

Country Reports

IEA Bioenergy: 09 2018

This report was prepared from the 2018 OECD/IEA World Energy Balances, combined with data and information provided by the IEA Bioenergy Executive Committee and Task members. Reference is also made to Eurostat. All individual country reports were reviewed by the national delegates to the IEA Bioenergy Executive Committee, who have approved the content. General background on the approach and definitions can be found in the central introductory report¹ for all country reports.

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NATIONAL POLICY FRAMEWORK IN DENMARK

Denmark's national binding target for renewable energy as stated in the EU Renewable Energy Directive (2009/28/EC) is 30% of gross final energy consumption in 2020. The targeted shares of the three sectors heating/ cooling, electricity and transport are shown in the table below.

Table 1: Denmark's 2020 renewable energy targets.

Sector	Share in gross final consumption per sector
Overall target	30%
Heating and cooling	40%
Electricity	52%
Transport	10%

Source: National Renewable Energy Action Plan of Denmark (2010)²

The main vehicle to foster renewable energy is the Promotion of the Renewable Energy Act of 2009. The act provides detailed feed-in tariffs/ premium for wind, biomass, biogas and other renewable energy source electricity production. In terms of biofuel, the blending quota accounts for 5.75 % in diesel as well as gasoline. The Danish energy sector has implemented its own set of sustainability criteria for biomass that go beyond the binding rules according to the Renewable Energy Directive, which only applies for liquid biofuels. The principles in the Danish rules are close to the UK legislation on a sustainable biomass supply.

¹ Available at <https://www.ieabioenergy.com/iea-publications/country-reports/2018-country-reports/>

² <https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans>

By 2050, Denmark wants to become independent from fossil fuels. To this end, the Danish government adopted the “Energy Strategy 2050” in 2012. In the heating sector a solid district heating network, fed by renewable heat from biomass, will be the main motor of the energy transition. Complementary, oil boilers are going to be banned in all new constructions by 2017. In the electricity sector, the Danish government greatly focuses on wind energy, expected to provide for 40% of total electricity needs and solid biomass and biogas. Transport will be based on electricity and biofuels.

A detailed description of all fiscal and non-fiscal supports for bioenergy development is available at: <http://www.iea.org/policiesandmeasures/renewableenergy/?country=Denmark>

TOTAL PRIMARY ENERGY SUPPLY (TPES) AND THE CONTRIBUTION OF BIOENERGY

The total primary energy supply of Denmark in 2016 amounted to 692 petajoule (PJ) with fossil fuels (oil, gas, coal) contributing around two thirds. Oil products account for more than one third (246 PJ). Natural gas accounts for 17% (121 PJ), coal products for 12% (79 PJ) and non-renewable waste 2.6% (18 PJ). Renewable energy sources have a share of 30% or 210 PJ – 22.9% bioenergy and 7.4% other renewable energy sources. 18 PJ of electricity is imported, which represents 2.6% of Danish TPES.

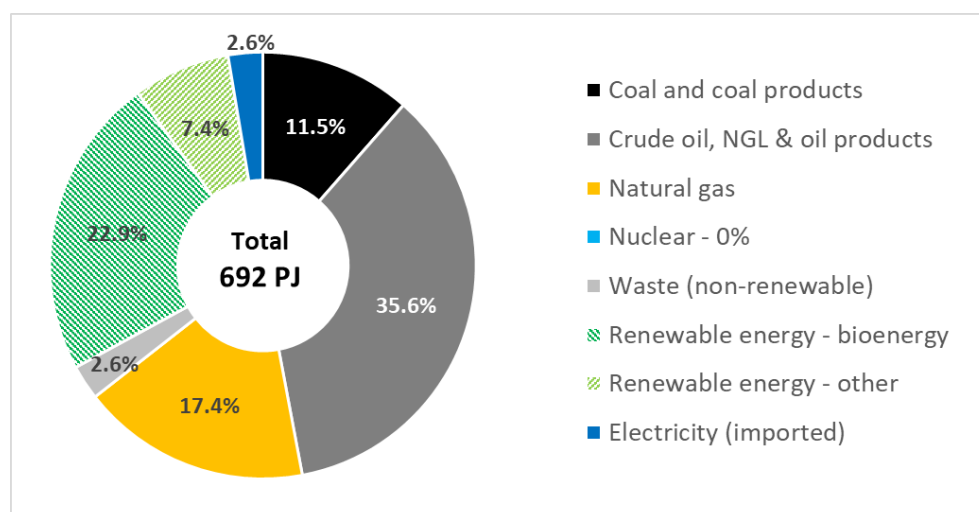


Figure 1: Total primary energy supply in Denmark in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Compared to 5 years earlier (2011) the share of coal has dramatically gone down from 18.0% to 11.5%, and the share of natural gas dropped from 20.7% to 17.4%. In the same period the share of renewable energy increased from 22.2% to 30.3%, with substantial increases both in bioenergy and other renewable energies. The share of oil products and waste remained relatively stable. Electricity imports increased from 0.6% to 2.6% of Danish TPES.

