



OUR FUTURE ENERGY



THE DANISH GOVERNMENT

NOVEMBER 2011



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Our future energy

Diminishing global resources and increasing global demand for energy are pushing fossil-fuel prices through the roof. These high prices have already imposed significant additional costs on Danish households and enterprises. In other words, it is no longer possible to build prosperity by using scarce fossil resources. Future prosperity requires energy efficiency and renewable energy.

Therefore, the government will make Danish society future proof by establishing a green growth economy and by converting to an energy and transport system based 100% on renewable energy by 2050. Such an enormous conversion is a huge task, so we must start right now.

Considered in isolation, the conversion will mean higher energy bills for both households and enterprises. But it is like an insurance policy. If energy prices rise by more than we currently expect - and there is a serious risk that this will happen - higher energy bills will be a relatively small price to pay in relation to what we are insuring against. The money will be a good investment.

Conversion could also be due to climate considerations. If we delay conversion globally, and if we do not start addressing climate change now, we will be leaving a very large unpaid bill for future generations to pick up.

Progress in global efforts against a climate in crisis has so far been far too modest. Denmark will exploit the power of good example to encourage the rest of the world to join global efforts to combat climate change. Concentrated focus on energy efficiency and comprehensive conversion of the energy sector is possible, without ruining the economy. It is entirely possible technologically. This has already been demonstrated by the analyses from the Danish Commission on Climate Change Policy.

Denmark is a wealthy country with a stable economy. So we can and must take the lead. Initiating a transition away from fossil fuels requires strong political drive. The current economic crisis in a large part of the world has exacerbated the political challenge, but it would be wrong to put the transition on stand-by.

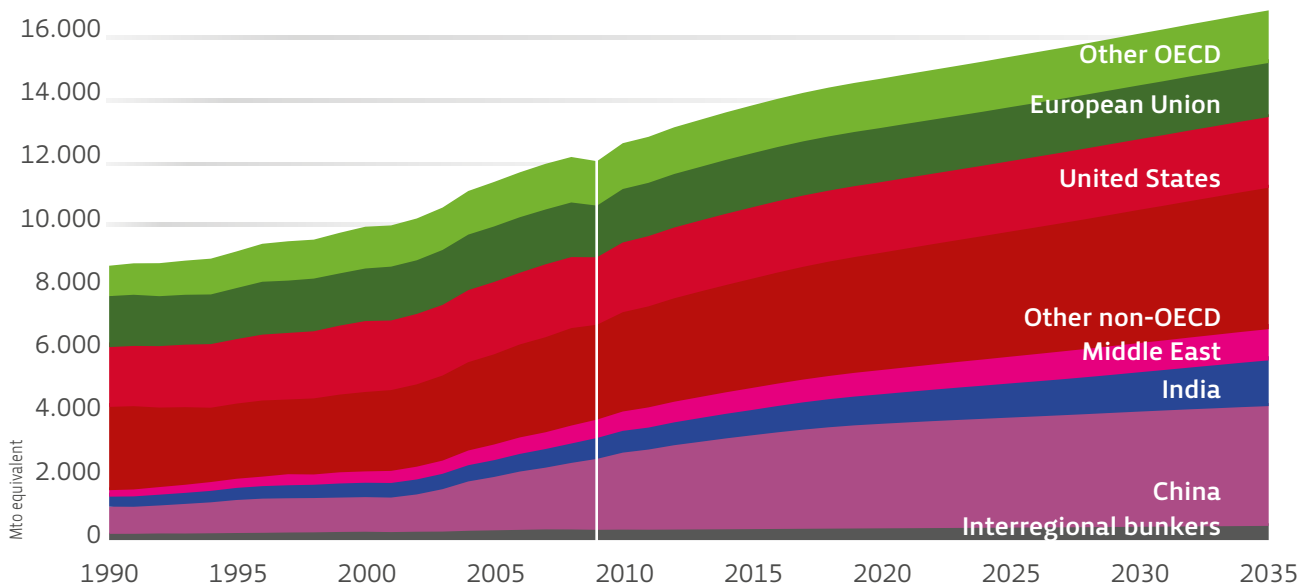


Figure 1.1 World primary energy demand by region up to 2035. Scenario based on national climate and energy policy targets (World Energy Outlook c OECD/IEA, 2011)

Therefore, we will increase our investment in energy efficiency and secure future energy supply which is not tied to fossil fuels, and does not impact the climate, with consequential higher costs for climate-change adaptation and similar.

Recent figures from the International Energy Agency predict that global demand for energy will increase by one-third towards 2035, and that oil prices will continue to rise. With lower energy consumption we will be less vulnerable to increases in future energy prices. These energy initiatives mean that energy consumption will be drastically restricted up to 2020. The savings in the final energy consumption in 2020 have been estimated at about DKK 6.9 bn. All else being equal, this will benefit the competitiveness of enterprises and the financial situation for households.

With the full package of initiatives in this proposal, Denmark will also achieve a reduction in greenhouse gas emissions of 35% in 2020 compared with 1990. This is a significant reduction, taking into account that greenhouse gas emissions not only comprise CO₂ emissions from energy supply. However, the government believes it is a realistic goal and with a future

climate plan, the government's goal of a reduction in total greenhouse gas emissions of 40% in 2020 is achievable.

Denmark is good at things green, and at making a business out of them. Investment in a green transition could enhance Danish opportunities for a global technological lead. Danish companies already have a global stronghold in several technological areas in which both Denmark and the rest of the world will invest in the decades to come in order to secure energy efficiency and produce renewable energy. An ambitious but realistic transition will underpin these strongholds. The transition will strengthen the domestic market for green solutions and it will promote technological innovation and research. Exploiting these opportunities will create new green jobs throughout Denmark.

Conversion of our energy system as proposed by the government here, is not free. It is estimated that, when they are fully phased in, in 2020, the energy initiatives will cost a total of DKK 5.6 bn. This expenditure will cover improved energy efficiency, expansion of supplies from renewable energy, as well as the state revenues lost because of reduced use of fossil fuels.

In the years to come, enterprises and households will have to spend several billion kroner on new and more energy-efficient equipment as well as renewable energy which is required to convert the energy system. However, there are also investments which would have to be made at all events.

With a saving in final energy consumption of DKK 6.9 bn., the immediate net costs will be less than 0.25% of GDP in 2020. If this is considered in the context of greater robustness towards increases in fossil-fuel prices and opportunities for growth through new green jobs, the government considers the price as an insurance premium which it is wise to pay.

This proposal presents a package of important energy-policy initiatives which kick-start green growth with investments in energy efficiency and renewable energy up to 2020. The initiatives

build further on the Energy Strategy 2050. But the government's higher level of ambition means that we will also achieve much lower energy consumption through strenuous efforts for energy efficiency and considerably more renewable energy; not least with more offshore wind turbines.

This proposal is for all of Denmark; everyone will join to finance the investment, and everyone will reap the rewards. The green transition is only possible if everyone takes part.

The government will invite all parties in Parliament immediately to negotiate an energy agreement up to 2020. Such an agreement will move Denmark forward towards the 2050 goal and it will leave enterprises, the public and the world at large in no doubt that Denmark will be at the very forefront in energy policy.

The Danish Government

The government's energy policy milestones up to 2050

In order to secure 100 pct. renewable energy in 2050 the government has several energy policy milestones in the years 2020, 2030 and 2035. These milestones are each a step in the right direction, securing progress towards 2050.

2020

Half of the traditional consumptions of electricity is covered by wind power

2030

Coal is phased out from Danish power plants
Oil burners phased out

2035

The electricity and heat supply covered by renewable energy

2050

All energy supply – electricity, heat, industry and transport – is covered by renewable energy

The initiatives up to 2020 will result in a greenhouse gas reduction by 35 pct. in relation to 1990.

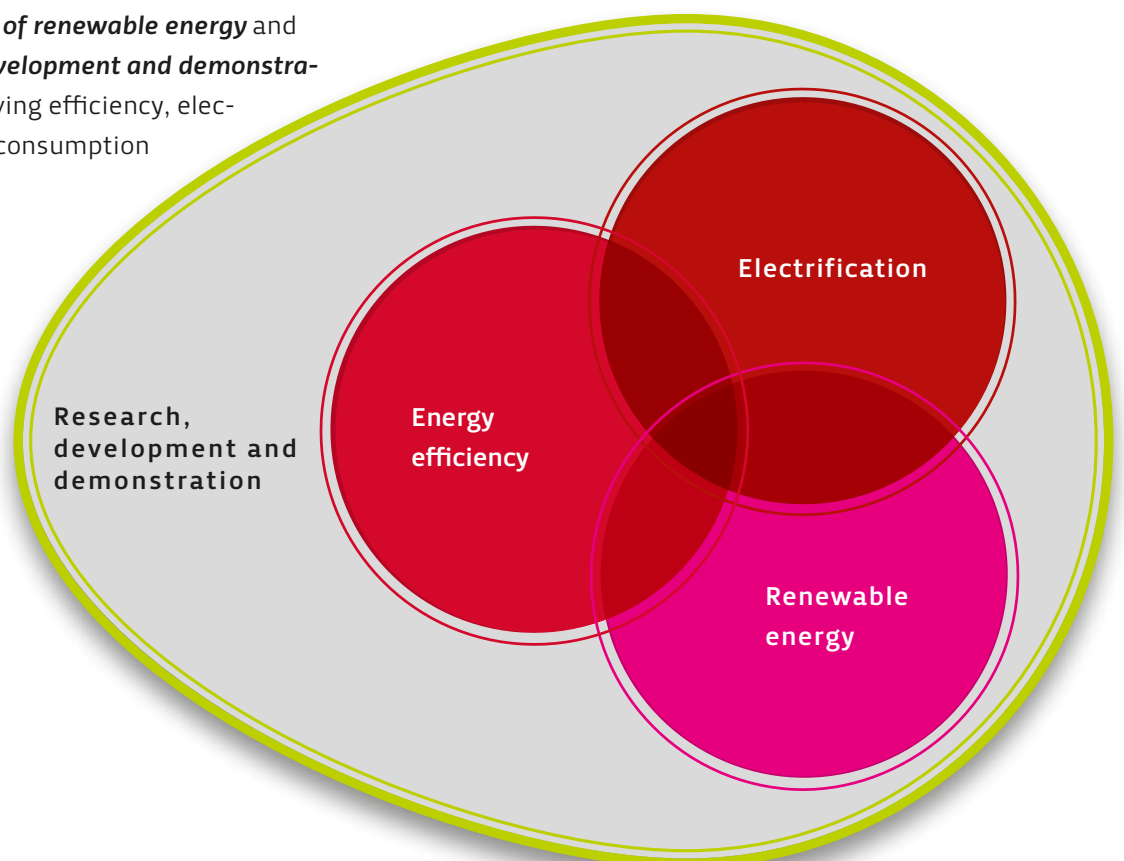


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New energy-policy initiatives accelerate the transition to green energy

The long-term goal for Danish energy policy is clear. All of Danish energy supply is to come from renewable energy by 2050. Exactly what the optimum energy system will look like in 2050 is as yet uncertain; there are far too many unknowns. However, much indicates that there are four critical focus areas: **energy efficiency, electrification, expansion of renewable energy** and finally **research, development and demonstration**. Only by improving efficiency, electrifying our energy consumption

and expanding supply from renewables will we be able to phase out fossil fuels completely. In order to do this intelligently and cost-effectively, we must also research, develop and demonstrate new technological solutions and innovative market models.



