

Geothermal Energy Use 2015 Country Update for Denmark



Birte Røgen^{1*}, Claus Ditlefsen², Thomas Vangkilde-Pedersen², Lars Henrik Nielsen² and Allan Mahler¹

INTRODUCTION

The geothermal resources in Denmark are available at relatively low temperatures suitable for heat production while electricity production is not possible with the present technologies. Both shallow and deep geothermal resources are used in Denmark.

DEEP GEOTHERMAL ENERGY

Denmark has three geothermal plants with deep wells producing heat for district heating from saline geothermal water.



The drilling of the geothermal demonstration plant in Copenhagen.

Other projects are at different levels of maturation. The first geothermal plant has been producing for 30 years now, and are producing heat from 15 % saline water. Likewise the two newer geothermal plants have saline geothermal water. All the plants have one injection well producing heat from the sandstone reservoirs through heat exchangers

and/or LiBr based absorption heat pumps, where the driving heat primarily comes from biomass boilers for heat and / or combined heat and power production.

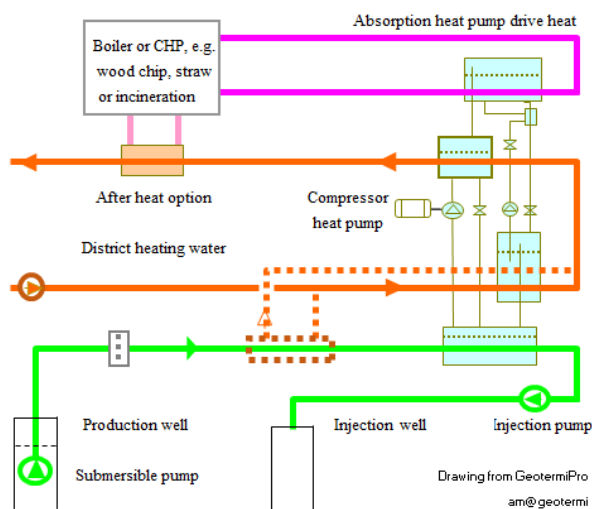
R&D in deep geothermal energy

The Danish Government has a political target of 100% renewable energy in the energy system in 2050. As part of many initiatives working towards this goal, also research and development in geothermal energy has increased.

The Danish Council for Strategic Research supports two ongoing research projects within geothermal energy: "The geothermal energy potential in Denmark – reservoir properties, temperature distribution and models for utilisation" and "Heat Storage in Hot Aquifers".

Preliminary plans exist to erect a geothermal plant in Copenhagen with 11 wells of which some of the production wells may be prepared for long term heat storage. Such a plant is expected to be designed to extract around 64 MW from 1000 m³/h geothermal water.

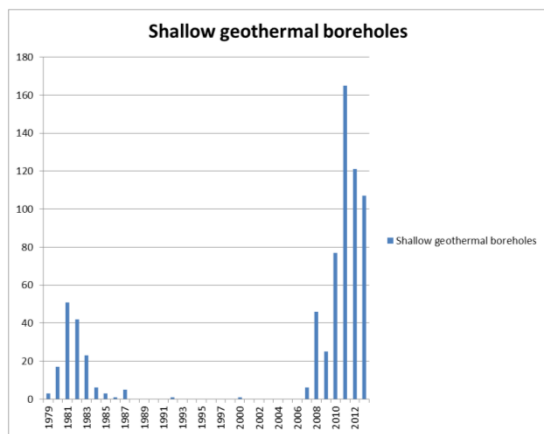
Location	Established	Reservoir	Reservoir	Geothermal
	year	Depth		
		km	°C	MW
Thisted	1984	1,25	43	7
Copenhagen	2005	2,6	74	14
Sønderborg	2013	1,2	48	12
Development option: 11 wells		2,6	74	64



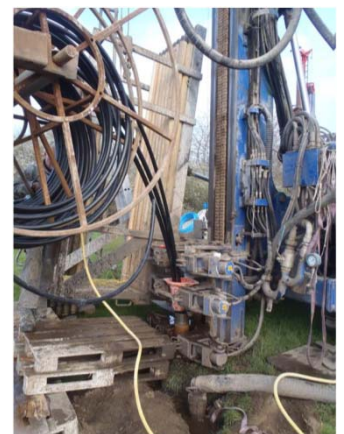
SHALLOW GEOTHERMAL ENERGY

Despite a large potential, the application of shallow geothermal energy in Denmark is relatively limited compared to e.g. Sweden or Germany. Today, the total number of ground source heat pumps in Denmark is around 40,000, and currently increasing with around 7,000 per year. Most of the existing installations are horizontal collectors. Only around 600 are Borehole Heat Exchangers (BHE) and some few are groundwater well open loop systems. During the last 5-6 years the number of BHE has increased significantly with more than a hundred boreholes constructed each year.