The total primary energy supply of renewable energy sources in 2016 is mostly covered by bioenergy, with over 75% (159 PJ). Wind energy amounts for 22% (46 PJ), and solar around 2% (5 PJ).

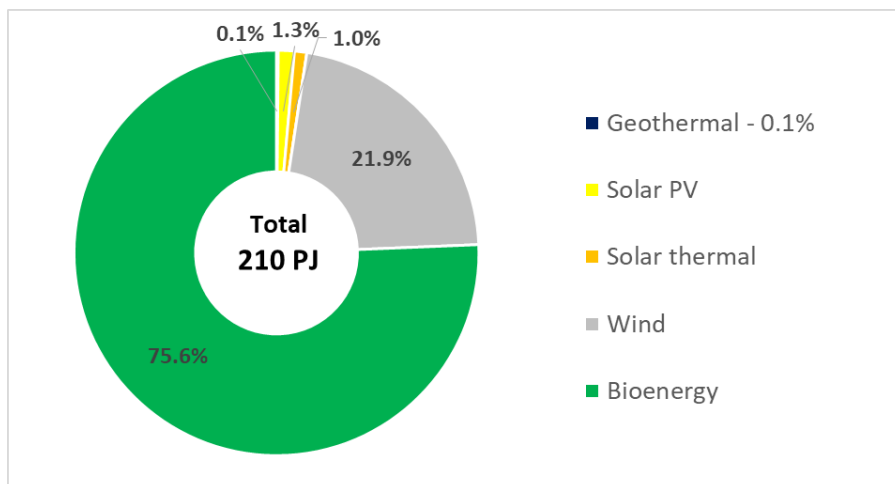


Figure 2: Total primary energy supply of Renewable Energy Sources in Denmark in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Most of the bioenergy consumed in Denmark comes from solid biomass; their share accounts for three quarters of the total use of bioenergy or 117 PJ. Around one third of that (42 PJ) is used directly in the residential sector. Mind the important role of straw in Denmark. The second largest item is renewable municipal waste (22 PJ) followed by biodiesel (10 PJ) and biogas (9 PJ). Biogasoline consumption is not significant.

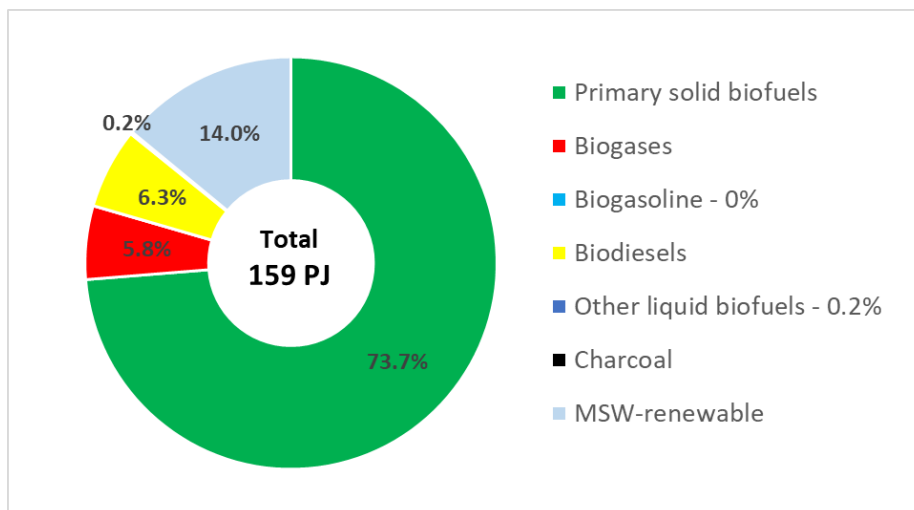


Figure 3: Total primary energy supply from bioenergy in Denmark in 2016 (Source: World Energy Balances © OECD/IEA 2018)

Bioenergy consumption levels in Denmark doubled between 2000 and 2010, while consumption levels remained rather stable between 2010 and 2014. With overall energy consumption going down in Denmark, this still meant that the bioenergy share in TPES was growing from 16.5% to 20.5%. In the past few years absolute consumption levels of bioenergy are increasing again – particularly for solid biomass - with bioenergy reaching a share of 22.9% in 2016.