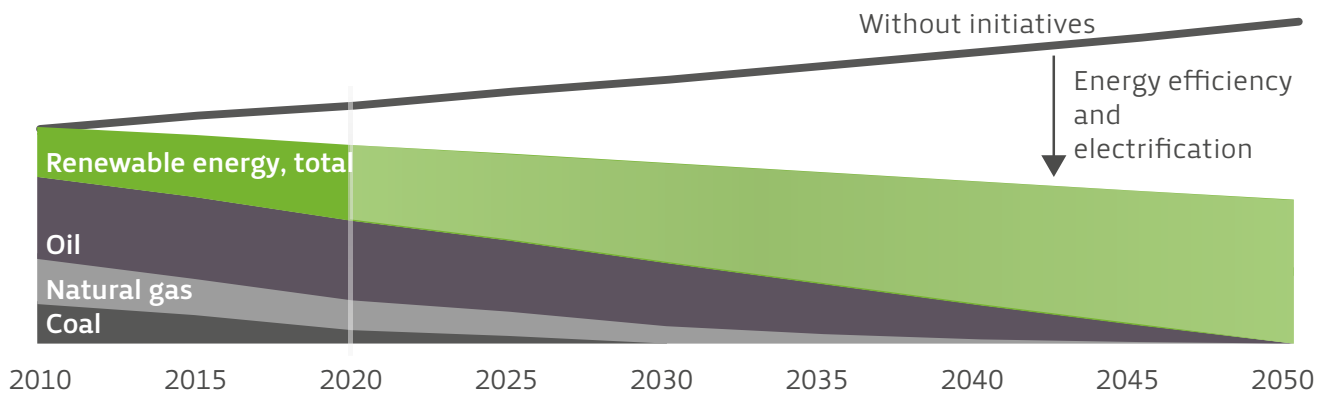


Figure 2.1 Illustration of energy consumption up to 2050

Energy infrastructures have a long lifetime and decisions taken today can have consequences reaching 30-40 years into the future. Realising the long-term goal therefore requires ongoing efforts, both in the consumption and supply sides. Many investment decisions will have to be made moving towards 2050, for example when oil-fired boilers are to be scrapped or windows are to be replaced. Such decisions must envisage use in 2050. We have to avoid becoming trapped with inefficient and non-renewable technologies. Otherwise we will be caught with an expensive and outdated energy sector in 30-40 years.

Therefore, even now, initiatives for energy efficiency and expansion of renewable energy have to be intensified. Internationally, Denmark has already come a long way in the green transition, but there is still far to go from today's energy supply, with around 20% renewable energy, to meeting the goal of 100% renewable energy.

A package of new energy-policy initiatives

In many ways, Denmark has started the transition well. However, it is time to move up a gear. Therefore, the government has presented a package of new energy-policy initiatives. These include a broad and ambitious range of energy-policy measures, which will result in increased efficiency and electrification as well as more renewable energy in the short term up to 2020, and further ahead towards 2050.

The green transition requires action in all parts of society. Therefore, widespread commitment as well as good information and opportunities to take action are essential. This will be done through initiatives that enhance incentives for enterprises and households to implement energy-efficiency improvements and to change to renewable energy. In addition, there are initiatives to promote research, development, demonstration and innovation within green technologies to prepare for the next phase in the transition by developing and improving the technological solutions. At the same time this will enhance Denmark's leading position within cleantech solutions. The government also proposes a number of new analyses to establish the required knowledge base for the important decisions awaiting us. Furthermore, a number of tools are proposed to continuously measure and evaluate whether we are on the right track and using the correct instruments to meet our goals.

The government will invite the parties in the Danish Parliament to negotiations on a new energy agreement. However, there will also be energy-policy initiatives implemented independently of a future energy-policy agreement. For example, initiatives implemented as part of a new Finance Act such as the green subsidies scheme for energy renovation of housing. This also applies for initiatives which the government will implement within existing political, economic and legislative frameworks.

More efficient energy consumption

An important element in the transition to 100 % renewable energy is that we get better at exploiting energy by changing to more efficient technology, and by being more aware of our energy consumption. Otherwise, economic growth will push up our energy consumption and make it disproportionately expensive, or ultimately impossible, to cover with renewable energy resources. Investment in more efficient use of energy will often quickly pay itself back. Furthermore, society as a whole will become less vulnerable to fluctuations in energy prices. The government wants to help households and enterprises to make sensible investments.

An especially important area is buildings. Buildings stand for 100 or more years and more extensive renovation is only carried out very few times. Therefore, it is important to grasp any opportunity for energy renovation as it arises. It is also crucial to ensure that new buildings have high energy efficiency, which can be achieved with the most modern and cost-effective technologies. Energy-efficient housing saves energy and money, both in the long and short terms. The government will present an overall strategy

for building renovation as well as a number of initiatives to improve individuals' opportunities to energy- renovate their own home. In addition to this, it is important that builders and tradesmen are better at integrating thoughts on energy efficiency in building and renovation processes.

The public sector has a special obligation to contribute by implementing cost-effective energy savings, and the government will intensify public-sector energy-saving initiatives.

Enterprises need to be more efficient as well. Even though much has been done over the past 30 years, there is still a lot left to do. Implementation of cost-effective energy savings does not just mean an immediate profit for the enterprise, it also makes the enterprise less vulnerable to unexpectedly high and fluctuating energy prices. In order to assist in this area, the government is presenting initiatives with special focus on energy consumption by enterprises.

We are particularly dependent on EU standards in a number of areas. For example, this applies for energy-using appliances. The government will continue to urge the EU as a whole to be ambitious in the efficiency area.

Initiatives to make energy consumption more efficient

- Increase energy-saving initiatives by energy companies by 75% from 2013-2014 and by 100% from 2015-2020 compared to 2010-2012
- Target energy-saving initiatives by energy companies towards existing buildings and businesses
- Continue the efforts by the Knowledge Centre for Energy Savings in Buildings
- Work to achieve the EU target of 20% energy savings in 2020 by adopting an ambitious directive on energy efficiency
- Work for ambitious EU requirements for the energy efficiency of appliances and products (ecodesign and marking directives)
- Prepare an overall strategy for energy renovation of the existing building stock by future-proofing the minimum requirements for building components, to be met when renovating buildings as well as an overall analysis of the area, including possible initiatives for better compliance with requirements in building regulations as well
- as possibilities of more utilisation of ESCO models. The strategy will be presented before the end of 2013
- Enhance public sector energy savings efforts from 2012
- The 2012 Finance Act agreement will establish a green subsidy scheme for energy renovation of housing. DKK 500 million has been earmarked for 2013 and DKK 500 million for 2014



Electrification

Electricity will be even more important in the future energy system. This is because Denmark is particularly favoured by good wind resources, which will be able to supply green electricity at relatively low prices. Electrification also in itself is an efficiency improvement at both the consumption and the supply sides.

There are great opportunities for electrification of consumption. District heating, individual heating and many industrial processes can be electrified with heat pumps. An array of international analyses indicate that in the longer term it will also be possible to electrify most personal transport with electric cars and plug-in hybrid cars. These are considerably more efficient than petrol and diesel cars. Transport based on electricity will also become increasingly green as electric-

ity production is converted to renewable energy, and it will contribute to more flexible electricity consumption. Therefore, the government is presenting initiatives which will improve the transition to more electrification of transport.

High electricity consumption combined with extensive wind power demands an intelligent energy system, also known as a smart grid, with flexible electricity consumption, strong connections abroad and an efficient international electricity market so that Denmark can export wind electricity and import hydro power, for example, depending on weather and market conditions. Therefore, the government also proposes a number of initiatives to take Denmark towards a stronger and more flexible energy system.

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Initiatives to promote electrification and an intelligent energy system

- New electricity transmission lines between Denmark, Germany and possibly Sweden in connection with the offshore wind farm to be built at Kriegers Flak
- Establish agreements with grid companies on the installation of intelligent electricity meters
- Continued incentives for demonstration projects for dynamic tariffs in specific electricity distribution grids
- Efforts for an enhanced EU grid infrastructure and an efficient European electricity market
- State co-financing of re-charging stations for electric cars
- Efforts in the EU to promote electric cars with focus on harmonisation and roll-out of car recharging infrastructure
- Extension of tax exemptions for electric cars to the end of 2015
- Preparation of an analysis and plan for expansion of transmission capacity abroad
- Preparation of a strategy for expansion of smart grids in Denmark. The strategy will be presented before the end of 2012
- Preparation of an overall strategy for the promotion of energy-efficient vehicles such as hybrid plug-in, electric cars etc.

Conversion to renewable energy in electricity and heat production

Denmark has sufficient renewable energy resources to satisfy energy consumption in the long term. In the decades to come, obsolete electricity and heat plants will be scrapped. This capacity will not be replaced by new fossil-based production, but by new capacity based on renewables. In order to ensure smooth expansion, Denmark has to start expanding wind and biomass sources now.

Denmark has particularly good conditions for wind power, with good wind resources, large, shallow offshore areas, and with many companies involved in the development and production of wind turbines. Therefore, the government is presenting an array of ambitious initiatives to expand wind power towards 2020. There will be significant expansion of offshore installations; a Danish stronghold. Expansion of onshore installations is also to continue. The primary challenge is to find suitable sites. However, the financial perspective is very favourable for onshore

installations and there is every indication that costs will fall further. Therefore, the government proposes phasing out subsidies for wind turbines connected to the grid from and including 1 January 2014.

Biomass is also important as a replacement for coal, but in the long term it is also a vital element for flexible electricity production and for the transport sector. Therefore the government is already improving incentives to replace coal with biomass, and it is investigating how and where Denmark in the future can best utilise the limited biomass resources and ensure sustainability.

In the long term, other renewables such as solar and wave energy will also be able to play a role in the Danish energy system. Both wave energy and solar energy could be valuable supplements to wind and biomass. The various technologies are productive at different times and this spread is valuable for the overall energy system. Therefore, the government is ready to continue supporting development and application of these technologies.

Initiatives to convert to renewable energy in electricity and heat production

- Call for tenders for 1,200 MW offshore wind turbines up to 2020, including 600 MW offshore wind turbines at Kriegers Flak
- Screening of areas in the first half of 2012 as well as setting the framework for testing and production turbines with a view to establishing 400 MW offshore wind turbines in coastal areas up to 2020
- Measures for more efficient tendering procedures and therefore cheaper expansion of offshore turbines
- Support municipal planning in order to establish 1,800 MW new wind power onshore (500 MW more than anticipated in the 2010 baseline projection), including an ambition to promote the Wind Turbine Secretariat in collaboration with the industry
- Tendering state-owned areas to erect wind turbines
- Gradual phase-out of premium for onshore wind turbines with introduction of a new cap of DKK 0.6/kWh for the electricity market price and premium, after which the premium will be gradually phased out for electricity market prices over DKK 35/kWh. This will apply for new onshore wind turbines connected to the grid on and after 1 January 2014
- Shift from coal to biomass in central CHP production through greater freedom for producers and buyers to make agreements
- Retention of current fuel restrictions for small-scale combined heat and power combined with targeted consultancy and greater flexibility in choice of fuel for the up to 30 district heating plants with the highest heat prices
- Fund to promote new renewable technologies (large heat pumps, geothermal energy etc.)
- Analysis of the use of bioenergy in Denmark. The analysis will focus on whether the right framework conditions for efficient and environmentally sustainable use of biomass resources are in place in Danish energy supply



Promotion of biogas

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Another important challenge is to secure expansion of biogas. Biogas is useful for the energy system and it reduces environmental problems from livestock production. This is also a technology in which Denmark has a leading position. Therefore the government is presenting new initiatives to promote use of biogas in Denmark.

Initiatives to ensure continued biogas expansion towards 2020

- Continuation of the current support for biogas used at CHP plants
- Introduction of an additional subsidy of DKK 22.5/GJ for biogas produced on the basis of livestock manure, provided a binding agreement on supply of biogas is established before 31 December 2013. The subsidy will be reduced in line with natural gas prices
- Introduction of subsidy equality so that biogas sold to the natural gas grid receives the same subsidy as biogas used at CHP plants
- Introduction of a subsidy of net DKK 39/GJ when biogas is used in industrial processes or as a fuel for transport
- Increase in start-up aid from the start-up construction fund from 20% to 30%
- Change in regulation in order to allow, on a voluntary basis, changing from fixed electricity premium to a premium for 100% biogas-based plants.
- Establishment of a task force to study and support specific biogas projects
- If there is not the required number of new projects in 2012-2013, a specific proposal will be presented for a duty to purchase in order to ensure expansion of biogas

Conversion to renewable energy in heating, industry and transport

Individual heat supply is also to be converted to renewable energy in the form of individual renewable-energy solutions, as well as renewables-based district heating. Therefore, the government is presenting a number of initiatives which will gradually phase out individual heating based on oil and gas, for replacement by district heating and heat pumps for example. Market-promoting initiatives, such as package solutions and ESCO models, increase the possibilities for enterprises and people to act for themselves and cost-effectively replace old and inefficient equipment with new technology based on renewables. A very important issue is to determine where district heating should have priority and where individual solutions are most appropriate. Therefore, the government is proposing a new initiative to enhance local energy planning. It is about identifying the local renewable energy resources and potential efficiency improvements, as well as involving the public, enterprises and municipalities in the green transition locally.

