

# Heating from the subsoil to heat 5,000 dwellings

Today geothermal plants can supply one per cent of Copenhagen homes with district heating.

In 2005 the geothermal plant at Margretheholm on Amager, Copenhagen, was taken into operation. The plant pumps water up from a depth of 2.6km in the subsoil and supplies one per cent of the Copenhagen area with district heating.

## Seismic data got it all started

In 2000 HGS (Hovedstadsområdets Geotermiske Samarbejde – the Copenhagen geothermal cooperation) began collecting seismic data on the layers in the Danish subsoil. The results from this data collection led to the decision to place a geothermal plant at Margretheholm close to Amagerværket in the Copenhagen area.

The geothermal plant exploits a sandstone hot water reservoir. The reservoir is 2.6km deep and at this depth the water is 73°C.



## Geothermal energy

Geothermal energy is heat from inside the Earth. In Denmark this renewable energy can be exploited by pumping geothermal hot water up from a depth of 1.5-3km and subsequently pumping it into the district heating grid. Whether it is possible to exploit geothermal energy depends on geological structures and the temperature of the water in the subsoil etc.

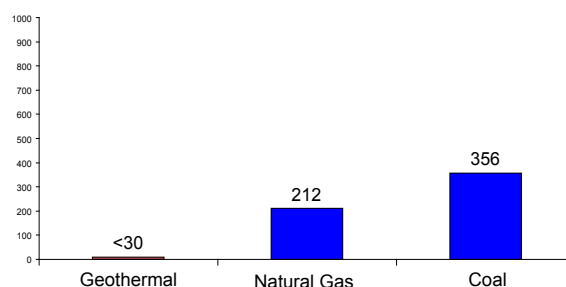
## Hot water creates district heating

At Margretheholm heat is produced by extracting hot water from one well, cooling it in a surface plant and pumping it back into the subsoil via another well. Heat is extracted from geothermal hot water using heat exchangers and heat pumps in the surface plant. In this way the highly saline geothermal water is not mixed with the water in the district heating grid.

## Environmental and economic advantages

The heating pumps in the geothermal plant run on surplus heat from Amagerværket. It is both cheaper and better for the environment to run heating pumps on heating instead of electricity.

Kg CO<sub>2</sub> / MWh      Heat production



**Figure 1:** Comparison of CO<sub>2</sub> emissions from pure heat production (not combined heat and power) based on geothermal heating, natural gas and coal. [Source: DONG Energy from International Geothermal Association 2001]

In total the plant can supply up to 27MW heating. Of this 14MW is from the subsoil and 13MW is from driving heat.



The annual heat production from the subsoil is approximately 300TJ corresponding to the heat consumption of 4,600 dwellings or 1 per cent of the district heating need in the supply area.

The plant can be expanded to a plant with geothermal wells arranged in a star pattern with a total of 5 production wells and 6 injections wells and a total heat production of approximately 1,500TJ annually.

### Reduction in emissions

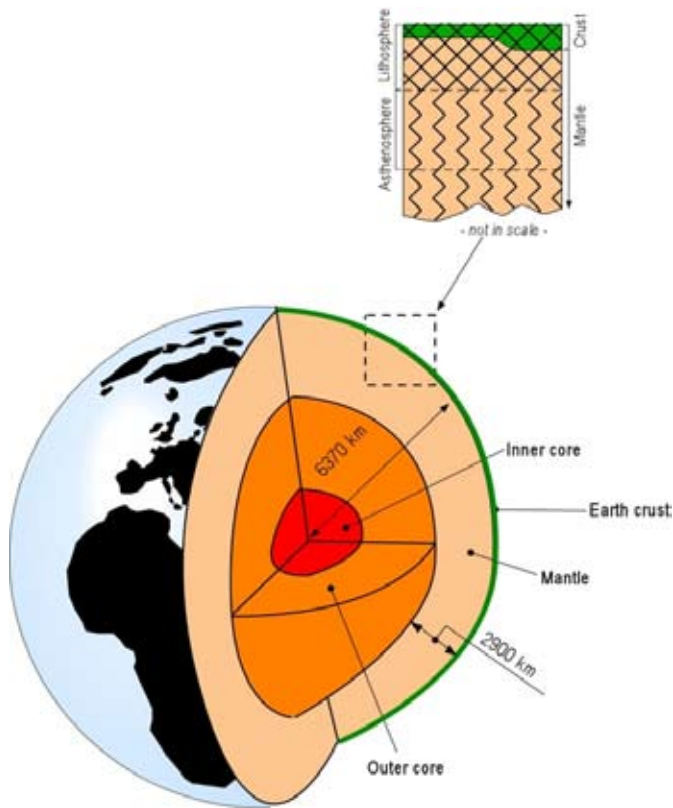
A geothermal plant gives off no direct emissions to the environment – no CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, particles, heavy metals etc. Emissions can be greatly reduced by replacing district heating based on coal and natural gas with geothermal heating. However, pumps driven by electricity are required in order for the water to circulate in the system, and this leads to minor greenhouse gas emissions.

### Heating requirements can be satisfied for several thousand years

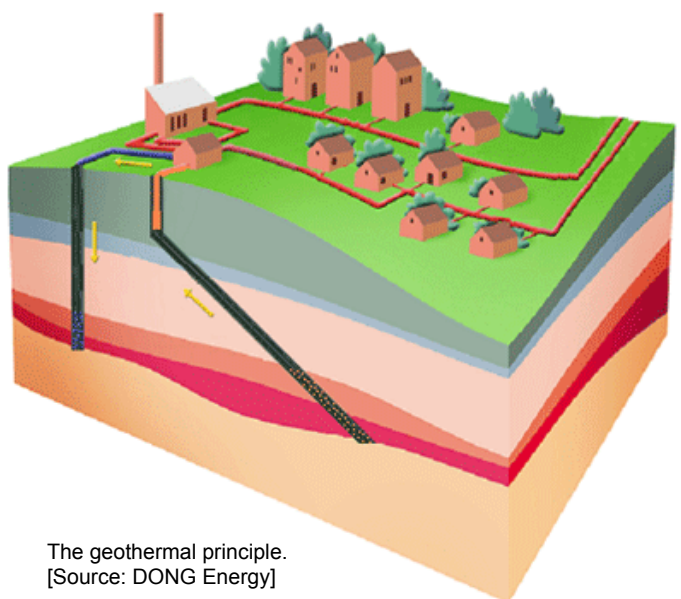
An investigation carried out by HGS has shown that there is enough geothermal energy to satisfy the district heating need of 30-50 per cent of dwellings in Copenhagen for several thousand years. Preliminary investigations suggest that there good possibilities for extracting geothermal energy in large parts of Denmark.

### Plants in Denmark

The first geothermal plant was established in Thisted (Jutland) in 1984, and in 2005 Margretheholm at Amagerværket (Copenhagen) was taken into use. A third plant is planned to be taken into operation in Sønderborg (south Jutland) in 2011.



**Figure 2:** Geothermal energy from the inside of the Earth. Energy is not derived from the sun as seen in other renewable energy sources. The Earth's core is up to 5,000°C hot and stores large amounts of energy – several 100 million times the known amount of energy found in fossil fuel reserves. [Source: DONG Energy]



The geothermal principle.  
[Source: DONG Energy]