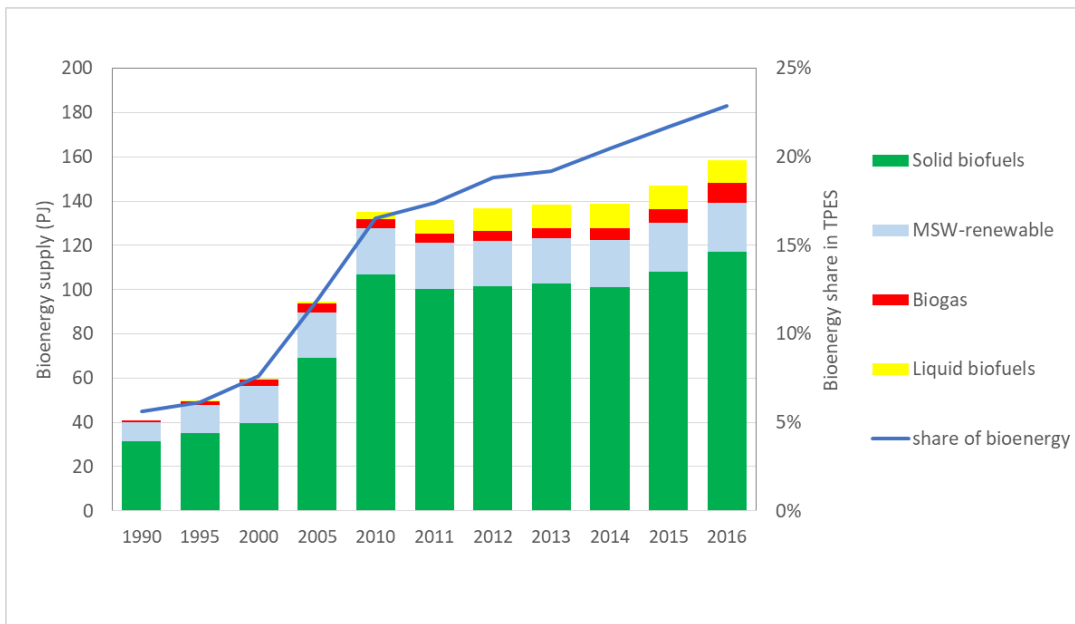


Figure 4: Development of total primary energy supply from bioenergy in Denmark 1990 – 2016 (Source: World Energy Balances © OECD/IEA 2018)

Table 2 expresses the 2016 TPES figures per capita, considering Denmark’s population of 5.73 million people. Compared to the other 22 member countries of IEA Bioenergy (expressed per capita), Denmark ranks highest for renewable MSW, in the top 5 for solid biofuels and biogas, and in the top 10 for liquid biofuels.

Table 2: Total primary energy supply per capita in 2016

	GJ/capita
Total energy	120.8
Bioenergy	27.7
Solid biofuels	20.4
Renewable MSW	3.9
Biogas	1.6
Liquid biofuels	1.8

Source: World Energy Balances © OECD/IEA 2018

Role of bioenergy in different sectors

Despite a low potential of hydropower, Denmark has a high share of renewable electricity - over two thirds of that through wind energy - with a quarter through electricity from biomass. The projections for 2017 indicate that even a 70% renewable share in electricity will be reached, partly related to increases of biobased electricity (through CHP).

The share of biofuels for transport amounts to 5.7% which is above European average.

Overall, the share of biomass used directly for heating in the different sectors is around 20%. Mind that heat output generated and sold by CHP plants and heat plants represents around 40% of fuel/heat provided, of which around half is produced from biomass in 2016. This biobased share has consistently increased in the past decade.

Table 3: Role of bioenergy and renewable energy in electricity production, transport energy consumption and fuel/heat consumption in 2016

Sector	Share of bioenergy	Share of renewable energy	Overall production/ consumption
Electricity production	16.1%	60% (0.1% hydro) (42% wind)	30.5 TWh (110 PJ)
Transport energy (final consumption)	5.7%	6.2%	174 PJ
Overall fuel and heat consumption³	Direct biomass: 19.1% Biobased heat: 19.0%	39.7%	275 PJ

Source: World Energy Balances © OECD/IEA 2018

According to Eurostat⁴, the following renewable energy shares in gross final energy consumption were reached in Denmark in 2016:

- Overall share: 32.2%
- In heating and cooling: 41.7%
- In electricity: 53.7%
- In transport: 6.8%

The overall target for 2020, as well as the separate targets for electricity and heating/cooling (see Table 1) have already been reached in Denmark. Only some extra efforts will be needed to reach the renewable energy target for transport. Mind that some of these figures can differ from the IEA derived data because of different accounting rules.