In the long term consumption by industrial processes must also be converted to renewable energy, partly through electrification and partly by converting to biomass. In order to initiate this development, the government is presenting a new support scheme for more use of renewable energy at enterprises.

Conversion to renewable energy in the transport sector is a special challenge. In the longer term, electric cars will play an important role, see the section on electrification. In the short term, biofuels are the obvious way of meeting the goal to increase utilisation of renewable energy in the transport sector, although it is important to secure the sustainability of 1st generation biofuels. In the longer term, in particular 2nd generation biofuels made from waste and residues may be able to play an important role, especially for heavy transport such as freight and aviation, where electric power is not an option. Today it has been estimated that the costs of large-scale production of 2nd generation biofuels will be far too high to make it appropriate to promote these within the framework of this initiative package.

Initiatives to convert to renewable energy in housing, industry and transport

- No new building with oil and gas-fired installations from 2013. Exemptions may be allowed in cases where no suitable alternatives are available
- No installation of oil-fired boilers in existing buildings from 2015. The model will allow for exemptions in buildings where no suitable alternatives are available
- Fund for partnerships on strategic energy planning in municipalities for better exploitation of local resources
- Market-promotion of initiatives (e.g. package solutions and ESCO models) for energy-efficient heat pumps and solar heating, with a view to replacing oil-fired boilers with renewable energy solutions
- Requirement for 10% biofuels in transport by 2020
- Efforts for more comprehensive EU sustainability requirements for 1st generation biofuels
- Analysis of future use of the gas infrastructure before the end of 2013, both in the transitional phase in which natural gas continues to be used, and in the future, when biogas and other renewable energy gas takes over
- Development of a model and timetable for phasing-out natural gas boilers
- Analysis of the role of district heating in future energy supply before the end of 2013
- Green business scheme of about DKK 250 million in 2013 and after this about DKK 1/2 bn. per year from 2014-2020 to promote use of renewable energy in enterprises

Energy research, development, demonstration and innovation

Investment in research, development, demonstration and innovation is necessary, if Danish enterprises are to continue to develop, produce and sell green solutions and thereby create green jobs in Denmark; in ten years and in the even longer term. In the future, sources of Danish revenues will include sales of green technologies and solutions to the rest of the world. So investment in green ideas and new technologies which cannot yet compete on the market is also investment in the future welfare of Denmark.

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There are still concrete technological challenges to be overcome before transition to a society with 100% renewable energy can be realised. These include energy storage, intelligent regulation of the electricity grid, green means of transport, and development of new renewable

technologies. Denmark also has a chance to be one of the preferred countries for international companies and research institutions to test new technologies and new methods in full scale. This openness and the framework that makes Denmark attractive must be marketed and exploited. Therefore, the government is presenting an array of initiatives to enhance Danish energy-technology research, development and demonstration.

To a large degree it is about securing cleantech enterprises the opportunity for large-scale demonstration projects and access to test environments, and the government will work to this end. In connection with establishing new wind turbine test facilities, it is also important to secure a good process and local involvement.

Initiatives to increase research, development, demonstration and innovation (RDD&I) in new energy technology

- Extension of the existing PSO fund for new renewable technologies for electricity production (solar, wave etc.). A total of DKK 100 mill. over four years
- Contribute to the establishment of test environments for green solutions such as Samsø as a 100% renewable energy island
- Focus of strategic energy research in areas which reflect Danish strongholds
- Recurring technology assessments for the transport sector
- Secure Danish energy-related RDD&I efforts with grants of more than DKK 1 bn. in the 2012 Finance Act agreement
- EU research, development and demonstration efforts within green transport technologies
- Work to double resources for energy-related RD&D in the EU budget, including in particular for renewables, energy efficiency and smart grids, and that the energy area is rendered high priority in the EU Horizon 2020 research programme

A cohesive and cost-effective energy policy

The overall energy policy is to be designed so that it forms the best possible framework for cost-effective transition to a green energy system. In part this requires that regulation of the energy sector supports the long-term goal, and it requires regular evaluation of the energy-policy instruments and assessment of whether results are in proportion to costs. It also requires that the economic incentives, including the entire tax and subsidy systems, promote less use of fossil fuels and more renewable energy.

Therefore, the government will assess the need to adjust the existing subsidy and tax system. Furthermore, the government will closely analyse and evaluate the impact of instruments and regulation of the energy sector in order to ensure cost effectiveness and progress towards the energy-policy targets.



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Initiatives to promote cost-effective green transition

- Regular evaluation of the impact of instruments and overall evaluation every four years in order to secure progress and cost effectiveness
- Development of economic model tools for the energy sector in order to realise a better decision base for the green transition
- Examination of the subsidy and tax system in order to assess the need for adjustments of the existing system, including possibilities to secure the right incentives for conversion to a green and flexible energy system
- Thorough investigation of the regulation of the Danish electricity supply sector with a view to securing incentives for green conversion, cost effectiveness, competition and consumer protection

An energy policy with international ambitions

It is important for the government that the transition to 100% renewable energy is with open borders and through many joint international projects. If many countries move in the same direction towards a green transition, demand for green solutions will grow. This will move development of new technologies up a gear and the green solutions will be cheaper.

Well-functioning energy markets and joint international projects on cohesive energy systems across borders, for example, create economic and technological advantages and opportunities for all. Denmark depends on other countries with other strongholds developing green solutions, which Denmark itself cannot produce. For example within the transport area. In the same way, Denmark sells what it is good at. Therefore, the government places high priority on the international perspective and collaboration.

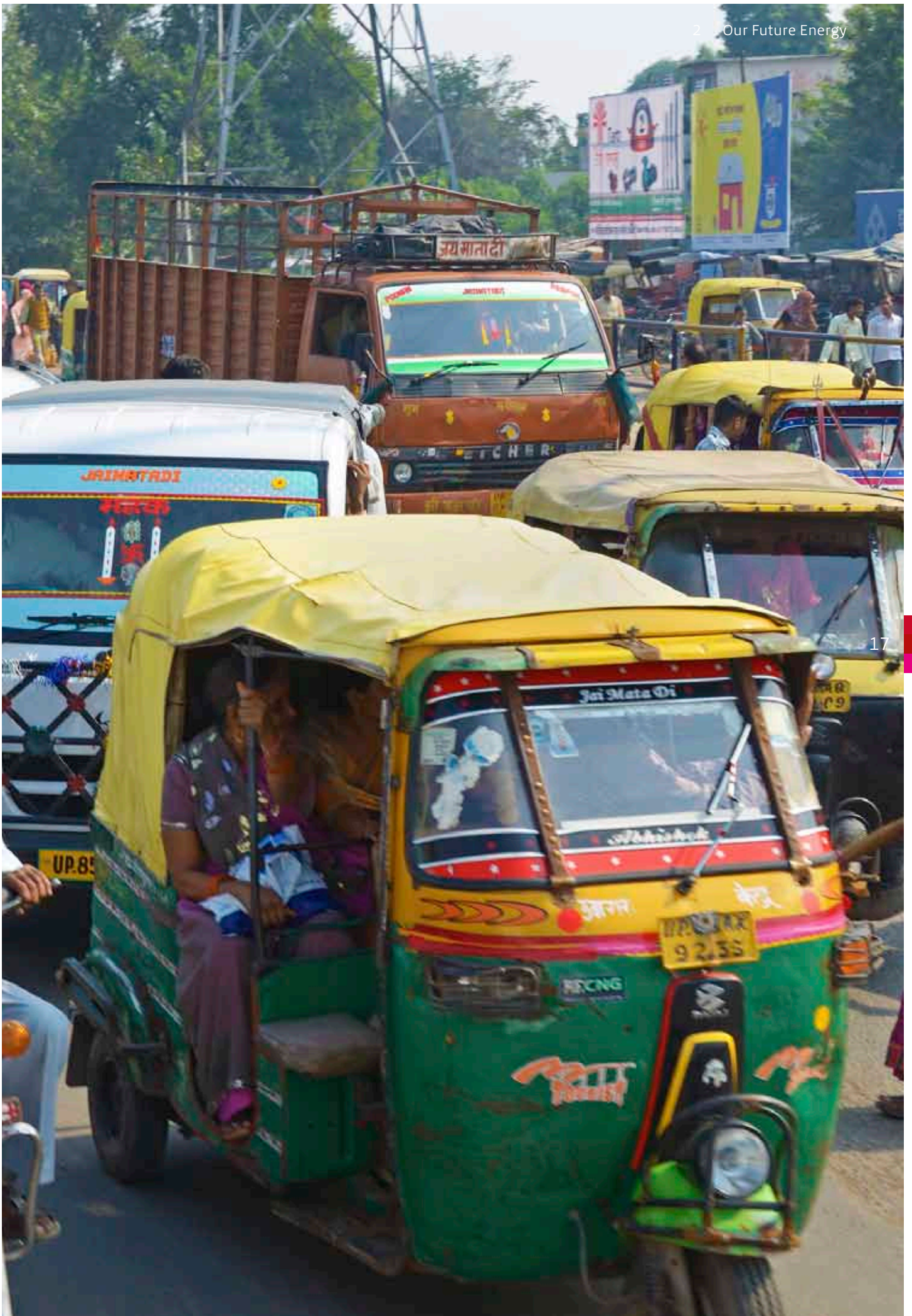
In particular, during the Danish EU Presidency in spring 2012, the government will work for the EU to draw up an aggressive agenda for green and sustainable growth. In light of the international financial crisis and the climate crisis, there is economic sense in EU Member States having a common, ambitious goal and strategic commitment to research and development in energy and climate. In particular the government will work to strengthen EU efforts for energy efficiency, so that the EU's goal of 20% more energy efficiency in 2020 can be realised.

Completing a green transition of the entire European energy system and developing the necessary infrastructure should be a common European vision. This will not only better prepare Europe for the future; it will also help each country to do this better and more cheaply. The government is working to have the EU increase its target for a reduction of greenhouse gas emissions in 2020 from 20% to 30%. This will also send an important signal to the international climate negotiations.

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Initiatives to support an international green conversion

- Efforts to increase the EU greenhouse-gas reduction target to 30% in 2020 compared with 1990 and a long-term energy strategy up to 2050, possibly with milestones
- Work for the EU to adopt an ambitious and long-term strategy towards conversion to a green energy sector in Europe, with targets for energy efficiency and use of renewable energy, including after 2020
- Push for adoption of minimum standards for energy and CO₂ taxes in connection with the revision of the EU Energy Tax Directive
- Continued efforts to have the EU adopt sustainability criteria for solid biomass
- Continued work in the UN to achieve a common global climate agreement as well as support the UN climate negotiations and bring Danish competences in the climate and energy area into play in a constructive manner, with concrete initiatives such as international and bilateral collaboration projects, tools, analyses etc.
- Push to address development, energy security and climate challenges cohesively through engagement in a number of initiatives which integrate sustainable energy supply and the climate agenda such as the UN Secretary General's Sustainable Energy for All initiative, the Rio+20 meeting in 2012 and the Clean Energy Ministerial





3

Milestones on the way to an energy system based on 100% renewable energy

The government has a number of energy-policy targets which are to act as milestones on the journey towards an energy and transport system based on 100% renewable energy in 2050.

