

# Denmark a leading player in combined heat and power

More than 100 years of experience and technology development.

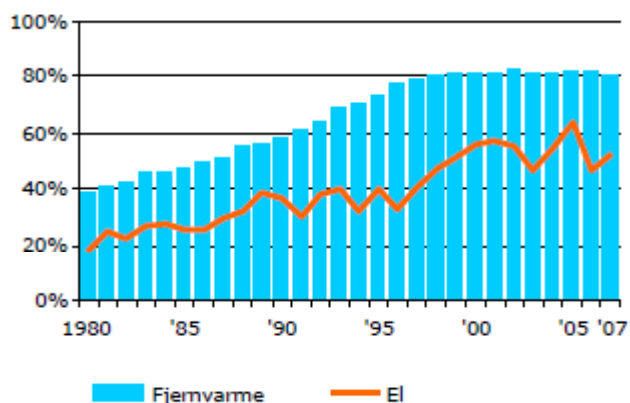
The widespread use of combined heat and power in Denmark is one of the most important reasons that we have been able to reduce our carbon emissions over several decades while our fuel consumption has remained almost unchanged. Combined heat and power not only saves fuel, it also makes it possible to use cleaner fuel, all of which is a benefit to the environment.

Today, Denmark is an important player on the market for exports of equipment for combined heat and power and district heating.

## Cogeneration of electricity and heat

Cogeneration of electricity and heat (combined heat and power or CHP) is one of the most energy-efficient and environmentally friendly ways in which to produce electricity and heat. CHP production utilises fuels much more efficiently, because the excess heat from generation of electricity is used in district heating systems for space heating of buildings instead of merely releasing it into the sea.

Figure 1: CHP share of thermal power and heat production for district heating



In 2007, more than 80% of Danish district heating was cogenerated with electricity, thus saving around 30% of fuel compared with separate generation of heat and power.

## The spread of combined heat and power systems, from 1904 to today

The first combined heat and power plant in Denmark was built in 1904 and supplied a large hospital with electricity and heat. During the 1920s and 1930s, a collective district heating system was developed based on waste heat from local electricity production. District heating also supplied some urban areas with heat and accounted for around 4% of total Danish heat supply. Later on district heating from combined heat and power expanded in larger cities, and in the 1970s around 30% of homes were heated from district heating systems.

After two oil crises in the 1970s, it was decided to expand the fuel-efficient combined heat and power system to medium and small-size cities, and the newly found natural gas in the North Sea was used extensively in decentralised CHP plants throughout most of Denmark.

## A total of 670 CHP plants today

The past hundred years of development has meant that today Denmark has a total of around 670 centralised and decentralised CHP plants. There are various forms of ownership of plants. The largest plants are owned by large energy companies, while the smaller plants typically are owned by production companies, municipalities or cooperative societies.



Ten per cent of all power in Denmark is generated from biomass and organic waste in CHP plants.

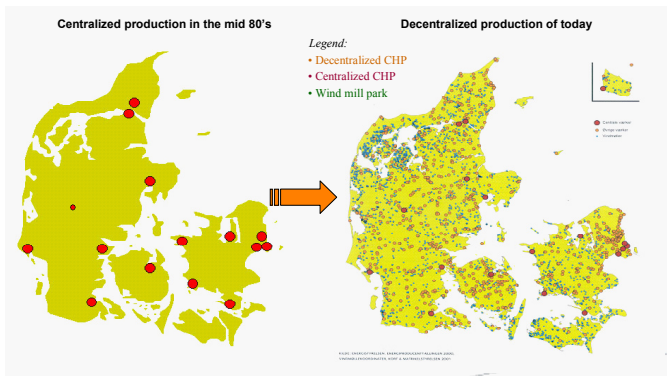


### Centralised and decentralised CHP plants

Centralised and decentralised CHP plants differ because centralised plants initially produced electricity and were located in large Danish cities, whereas decentralised power plants were originally heat plants located in medium-size and smaller cities.

Since the 1980s Danish energy production has been subject to decentralisation, which means the production of electricity and heat takes place throughout the country. The Danish Energy Agency has laid down the general conditions for establishing and operating district heating systems. These are to ensure fair prices on heating for consumers and society and the economy in general.

Figur 2: 20 years Development of Decentralized CHP's and Wind Mills

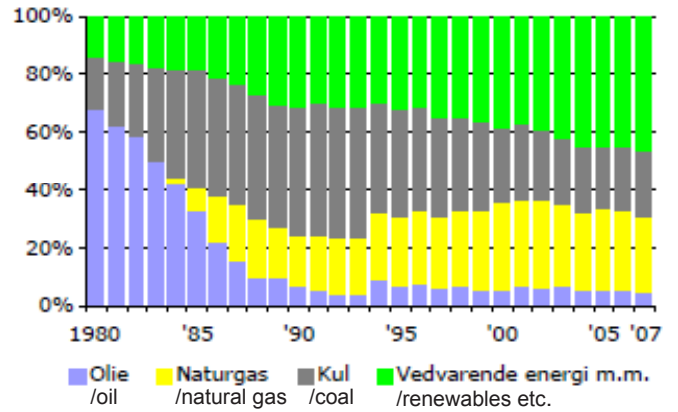


### Six out of ten consumers receive district heating

More than half of all electricity produced in Denmark is produced at CHP plants. Today, around 1.5 million houses and buildings in Denmark are heated from district heating, which means that six out of ten consumers receive heat from a district heating system or a CHP plant. This corresponds to one of the highest shares of district heating in the world.

More than half of all electricity produced in Denmark is produced from biomass and organic waste. In this way one out of four Danish homes are heated from energy-saving district heating based on carbon neutral fuels, which is the most environmentally friendly way of heating.

Figure 3: Fuel consumption for district heating production, percentage distribution



### Financial benefits for consumers

Before a district heating plant or a CHP plant can be built, it must be documented that the socio-economic impact is good and consumer prices are low. By far the majority of consumers of district heating pay less for their heating than the cost of owning their own oil or natural gas boiler.

According to Danish legislation, district heating is to be sold at a price corresponding to the cost of producing and distributing, i.e. according to a 'non-profit principle'. This means that heat consumers benefit from the low costs.