³ This includes final consumption of fuels and heat in industry, the residential sector, commercial and public services and agriculture/forestry. Transport fuels are excluded. Energy used for transformation and for own use of energy producing industries is also excluded.

⁴ http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_335a&lang=en

RESEARCH FOCUS RELATED TO BIOENERGY

Danish research activities within bioenergy cover a large range of topics, i.e. pre-treatment of lignocellulosic biomasses for biogas production, integration of bioenergy in the energy systems, optimal utilisation of solid biofuels, safety in handling and storage, and production of biofuels.

An overview of all finalised and ongoing projects within research, development and demonstrations can be found at <https://energiforskning.dk>. This is a website for all Danish research, development and demonstration funding programmes within energy and climate.

RECENT MAJOR BIOENERGY DEVELOPMENTS

The production of bioenergy provides an important contribution in the transition of becoming independent of fossil fuels. The majority of the coal used in the Danish centralised power plants is replaced by biomass. In 2030, it is expected that coal will no longer be used for power production. The production of biogas is increasing significantly. A large share of the Danish biogas production is being upgraded and injected into the natural gas grid.

The development within solid biomass is driven by a tax exemption for fuels used for space heating purposes while taxes apply to fossil alternatives. The development within biogas production is mainly motivated by subsidies. The current scheme for subsidies expires in year 2020. In 2018, new schemes for subsidising bioenergy production will be adopted.

The conversion from fossil fuels to renewable energy in large units is as described mainly driven by solid biomass:

- In 2016 the retrofitted boiler station on Studstrupværket was inaugurated. It now has the possibility of operating at full load on wood pellets only or a mix of wood pellets and straw with a capacity of 515 MJ/s heat and 360 MW electrical production. In 2017 it was expected to reach a reduction of the consumption coal from 1.1 million tons to 140,000 tons or 90%.
- In 2017 two new wood chip fired furnaces were inaugurated in Skærbæk replacing natural gas and oil fuels. The boiler has a heating capacity of 320 MJ/s and electrical production of 90 MW.
- In 2019 a new wood chip fuelled boiler plant with a capacity of 25 MW electric and totally 129 MJ/s heat for district heating and high temperature process heat replaces Denmark's largest coal based power plant.
- Also in 2019 a new unit in the Copenhagen area (Amagerværket Unit 4) will start the production of heat and electricity operating on wood chips. With expected 150 MW electrical production and 400 MJ/s heat it is expected to become the World's largest wood chip fired CHP plant. With the new unit only renewable sources will be used at Amagerværket.

Biogas is rapidly increasing in Denmark and the total production is expected to more than triple from 2012 to 2020. The Danish Energy Agency is responsible for the rules and regulations regarding the different support schemes. The Danish Energy Agency is administrating the payment of subsidies mainly as feed-in tariffs.⁵ The Danish biogas plants are spread over the country. The majority comes from manure-based plants. See biogas map:

https://ens.dk/sites/ens.dk/files/Statistik/biogas_map2016_uk.pdf.

⁵

https://ens.dk/sites/ens.dk/files/Bioenergi/the_danish_subsidy_scheme_for_the_use_of_biogas_and_current_subsidy_levels.pdf

LINKS TO SOURCES OF INFORMATION

The following websites provide useful information and data on national Danish bioenergy policy, production and consumption.

- Energy – for a green Denmark: https://efkm.dk/media/11857/energiudspillet_eng.pdf
- The Danish Energy Agency – Energy Statistics: <https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps>
- Statistics Denmark: <https://www.dst.dk/en>

Funding organizations at national level related to environment or energy

- Danish Energy Agency - Energy Technology Development and Demonstration Program (<https://ens.dk/en/our-responsibilities/research-development/eudp>)
- Ministry of Environment and Food - The Danish Eco-Innovation Program (<https://eng.ecoinnovation.dk/the-danish-eco-innovation-program/>)
- Innovationsfonden – a range of different programs (<https://innovationsfonden.dk/en/programmes>)



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