Fossil fuels cannot just be replaced with renewable energy one-to-one. The government's policy is based on the fact that renewable energy is not free and that biomass resources are limited. Therefore, it is important that energy consump-

tion gradually lessens so that Denmark only invests in the energy it needs.

Towards 2020 the government's package of new energy-policy initiatives brings Denmark a long way towards meeting the long-term goal as well as towards the milestones set along the way. Furthermore, the government's new initiatives will provide a significant contribution to satisfying the climate-policy goals in the short and long terms.

Government's targets	Results of 'Our Future Energy' in 2020
100% renewable energy in 2050	A reduction of the total consumption of fossil fuels by 26% from 2010-2020 is a major leap towards the total phasing-out of fossil fuels and the conversion to 100% renewable energy
100% renewable energy in electricity and heat supply by 2035	On track towards the target in 2035 by cutting consumption of fossil fuels for electricity and heat supply by 50% from 2010 to 2020
Coal phased out in 2030	A large contribution to the target as coal consumption is reduced by 65% in 2020 in relation to today
Oil-fired boilers phased out by 2030	Halving the number of oil-fired boilers in 2020 in relation to 2010 and a good start towards the effort to be done from 2020 to 2030
Half of electricity consumption supplied by wind in 2020	The share of wind power in electricity consumption will be 52% in 2020
EU targets	
A 30% share of renewable energy in final energy consumption in 2020	The target is met with a share of 36% RE in final energy consumption in 2020
A 10% share of renewable energy in transport in 2020	The target is met with a share of more than 10% RE in transport in 2020
Target from the national Energy Agreement 2008	
4% less gross energy consumption in 2020 in relation to 2006	The target is met by a reduction of almost 14% in 2020 in relation to 2006

**Milestone:
Half of traditional electricity consumption
to be supplied by wind in 2020**

Wind is an unlimited resource. For Denmark it is the most plentiful renewable energy source because of the good wind resources and space for wind turbines offshore. Furthermore, Denmark has a good commercial basis in the wind turbine area and the Nordic electricity market contributes to enabling integration of large amounts of varying electricity from wind turbines. Therefore, there are clear indications that wind power will play an important role in the future Danish energy system. Even though offshore wind power is a relatively expensive technology today, it will become ever more attractive in the future, as technological developments reduce the costs, and prices of fossil fuels rise.

Ambitious expansion over the next 20 years will also ensure that sufficient electricity is produced to compensate for scrapping many of the existing power plants up to 2030 as well as increasing electricity consumption.

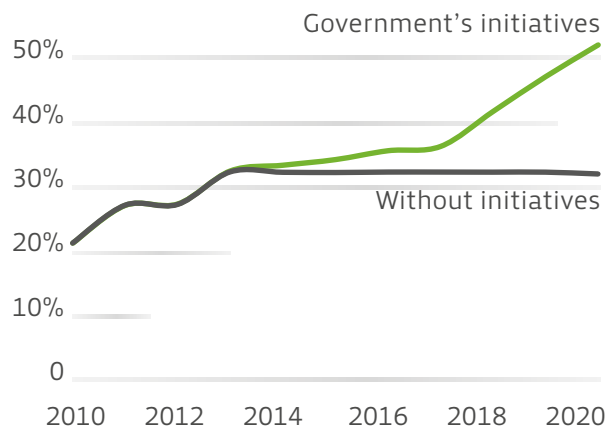


Figure 3.1 Share of wind in electricity consumption

In 2010 wind power covered 22% of Danish electricity consumption. The government's new initiatives will increase wind capacity by 2,100 MW of wind power, in addition to the expected expansion which will take place with the replacement of old wind turbines. The result will be that the proportion of wind will be 52% in 2020, thereby meeting the government's target, see figure 3.2.

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The government has set a goal that one-half of traditional electricity consumption is to be supplied by wind in 2020. Regular expansion of wind power must be secured so that the energy system can gradually be adapted to integrate increasing amounts of wind energy. Fifty percent of wind energy in the electricity system is a challenge for security of supply, but it can be managed, if at the same time Denmark moves towards a more intelligent energy system with flexible electricity consumption, strong connections abroad and an efficient international electricity market.

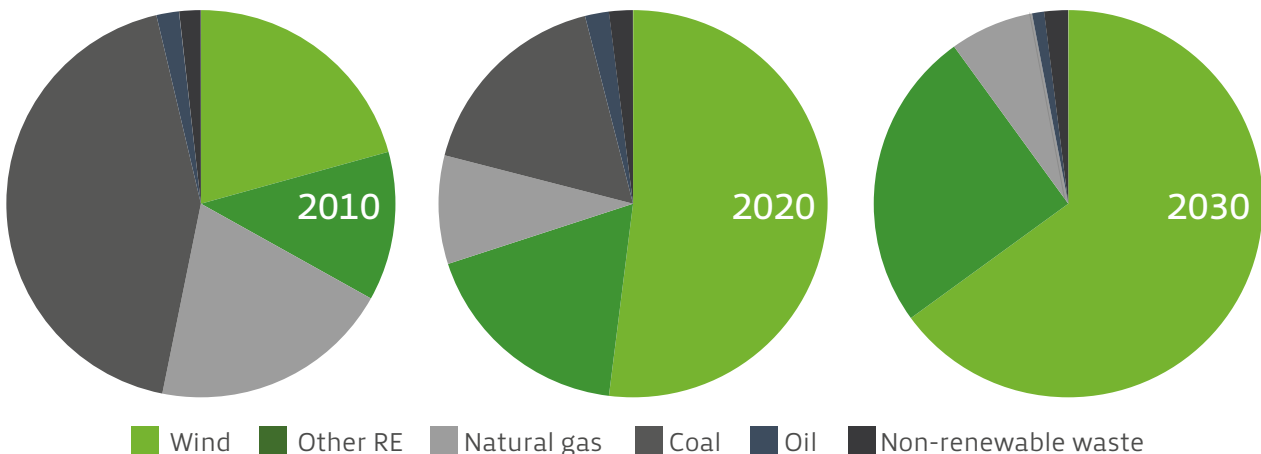


Figure 3.2 Electricity production by energy source (adjusted for electricity trading)

Milestone: Coal to be phased out of Danish power plants by no later than 2030

As part of the transition to an energy system covered by renewable energy, the government has set a goal to phase out the use of coal by as soon as 2030. Coal is a cheap alternative to oil and gas, but relatively it is also the most harmful fuel for the climate.

Today coal covers about 40% of Danish electricity production and almost 20% of district heating production. Therefore, there is a considerable challenge in phasing out coal in less than 20 years. Not least because electricity consumption over the same period is expected to rise. On the other hand it is possible to meet the goal without scrapping well functioning power plants. Most of the Danish power plants are expected to be obsolete in the period up to 2030.

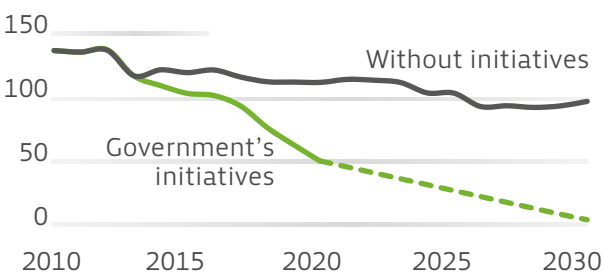


Figure 3.3 Coal consumption (PJ) for electricity and heat

With the government's new initiatives, coal consumption will be reduced by 65% up to 2020. This will cause significant changes in Danish electricity production, see figure 3.3. The most significant contributions to reducing coal consumption are the government's new initiatives to replace coal with biomass and initiatives to promote wind power.

Milestone: Oil-fired boilers to be phased out by no later than 2030

Phasing out oil-fired boilers is also a step on the way to 100% renewable energy. Using oil to heat houses is not efficient, environmentally friendly, or economical; neither in the short term nor in the long term. On the contrary, for a majority of house owners it will be financially attractive to scrap their oil-fired boilers and install district heating, heat pumps, or other renewable-energy solutions.

There are currently 250,000-300,000 oil-fired boilers in Denmark; many of them old and approaching their end-of-life. The government's new initiatives, including restricting installation of new oil-fired boilers, will ensure that oil-fired boilers are replaced with collective or individual renewable-energy-based alternatives. As a result of the government's efficiency initiatives, and initiatives to convert individual heating, it is expected that, compared to today, there will be approximately half the number of oil-fired boilers by as early as 2020. The long-term impact is even greater.

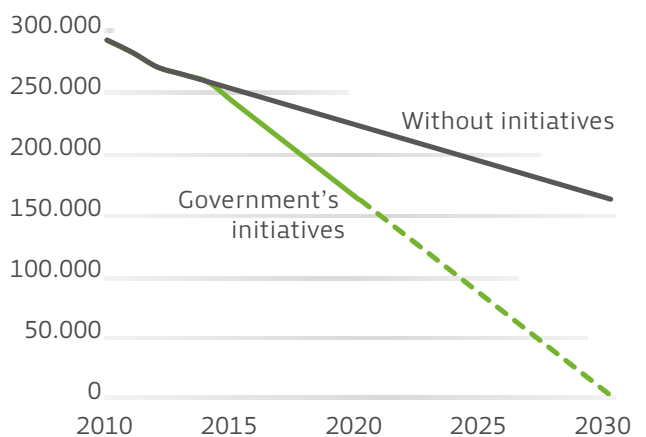


Figure 3.4 Number of oil-fired boilers

Milestone: Danish electricity and heat supply to be covered by renewable energy by 2035

Many analyses indicate that electricity and heat supply are likely to be the first areas to phase out fossil fuels due to the availability of cost-effective alternatives. Phasing out coal- and oil-fired boilers by 2030 is a large step in this direction. However, 100% renewable energy in electricity and heating by 2035 also requires conversion from natural gas to renewable energy; both at decentralised CHP plants and in houses (individual heating).

The government's package of initiatives is a major leap towards meeting the 2035 goal. This is very much because total energy consumption is reduced significantly. Up to 2020 gross energy consumption will be reduced by 8% compared with 2010 and by almost 14% compared to 2006, the base point for the goal in the 2008 Energy Agreement. To a large extent these are lasting effects because measures are aimed at buildings and businesses, where investments in more energy-efficient infrastructure have a long lifetime.

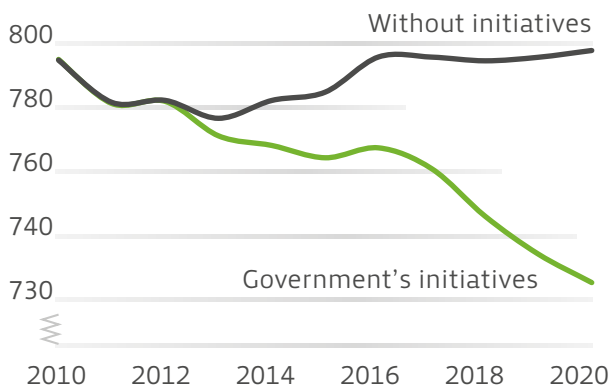


Figure 3.5 Gross energy consumption (PJ)

The government's initiatives for conversion to wind, biomass and biogas will also have a significant effect on electricity and heat supply, both in the long and short terms. Current annual consumption of fossil fuels, coal, oil and gas, is almost 300 PJ, while renewable energy accounts for around 150 PJ. The government's initiatives

mean that by as soon as 2020 this distribution will have been reversed. Use of fossil fuels for electricity and heat production will be more than halved from 2010 to 2020.

