue to be based on oil and gas or be switched to biomass wood chips and pellets, which are currently tax exempt.

### **4. Combined heat and power will play a smaller role in the future**

Decentralised combined heat and power plants (CHP) face major economic challenges in the coming years. With oil prices at a low compared to previous years, decentralized CHP plants can no longer make sufficient gains from the electricity they produce and most of the time many are only used to generate heat. This loss of income from the sale of electricity means that homeowners face higher heating prices. Such decentralised CHP is supported today through a basic subsidy that will disappear with the end of 2018, something which will lead to further increases in district heating prices. The future of decentralized CHP is therefore particularly uncertain.

District heating production can already be achieved in an economic manner through the use of heat pumps and, because electricity production is increasingly based on wind and solar, the need for power generation from CHP plants is set to decline significantly. In the future, the existing power plants can serve as backup capacity for power generation as the cost of keeping the existing decentralized CHP plants operational is low. In the longer term, however, it will be necessary to re-evaluate whether investment in other types of production plants would be more appropriate once the existing decentralized CHP is finally scrapped or when conventional natural gas is phased out of the energy system.

## Overall recommendations

The analyses contained in this first report by the Danish Council on Climate Change give rise to a number of recommendations regarding Danish climate policy.

### Danish Council on Climate Change recommends

- the national target of a reduction of Danish greenhouse gas emissions by 40 percent in 2020 compared to 1990 levels should be maintained,
- ensuring a steady expansion of supply infrastructure, such as charging stations to facilitate the deployment of electric vehicles, in order to support the transition to new fuels in transportation,
- a thorough examination of whether the taxation system can be positively readjusted in order to support the considerable changes which the transportation sector faces,
- a clarification of individual biomass types with regards to identifying whether their use as an energy source has a genuine impact on the climate, and that in an international context Denmark works to ensure that this is reflected in the greenhouse gas reporting,
- that the tax and subsidy system ceases to favour biomass, and energy taxes are restructured as far as is possible without distorting choices among forms of energy. A lowering of the tax on electricity for heating purposes is particularly important, since the possibilities for replacing one form of heating with another makes it especially distortive that the tax on electricity for heating is higher than that on other types of heating,
- the PSO levy should be modified so that it does not distort electricity consumption. This would serve to illustrate how such a conversion could be carried out while highlighting the advantages and disadvantages of restructuring in comparison to using other means to fund the costs currently covered by the PSO levy,
- the base payment for district heating as financed by the PSO levy should be delivered as planned by the end of 2018. Possible measures to counter the sharp rise in costs for homeowners need to be designed so that they do not work against, but rather encourage, an increase in the amount of electric heating,
- the expansion rate of renewable energy in the electricity and district heating sector should be either maintained or increased in the upcoming energy agreement for the period 2020-2030, while at the same time working to improve how renewable energy is utilised through electrification and the expansion of our cable connections abroad.