A three year project supported by the Danish Energy Agency has resulted in guidelines for the design and installation of closed loop boreholes. The project has addressed a number of different topics related to ground source heating and cooling such as the thermal properties of shallow Danish deposits (Ditlefsen et al. 2014), drilling and grouting techniques in soft sediments, mapping of shallow geothermal gradients, modeling of heat and groundwater flow as well as groundwater protection and other environmental considerations. Results from the project can be seen on the project homepage www.geoenergi.org.

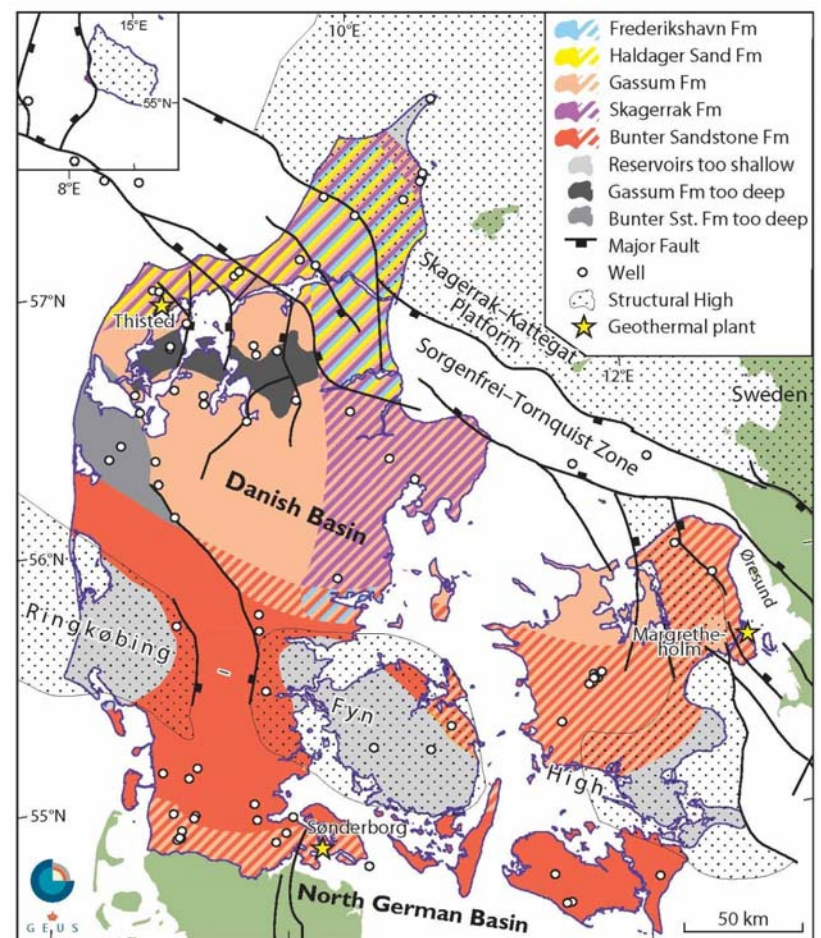


Number of shallow geothermal boreholes reported to the national borehole database Jupiter.



Installation of borehole heat exchanger at test site.

HOT NEWS
Geothermal guarantee scheme is being established in Denmark.



GEOTHERMAL RESERVOIR MAP

Map showing the regional distribution of sandstone formations containing potential reservoirs together with existing deep wells and the location of the three geothermal plants at Thisted, Margretheholm near Copenhagen and Sønderborg. The map illustrates where the potential reservoirs are present in the 800–3000 m depth-interval with reasonable reservoir properties. The dark-grey and black areas indicates that the reservoir is buried too deep (Gassum in Northern Jylland; Bunter in Western Jutland, - both located in the central parts of the Danish Basin) while the light-grey areas indicates areas where no reservoirs are expected to be present (Ringkøbing-Fyn High) or are too shallow buried (< ~800 m; northernmost Jutland). The hatched areas indicate that two or more of the mapped reservoirs are expected to have geothermal potential. An updated version of the map will be presented as part of a new GEUS-website that currently is being finalized.