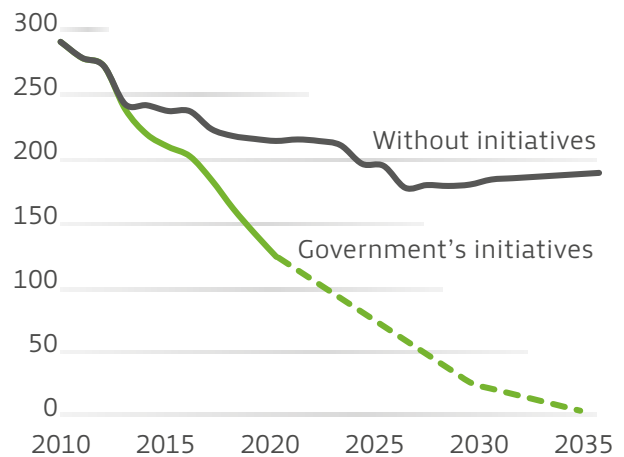


Figure 3.6 Consumption of fossil fuels for electricity and heat (PJ)

Full conversion to renewable energy by 2050

Full conversion of electricity and heat consumption to renewable energy by 2035 will take Denmark a crucial step closer to 100% renewable energy by 2050. The challenge in the period between 2035 and 2050 will be a radical conversion of the transport sector; primarily to electricity and biofuels, but possibly also hydrogen.

A fundamental requirement for an energy and transport system based on renewable energy is that overall energy consumption is reduced. This applies for both heat consumption and traditional electricity consumption, so that there is space for new types of electricity consumption in the system. Wind power can satisfy a large amount of traditional and new electricity consumption. This will be particularly relevant when consumption becomes more flexible with electrification of transport and large parts of the heat system. When wind conditions are calm in Denmark there is a need for electricity exchange with other countries and flexible electricity production produced from biomass and biogas; ideally

using waste heat for district heating. In other places geothermal energy, heat pumps and solar energy can play an important role.

As early as 2020, more than 36% of total energy consumption will be supplied from renewable energy. This will put Denmark on the right course towards 100% renewable energy by 2050.

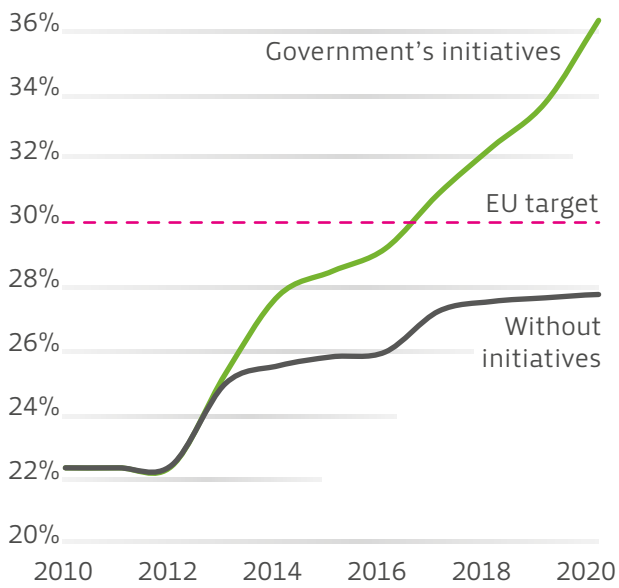


Figure 3.7: Share of renewable energy

The government's package of initiatives displaces coal, oil and gas as a result of efficiency improvements and from renewable energy expansion. Overall, consumption of fossil fuels will

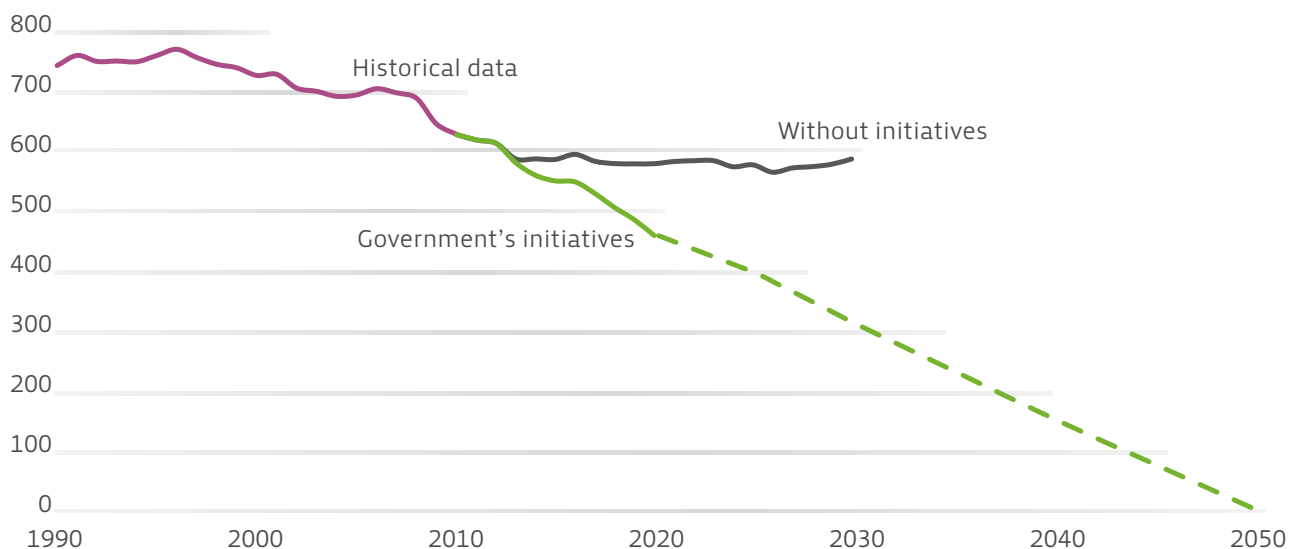


Figure 3.9 Consumption of oil, coal and natural gas (PJ)

be reduced by 26% from 2010 to 2020, see figure 3.9. However, considerable efforts will still be necessary in the period 2020-2050 to displace all fossil fuels; not least in the transport sector.

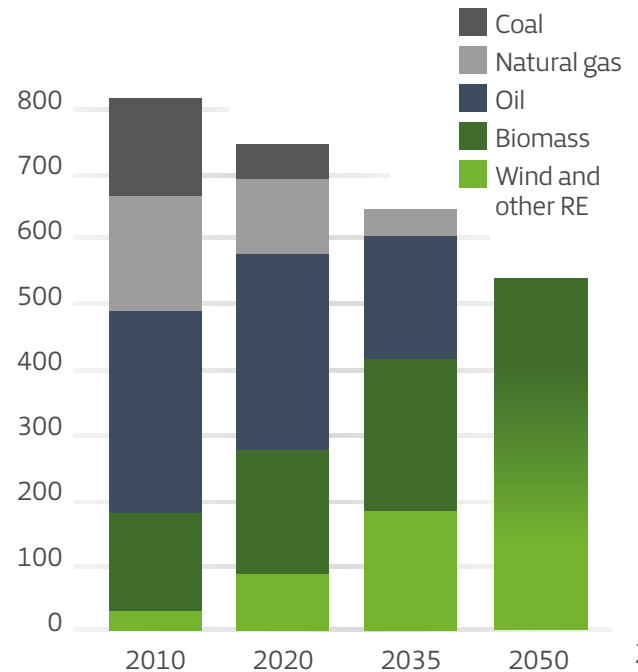


Figure 3.8 Consumption of fossil fuels and renewable energy (PJ)

The effect of the government's package of new initiatives will also mean that a significant change in the composition of total Danish energy consumption will take place as early as 2020, with wind and biomass taking the place of coal in particular, see figure 3.8.



4

Contribution to climate targets from the package of energy initiatives

Today, the energy sector, excluding transport, accounts for 56% of all Danish greenhouse gas emissions and therefore it is crucial for climate targets. Emissions arise from burning fossil fuels; coal, oil and gas. Any reduction in the use

of fossil fuels, either through energy efficiency measures or conversion to renewable energy, will therefore contribute to meeting Denmark's climate target.

25

Government's target	Results of 'Our Future Energy' in 2020
Cut greenhouse gas emissions by 40% by 2020 in relation to 1990	With government initiatives Denmark will achieve a reduction in greenhouse gas emissions by 35% by 2020 in relation to 1990. In order to reach the target of 40% the government will present a climate plan in 2012 with a strategy for extra initiatives.
Danish climate commitments	
Reduction targets for the years 2013-2020 increasing to a 20% reduction in the non-ETS emissions by 2020 in relation to 2005.	With government initiatives the emissions from the non-ETS sectors are reduced by almost 8 mio. tonnes CO ₂ -equivalents. In order to reach the total target for the period, further 1,5 mio. tonnes must be reduced.
Total Danish emissions in the period 2008-2012 is to be cut by 21% in relation to 1990 (Kyoto).	The target will be reached without further initiatives.
EU long-term objective	
A reduction of 80-95% of the total EU emissions by 2050 in relation to 1990, as part of an effort in all industrialized countries. This objective is not legally binding, and no effort sharing between member states has been agreed on.	With a greenhouse reduction of 35% by 2020 in relation to 1990 Denmark has laid the tracks for its contribution to the realization of the ambitious EU objective in 2050

Box 4.1 Climate-policy targets and results in 2020



Initiatives in this energy proposal will contribute significantly to reducing greenhouse gas emissions in Denmark and thereby to meeting the government's target to reduce total Danish emissions by 40% in 2020, compared with 1990.

The government's new energy-policy initiatives will result in Denmark achieving a reduction in greenhouse gas emissions of 35% in 2020 compared with 1990. Specifically this means that in 2020 Denmark will emit about 15 million tonnes

less than today. This corresponds to a reduction of more than all the current annual emissions from the transport sector. There is no doubt that this will be a dramatic effort, especially considering the fact that greenhouse gas emissions not only comprise CO₂ emissions from energy supply. However, there is still some way to attain the government's goal of 40% in 2020. Therefore, in 2021 the government will present a climate plan to account for how the 40% goal can be met by involving all sectors.

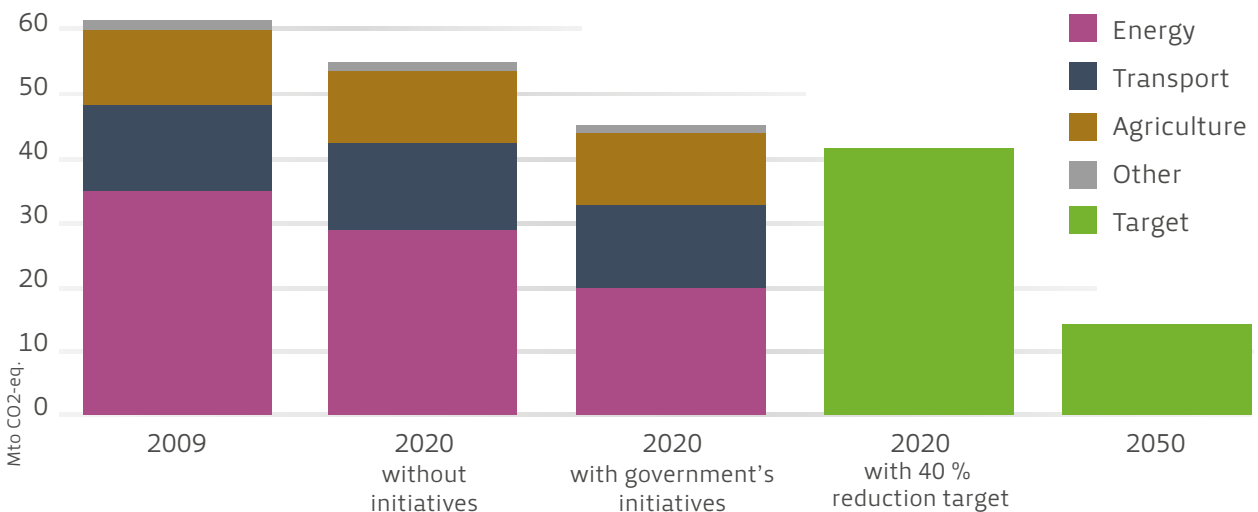


Figure 4.1 Total Danish greenhouse gas emissions

Danish reduction efforts to realise the government's goal of a 40% reduction in greenhouse gas emissions by 2020 will include both the ETS and non-ETS sectors. However, the EU has an overall reduction target for the ETS sector in the EU and an extraordinary Danish initiative will therefore, in the short term, reduce the immediate need for efforts in other EU countries.

