HEAT GENERATION IN DENMARK

The Danish district heating system supplies almost three-quarters of the population with heating. There are around 360 district heating companies in Denmark, which either generate the heat themselves or buy it from other production companies. The heat is generated in many different ways, using a wide variety of fuels. Most of the production takes place in CHP plants that generate both electricity and heat. They do so by harvesting energy from a number of different fuels such as waste, gas, coal and biomass.

Some district heating companies use only natural gas in their production facilities, while others combine several different technologies distributed between multiple plants.

The technologies currently available also include CO₂-free sources of heat such as solar and geothermal heat. In addition, many places also exploit surplus heat from industrial facilities to supply district heating, and other plants likewise use heat pumps and electricity cartridges to utilise the electricity generated by wind turbines.

In practice, the district heating system actually functions like a giant battery with the capacity to assimilate and store production from other energy technologies. Denmark enjoys a high level of supply reliability, which means that customers need not worry whether there is heat in their radiators and hot water in their taps. The reason for this is that all plants operate reserve load boilers, typically gas- or oil-fired. These boilers are brought online if the CHP plant fails to deliver, but they are also useful during the winter months when more heat production is required.

OWNERSHIP

310 district heating companies in Denmark are cooperative societies owned by the users, 50 are municipally owned and only few are in private hand.
FUELS:

Many different types of fuel are used to generate heat. The most common fuels include natural gas, waste and biomass. Coal is still used in a number of plants, but its use is being phased out in favour of more eco-friendly fuels and technologies. Oil is only used to a limited extent, firing a few boilers as reserve capacity for when Denmark is in the grip of a particularly harsh winter. Denmark has been utilising heat from waste incineration for more than 100 years. Biogas is another green fuel that is becoming increasingly prevalent in district heating production in Denmark. The Danish district heating system is 72% green today.
THE DISTRICT HEATING NETWORK

District heating in Denmark comprises numerous independent district heating grids that are not interconnected. This means that unlike electricity, it is not possible to send hot water from Skagen in the north of the country to Tønder in the south, or from Amager in the east to Esbjerg in the west. This would demand huge pipes to transport the volume of water required, as well as extremely high pressure to drive the water across such large distances – and the loss of heat in the network would be disproportionately high. However, there are large, widespread district heating grids in the biggest cities: Copenhagen, Aarhus, Odense and Aalborg – and in South Jutland.

A SMALL DISTRICT HEATING AREA
Has a small district heating network supplying a village of down to 100 dwellings. The primary heat source is typically biomass, but some villages and smaller towns also exploit solar heat and natural gas as reserve capacity sources.

A DECENTRALIZED DISTRICT HEATING AREA
Consists of a larger district heating network usually connecting a medium large town with smaller, neighbouring towns. Several different types of fuels and heat sources are used here.

A CENTRALIZED DISTRICT HEATING AREA
Consists of one large district heating network connecting several large CHP plants, refuse incineration plants and heat generation facilities. This type of system also allows for generation of district cooling.
AARHUS AS AN EXAMPLE

To provide an example of a major district heating system, let us take a look at Aarhus – one of the biggest cities in Denmark with a total of 350,000 customers.

Kredsløb operates a giant waste incineration plant and one of the biggest straw-fired CHP plants in Denmark. The facility uses 670 tonnes of straw per day, which translates into 240,000 tonnes of straw every year.

In addition, the company receives heat from the CHP plant in Studstrup, which has been converted from coal to wood pellets. An 80 MW electric boiler has also been installed as an extension to the Studstrup plant. This is equivalent to adding 55,000 electric kettles to the kitchen, lined up next to each other. The electricity is brought online when electricity prices are at their lowest, thus providing a supplement to the other production facilities.

In the future geothermal energy will provide 20% of the district heating in Aarhus.