An ambitious Danish effort in the ETS sector could also demonstrate that only limited costs are involved in securing quicker green conversion of the ETS sector. In particular, given the need to relieve dependency on fossil fuels and curb climate change. By taking the lead, and showing that ambitious conversion of the ETS sector is possible, initially Denmark will be able to pave the way for support for the Danish ambition for the EU to increase its reduction target in 2020 from 20% to 30% compared with 1990, and for more ambitious reduction targets after 2020.

In 2050 fossil fuels are to be phased out entirely from the energy and transport sectors in Denmark. The result will be that total Danish emissions in 2050 will be just under 80% less than in 1990.

This shows that intervention in the energy sector takes climate efforts a long way forward. However it is also important to reduce greenhouse gas emissions from other sectors, especially agriculture and transport.

The government will present a climate plan in 2012. This plan will ensure that Denmark meets the government's goal of a total greenhouse-gas reduction of 40% in 2020 compared with 1990, and that Denmark lives up to its EU commitment to reduce greenhouse gas emissions from the non-ETS sector by 20% by 2020 compared with the level in 2005. Furthermore, the climate plan will set a national goal for the non-ETS sector in 2020.

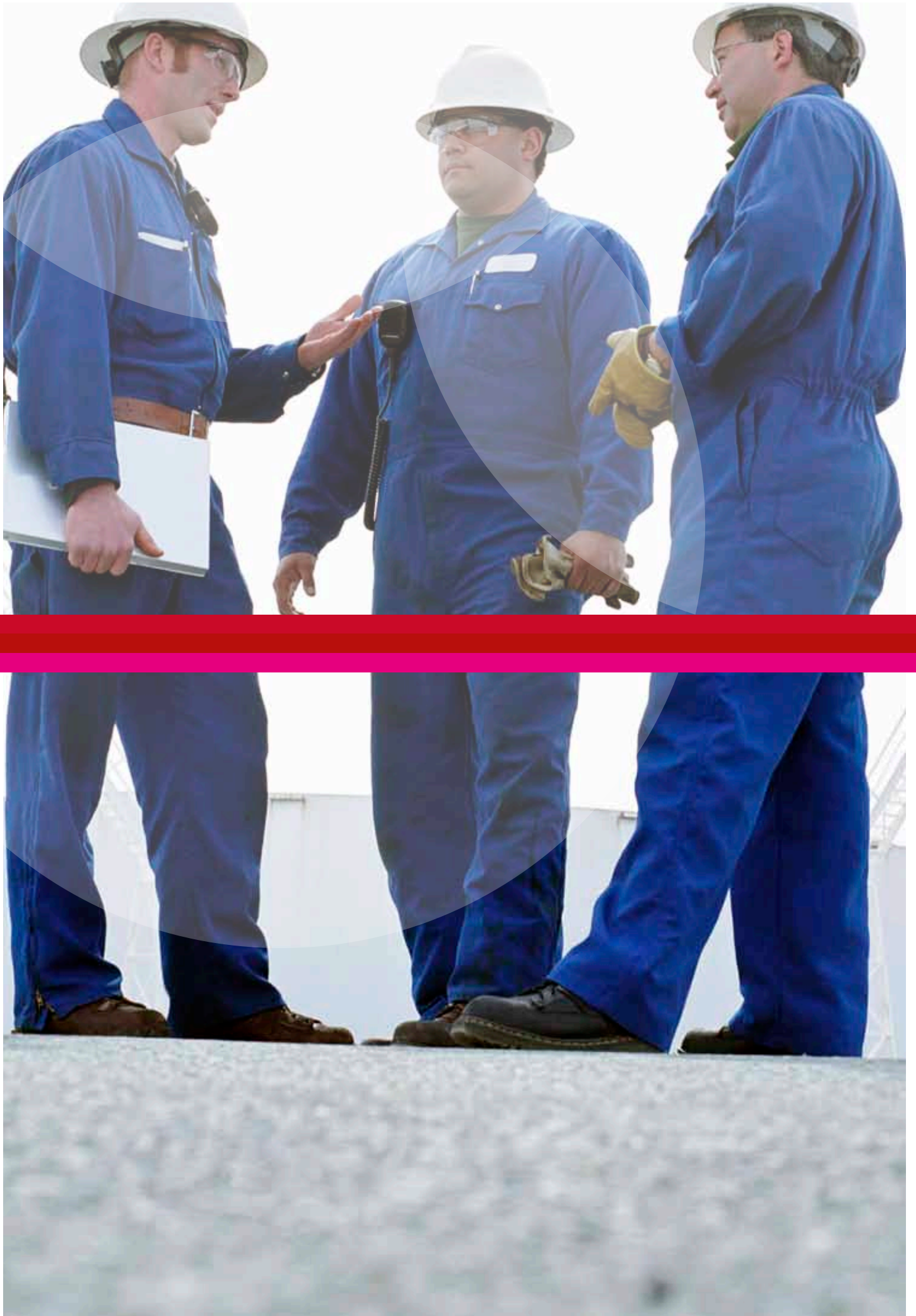
Through its climate plan, the government is also commencing long-term efforts to ensure that Denmark can contribute to meeting the EU goal to reduce total greenhouse gas emissions by 80%-95% in 2050 compared with 1990.

The climate plan will be followed up by a Climate Act, which amongst other things will secure ongoing monitoring of fulfilment of climate goals both in the short and long terms.

The non-ETS sectors are transport, agriculture, household, industry and waste.

As part of the EU climate and energy package (agreed in 2008) Denmark has committed to reduce the greenhouse gas emissions from the non-ETS sectors by 20% by 2020 in relation to 2005. Commitments for the period 2013-2020 are annual commitment targets. This means that the sub-targets are toughened up annually starting in 2013 until the final target is reached in 2020. In this way a

linear path with annual sub-targets is established. The Danish reduction target is a part of the effort sharing agreement decided by the EU member states in order to secure that the EU reduces by 20% by 2020 in relation to 1990. It is possible to exceed the national commitment targets in the first years in order to 'save up' for years to come.



5

Conversion to a green economy

Denmark is facing a historic conversion of the entire energy system. This will increase costs in the years to come and it will mean thinking out of the box more than ever before.

But it can be done and the sooner we start the better. As pointed out by the OECD, a green conversion has an economic cost in the short term, but this is necessary to avoid higher costs in the long term and irreversible damage to natural resources.

The Danish Commission on Climate Change Policy has assessed that Danish conversion is possible without significant additional costs in the long

term. The costs of full conversion to renewable energy will be about 0.5% of GDP in 2050, taking into account developments in renewable energy technologies and that prices of fossil energy sources in 2050 will be significantly higher than today.

Investment in conversion of the Danish energy system is also insurance against increasing energy prices. There is every indication that supply using fossil fuels will become more expensive in both the short and long terms as resources deplete and demand rises.

Overall conversion involves both costs and benefits.

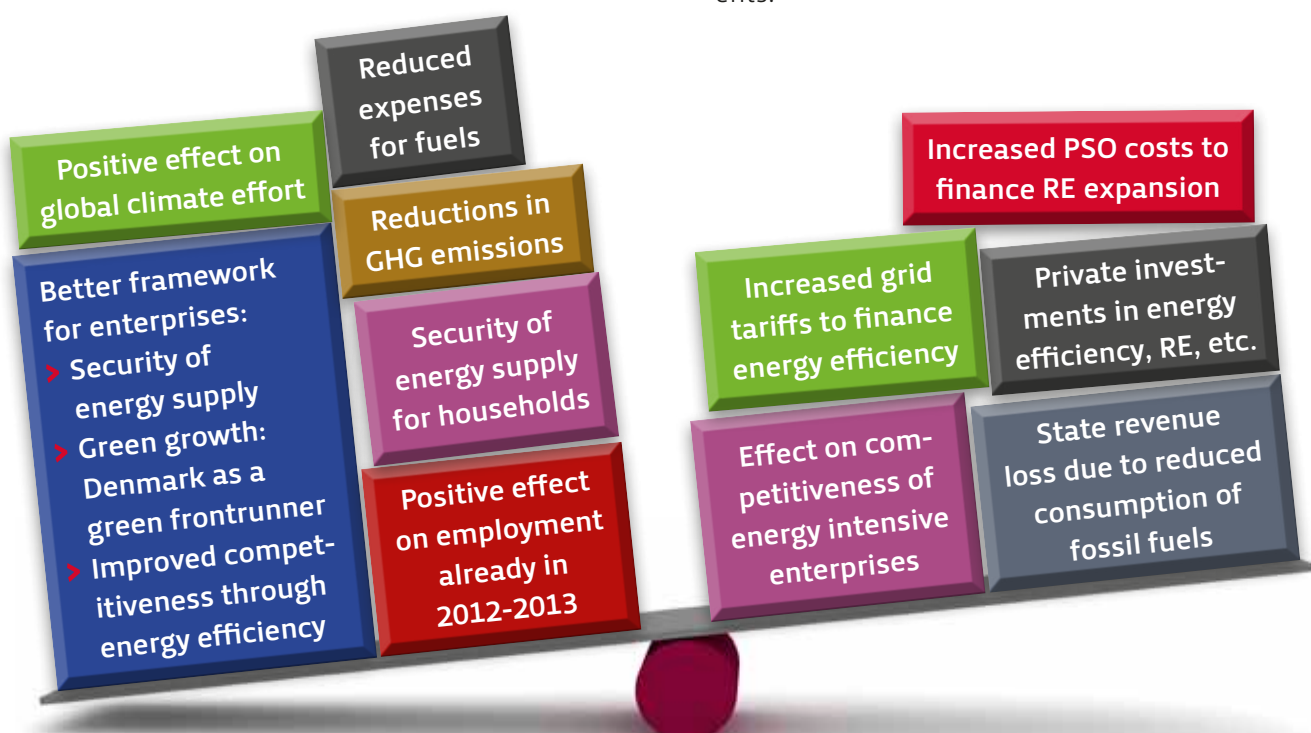


Figure 5.1 Benefits and costs of the new energy-policy initiatives

Increasing prices of fossil fuels

By demonstrating due diligence and presenting a plan for conversion, Denmark will avoid continued dependence on fossil fuels. This will be a great advantage. Much indicates that drastically increasing global demand for energy and diminishing fossil resources will put pressure on security of supply in the years to come.

This is particularly critical with regard to oil, where huge amounts will have to be invested globally in new production capacity if the growing demand is to be satisfied. Moreover, a great deal of oil extraction involves very difficult environmental challenges, for example in Arctic areas. In addition, most oil deposits are in a few, politically unstable, countries.

Together this will all mean increasing prices in the years to come. According to the International Energy Agency (IEA), oil prices can rise to up to USD 150 per barrel in 2016-2017; an increase of about USD 50 compared with current levels.

High energy prices on their own are detrimental for the economy and for the possibilities of enterprises to plan investment and contribute to growth. The consequences are immediately apparent for companies on their bottom lines. The increase in oil prices in spring 2011 by USD 20 gave Danish companies an additional fuel bill of DKK 20 bn.

New investment secures lower energy consumption

The energy initiatives require financing of DKK 5.6 bn. in 2020. These costs cover more energy efficiency, expansion of renewable energy supply, as well as the revenues the state will lose because of the reduced use of fossil fuels.

The energy initiatives also involve a significant change in the composition of energy bills for

enterprises and households. The reductions in energy consumption will not come without enterprises and households themselves making large investments in energy efficiency and new renewable-energy technology such as heat pumps etc., which is generally more expensive than the technology it replaces. These investments will lead to capital costs which in 2020 will be several billion kroner higher than without the government proposals. However, much of this investment will probably replace investment which would have taken place at all events.

On the other hand, this investment will mean lower current costs for fuel because of lower energy consumption. Lower energy consumption will make Denmark less vulnerable to increases in future energy prices. This will benefit both household finances and the competitiveness of enterprises. These energy initiatives mean that energy consumption will be drastically limited up to 2020. Savings in final energy consumption in 2020 are estimated to amount to DKK 6.9 bn.

More energy savings for businesses and households

With the technologies and solutions which are already well known, there are great possibilities to reduce energy consumption in buildings and enterprises and in so doing achieve significant savings. The Danish Building Research Institute has estimated that the potential for energy savings in the existing building stock is around 70-75% up to 2050. Much of this potential will be profitable if energy improvements are made when the building is to be renovated anyway, e.g. improving insulation when a roof is to be renewed.

Analyses from Danmarks Nationalbank and the International Energy Agency, amongst others, show that many Danish enterprises in general have low energy consumption compared with other countries, and that this difference in isolation could be a competitive advantage. In par-

ticular it would be an advantage in periods with increasing energy prices, if the costs of achieving lower energy consumption were not too high. There will be a special benefit if green solutions are chosen when material is to be replaced anyway.

A 2010 study shows that the savings potential for businesses is around 15%, with a payback period of about four years, and up to 32% if the payback period is 10 years.

Initiatives in this proposal from the government will greatly bolster these efforts with a total of DKK 1.4 bn. per year. This amount also includes subsidies for enterprises converting to renewables. The initiatives will help households and enterprises overcome the barriers they face today with regard to energy efficiency improvements.

More green export opportunities

The conversion will give Danish enterprises a green edge, or enhance the edge they already have in the growing global markets. For many years now, Danish green enterprises have been successful in the global markets, benefiting green growth in Denmark. In 2010, Denmark exported energy technology and equipment worth DKK 52.2 bn.

In the years to come it is expected that a combination of energy and climate-policy objectives, as well as security of supply considerations, will create a growing global market for low carbon and energy efficiency technologies and solutions of more than USD 1,500 bn. by 2020 (HSBC).

Examples of green growth areas

Wind power is one of the most competitive forms of renewable energy and strong growth in the wind turbine industry is expected towards 2020, both in markets close to Denmark and globally. The estimated value of the global market is expected to grow to more than DKK 800 bn. by 2015 and almost DKK 1,600 by 2020. Expansion of offshore wind energy will help strengthen this growth and exports, and it will create good opportunities for retaining, and possibly increasing the number of knowledge and production jobs in Denmark.

The sharp focus on energy efficiency in both households and enterprises, which has influenced Danish energy policy over the past four decades has been a fertile foundation for the development of a number of innovative solutions and technologies, which again have contributed to establishing a number of large Danish export companies.

Similarly, boosting energy-saving initiatives will create an incentive for enterprises to develop new solutions for the Danish market, which can also be sold on export markets as the expected growth in the global market for energy-efficient solutions takes a hold in the years to come.

A third example is biogas. A fixed framework for future biogas expansion will activate considerable investment throughout Denmark. Up to 30 projects are currently being prepared. Such efforts will generate growth and employment within these sectors in the short term, and bolster a more long-term expansion of the strongholds of Danish enterprises and research institutions.

As production of renewable energy is generally more labour intensive than conventional energy production, employment in the energy sector will grow significantly overall, as has also been indicated by the OECD.

Early employment effect

This package of initiatives will lead to significant investment in wind turbines, conversion of power plants to biomass, establishment of biogas plant and heat pumps, additional insulation of houses, new energy-efficient equipment in industry etc. This will create new jobs in the cleantech sector, among other things.

In the short term the energy initiatives on their own will generate investment of DKK 6.7 bn. between 2012 and 2013, corresponding to 900 new jobs in 2012 and 5,500 in 2013.

Positive impact on global climate efforts

Conversion will also enable prevention of climate change and in so doing prevent having to leave a large bill to pay for future generations. An increase in Danish efforts will not in itself prevent the global consequences of climate change and the pressure on resources, but by taking the lead, Denmark will show that it is possible to reduce greenhouse gas emissions without significant extra expenditure.

In line with other countries deciding to follow in Danish footsteps, the global effect of Danish efforts will gradually become more visible. The costs of the conversion will fall at the same time for the individual country, including Denmark.

Financing energy-policy initiatives

Even though converting to green energy supply has many benefits, it will not come by itself. Many cost-effective investments in energy renovation are not implemented, either because of lack of knowledge, lack of capital or due to other barriers. Costs of renewable energy are still higher than for conventional fossil technology.

Getting house owners, enterprises and energy companies to invest in energy efficiency and renewables demands extra support. This will remain the case for many years to come, until the technologies have been developed far enough, and prices of fossil fuels and CO₂ have risen high enough, for the green alternatives to be fully competitive.

Therefore, the government's initiatives involve an additional financing requirement. The total financing requirement for the government's energy initiatives amounts to DKK 0.2 bn. in 2012 and will rise to DKK 5.6 bn. in 2020. The initiatives will be fully financed throughout the period and will not impact the public purse.

Source of financing	Purpose	Amount in 2020
Security of supply tax	Support for biogas etc.	0,8
PSO	Expansion of RE	1,8
Grid tariffs	Energy efficiency	0,9
Extra financing through taxes etc.		3,5
Security of supply tax	Cover loss of state revenues	2,1
Extra financing through taxes etc. in total		5,6

Table 5.1 Financing the government's proposal (2011 prices, DKK bn)

The financing requirement will be met from the following three sources:

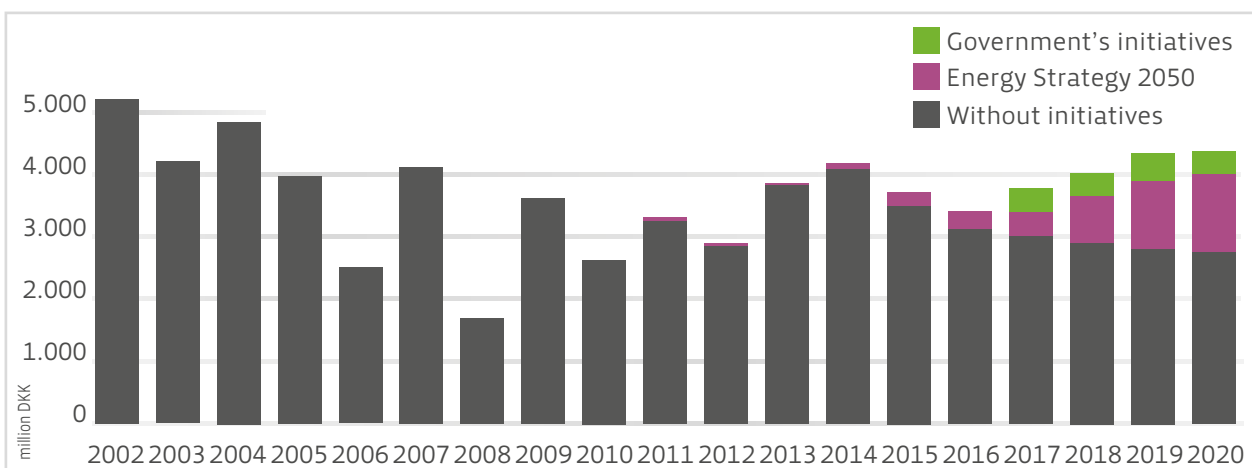
- **Security of supply tax:** As the consumption of fossil fuels drops, state revenues from taxes on coal, oil and gas will also drop correspondingly. Therefore, a security of supply tax is proposed. The security of supply tax is a tax on all fuels - fossil and biomass - for space heating. The security of supply tax will also finance some of the subsidies for renewable energy which cannot be financed via the PSO schemes.
- **PSO (Public Service Obligation):** Expansion of renewable energy in electricity production such as offshore and onshore wind turbines is financed through the PSO, which is a supplement to the price of electricity paid by all electricity consumers. In addition, there is a new gas PSO scheme, collected through gas bills, which finances subsidies for renewable energy for the gas grid.
- **Grid tariffs:** Energy saving initiatives by energy companies are financed via the companies' tariffs and therefore through energy bills sent to consumers.

Figure 5.2 Financing of the government's energy initiatives

The security of supply tax will increase gradually, and in 2020 it will cover lost tax revenues of DKK 2.1 bn. resulting from the lower consumption of fossil fuels arising from this package of energy initiatives. In addition to this are the subsidies for renewable energy of DKK 0.8 bn.; i.e. a total of DKK 2.9 bn. in 2020. The exact tax rates and phase-in will be finally determined in connection with specific implementation in future legislation. The additional financing requirement via grid tariffs will increase in line with increasing savings obligations for energy companies and in 2020 it will amount to an additional DKK 0.9

bn. The extra PSO costs will increase in line with expansion of renewables up to 2020, and the extra PSO costs are estimated at DKK 1.8 bn., see box 5.1.

In addition to financing the initiatives in the proposal, the sources of finance will also in themselves provide an incentive to reduce energy consumption and convert to green energy. For example, the security of supply tax will encourage home owners to insulate their houses or replace oil-fired boilers with heat pumps to achieve lower energy consumption.



PSO for an environmentally friendly electricity production is an extra charge to the price for electricity paid by all electricity consumers. The PSO costs vary concurrently with the market price of electricity and influence the need for support to RE. With the type of financing

chosen in the government's proposal, the costs of PSO are kept on an even level all the way to 2020 and will not exceed the level of the years 2002-2004 in which the PSO reached a historical peak.

Boks 5.1 Development in PSO-financing 2002-2020 (2011 prices)

Economic consequences for enterprises and households

The transition to fossil fuel independence will be financed by those who use the energy. Therefore, the financing requirement will primarily be covered by households and enterprises. It is important that the phase-in of the package of energy initiatives is appropriate and predictable, so both enterprises and households have good opportunity to adapt to the transition. Therefore, costs

will increase gradually up to 2020, as outlined in figure 5.2.

The increased costs should be considered in relation to the financial benefits for households and enterprises from, for example, exploiting subsidies for energy savings or receiving district heating from CHP plants which convert to biomass.

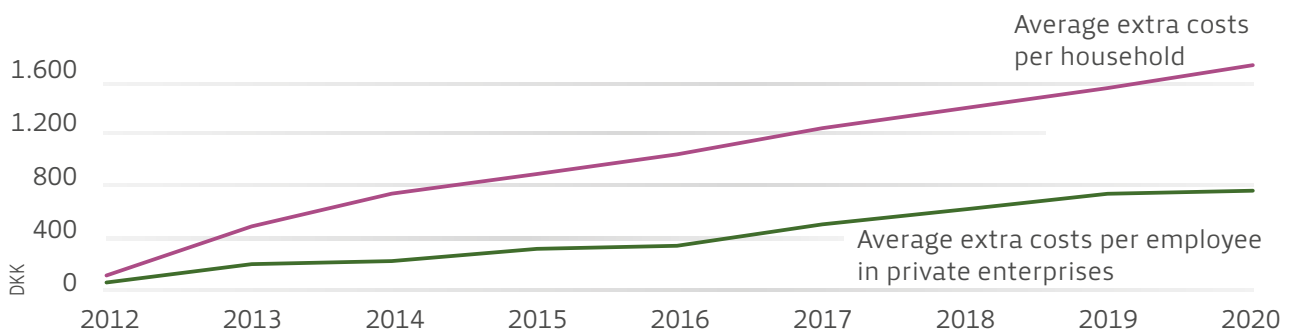


Figure 5.2 The phase-in of the costs of financing the government's energy initiatives towards 2020 (2011 prices)

Households

Financing the initiatives (PSO costs, grid tariffs and increased taxes on heating) will lead to relatively few additional costs for Danish households of on average DKK 1,700 per household in 2020. Furthermore, the additional costs will come gradually up to 2020 and this will give households plenty of opportunity to adapt, for example by reducing their energy consumption.

The enhanced energy-saving initiatives which follow as a consequence of the initiatives are likely to mean that the average household will reduce energy consumption by 8%-10% in 2020. For example, energy savings can be achieved through improved roof/loft, floor and wall insulation, and by installing more energy-efficient windows or more efficient appliances.

36 Up to one-half of all Danes currently live in houses or flats with district heating from large-scale CHP plants. These plants will now reap financial benefits by using biomass which is subject to lower taxes than fossil fuels. This in itself can only benefit consumers through lower district heating prices.

In the following are examples of calculations showing what energy bills could look like in 2020 for various types of household. In addition to taking into account higher costs as a result of

financing the government initiatives, the examples also include other costs for households with regard to buying energy and lowering energy consumption as a result of energy-saving initiatives etc. The examples also include investment costs to realise energy savings.

There are two types of household with district heating from a large-scale CHP plant and from an individual oil-fired boiler, respectively. The examples show that energy bills can be reduced considerably, and in some cases they can even be less than would otherwise have been the case without the government initiatives, if households implement energy-saving initiatives etc.

Table 5.2 shows the energy bills in 2020 for two example families with district heating. One family lives in a detached house of 130 m² and, in addition to district heating consumption, it has an annual electricity consumption for lighting and appliances of 4,000 kWh. The other family lives in a 75 m² flat and, in addition to district heating consumption, it has an annual electricity consumption of 2,500 kWh. Both dwellings have average insulation.

The total annual additional cost for the detached house in 2020 is DKK 2,300. If the effect of reduced energy consumption arising from energy-saving initiatives is included, this falls to an annual additional cost of DKK 1,700. If the CHP



plant also increases its consumption of biomass and reduces coal consumption, the annual additional cost will fall to DKK 900-1,700, depending on the conversion carried out by the CHP plant.

The additional costs for the flat are not as high as for the detached house. Initially, annual additional costs in 2020 amount to DKK 1,400. With energy savings and increased use of biomass at the CHP plant, annual additional costs fall to DKK 600-1,100.

Energy bill (electricity and heating), DKK per annum		2011	2020			
Heating with district heating from a central CHP plant			Without initiatives ¹⁾	With initiatives ¹⁾	With initiatives and savings ²⁾	Shift to biomass on CHP plant
Detached house of 130 m ²	Heating ³⁾	12.200	12.800	14.800	14.200	13.400 - 14.200
	Electricity ³⁾	8.300	8.900	9.200	9.200	9.200
	Total	20.500	21.700	24.000	23.400	22.600 - 23.400
Apartment of 75 m ²	Heating	7.200	7.500	8.700	8.400	7.900 - 8.400
	Electricity	5.200	5.600	5.800	5.800	5.800
	Total	12.400	13.100	14.500	14.200	13.700 - 14.200

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1) An unchanged energy consumption is assumed in relation to consumption in 2011

2) In both examples the costs related to energy savings is subtracted from the total savings. In the examples it has been added that the family saves 9% on energy consumption for heating.

3) The level of energy prices for each household can vary, and the numbers are characterized by uncertainty. Furthermore, there is uncertainty concerning the level of the capital costs needed, and it should be noted that e.g. district heating prices vary and are practically dependent on the local circumstances of the district heating area in which the household is placed.

Table 5.2 Economic consequences for two families with central CHP heating (2011 prices)



A corresponding ordinary detached house with a wood-fired boiler, natural gas supply, small-scale natural-gas combined heat and power, or oil-fired boiler will have slightly higher additional annual costs of about DKK 2,300-2,700 in 2020. Including the effect of reduced energy consumption, the additional annual costs will fall to DKK 1,000-2,500.

In many cases, consumers with individual heating will be able to reduce their energy bills by installing a heat pump when the existing installation wears out. This applies not least for consumers with oil-fired boilers as, all else being equal, oil-fired boilers are often the most expensive method of heating. Table 5.3 shows the energy bill in 2020 for two example families with oil-fired boilers. One family lives in a detached house of 130 m² and, in addition to oil consumption, it has an annual electricity consumption for lighting and appliances of 4,000 kWh. The other family lives in a detached house of 180 m² and in addition to oil consumption it also has an-

nual electricity consumption of 4,000 kWh. Both dwellings have average insulation.

The annual additional costs in 2020 for the 130 m² detached house will be DKK 2,300. If the effect of reduced energy consumption arising from energy-saving initiatives is included, this falls to an annual additional cost of DKK 1,000. Installing a heat pump when the oil-fired boiler has worn out, will give the family an overall saving instead of additional costs. This includes the additional costs of investing in a heat pump. The example shows that the family will be able to save about DKK 6,700 annually compared with the costs in 2020 without the package of initiatives and with the oil-fired boiler.

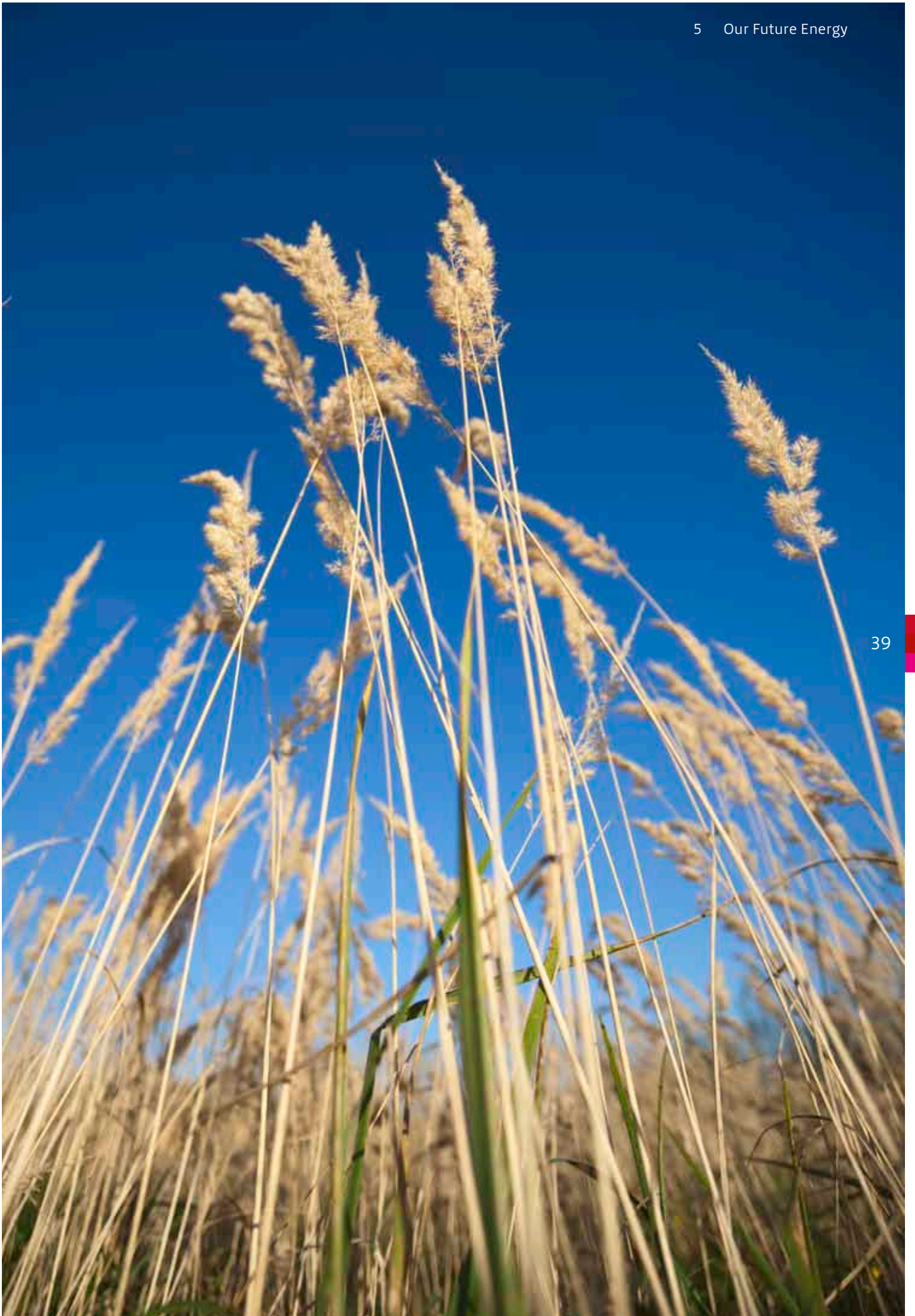
Initially, the family in the 180 m² detached house will have higher additional costs because of the package of initiatives; an annual total of DKK 3,100. However, there will also be a greater benefit from installing a heat pump, i.e. DKK 9,400 a year, including the cost of investing in a heat pump.

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Energy bill (electricity and heating), DKK per annum		2011		2020		
			Without initiatives ¹⁾	With initiatives ¹⁾	With initiatives and savings ²⁾	With initiatives and heat pump
Detached house of 130 m ²	Heating	19.600	21.600	23.600	22.300	14.600
	Electricity	8.300	8.900	9.200	9.200	9.200
	Total	27.900	30.500	32.800	31.500	23.800
Detached house of 180 m ²	Heating	27.100	29.900	32.700	30.900	20.200
	Electricity	8.300	8.900	9.200	9.200	9.200
	Total	35.400	38.800	41.900	40.100	29.400

1) An unchanged energy consumption is assumed in relation to consumption in 2011
2) It is added that the family saves 9% on energy consumption for heating.

Table 5.3 Energy bill in 2020 for two families with oil-fired boilers (2011 prices)



Enterprises

By far the majority of the business community will experience relatively limited additional costs as a result of financing the package of energy initiatives. Considered in isolation, financing the government's new initiatives will incur additional costs for private businesses totalling DKK 1.5 bn. in 2020. This corresponds to an average of about DKK 800 per employee in 2020.

However, this does not take account the fact that a number of enterprises will benefit from energy-saving initiatives that will be implemented by energy companies, or from the new green business scheme under which subsidies will be available for using renewable energy for process purposes.

Table 5.4 shows what financing will mean specifically for a medium-sized office enterprise and a large energy-intensive manufacturing enterprise in 2020.

For general business, as exemplified here by a medium-sized office enterprise, there will be a slight annual increase of about DKK 240 per employee in 2020. An increase of this size is not likely to affect greatly the competitiveness of enterprises, partly because phase-in will be gradual up to 2020, when the impact will be greatest.

The increasing costs could, however impact competitiveness in 2020 for sectors in which energy consumption is greatest and which are very vulnerable to competition. Given that there is a wide spread in the energy consumption of individual enterprises, some enterprises in these sectors will be impacted somewhat less than the sector average, however. This group of manufacturing enterprises makes up to a very small part of the Danish private business community. In table 5.4 these are exemplified by a large industrial enterprise.

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Fully implemented in 2020	Total energy expenditure without proposal	Total energy expenditure with proposal	Change in relation to a situation without the proposal
Medium-sized VAT-registered office enterprise (aprox. 250 employees)	DKK 0.65 mill.	DKK 0.71 mill.	+9.1 pct.
Large industrial enterprise in energy-intensive sector (aprox. 400 employees)	DKK 100 mill.	DKK 103 mill.	+3 pct.

Table 5.4 Examples of the increased costs in enterprises as a consequence in 2020 of government's initiatives (2011 prices)



In order to take into account the competitiveness of production enterprises as much as possible, the government proposes relaxing energy taxes on process energy by about DKK 0.6 bn. This will release the business community as a whole from increases in energy taxes.

However, the business community will have to contribute to expanding renewable energy and energy efficiency through the PSO and grid tariffs. Danish enterprises with a very high electricity consumption will not be affected by the higher PSO costs in the same way as the rest of industry, as they will receive a special discount. A number of large enterprises which produce their own electricity for consumption will also be able to avoid the higher PSO costs.

A large amount of the funds energy companies spend on meeting their energy-savings obligations, and which are financed through tariffs,

will also be returned to enterprises as direct or indirect subsidies to realise energy savings. Enterprises will be able to receive even more energy advice than they do today as well as subsidies to buy energy-efficient production equipment.

Enterprises receiving assistance from energy companies in connection with realisation of energy savings will usually receive more back than they have paid. On the other hand, enterprises which have not received assistance from energy companies will suffer additional costs. As the energy savings generally have a short payback period (usually less than 3-4 years) initiatives will also improve enterprises' competitiveness.

The government proposals also mean that enterprises can obtain subsidies to convert to renewable energy. The scheme will be aimed at enterprises using energy in processes, including energy-intensive enterprises.







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