

Geothermal Energy Use, Country Update for Germany

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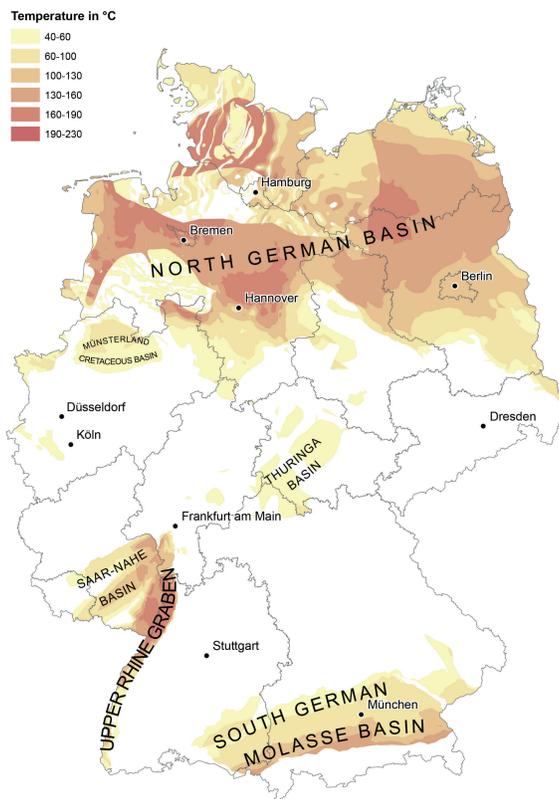


Figure 1: Regions with hydrothermal resources in Germany (proven and supposed) and associated temperature ranges (map adapted from Suchi et al. 2014).

Geothermal Power Generation

In Germany, geothermal electricity generation is based on the use of binary systems (Kalina cycle or ORC). Aquifers with temperatures of more than 140 °C and hydraulic conductivities suitable for power generation can be expected in parts of the North German Basin, the Upper Rhine Graben and in the South German Molasse Basin (Fig. 1).

With the commissioning of the 4.3 MW_e plant in Grünwald/Laufzorn close to Munich in the South German Molasse Basin in November 2014, geothermal power in Germany reached an installed capacity of 34.5 MW_e at the end of 2015. Further units for power generation are located in the Upper Rhine Graben and in the South German Molasse Basin (Fig 2).

Electricity production amounted to 151.05 GWh in 2015, almost doubling the power production in 2014 (79.96 GWh).

The geothermal information system for Germany (GeotIS, www.geotis.de) provides information and data compilations on deep aquifers in Germany relevant for geothermal exploitation.



Figure 2: Installations for geothermal energy use in operation in Germany (<http://www.geotis.de>)

Centralised Installations for Direct Use

Common deep geothermal utilisations using thermal water with temperatures above 20 °C from wells deeper than 400 m are district heating plants or combined heat and power plants (CHP), thermal spas, and space heating. At present, 180 geothermal installations of these types are in operation in Germany (Fig. 2).

In 2015, the installed geothermal capacity reached 336.6 MW_t. 23 district heating and combined plants accounted for the largest portion of the geothermal capacity with 285.0 MW_t. Altogether, the installed capacity of deep geothermal heat use in Germany shows a considerable increase from 163.4 MW_t in 2010 to 336.6 MW_t in 2015. Heat production by deep geothermal utilisation rose from 716.2 GWh in 2010 to 1,099.1 GWh in 2015 (<http://www.geotis.de>).

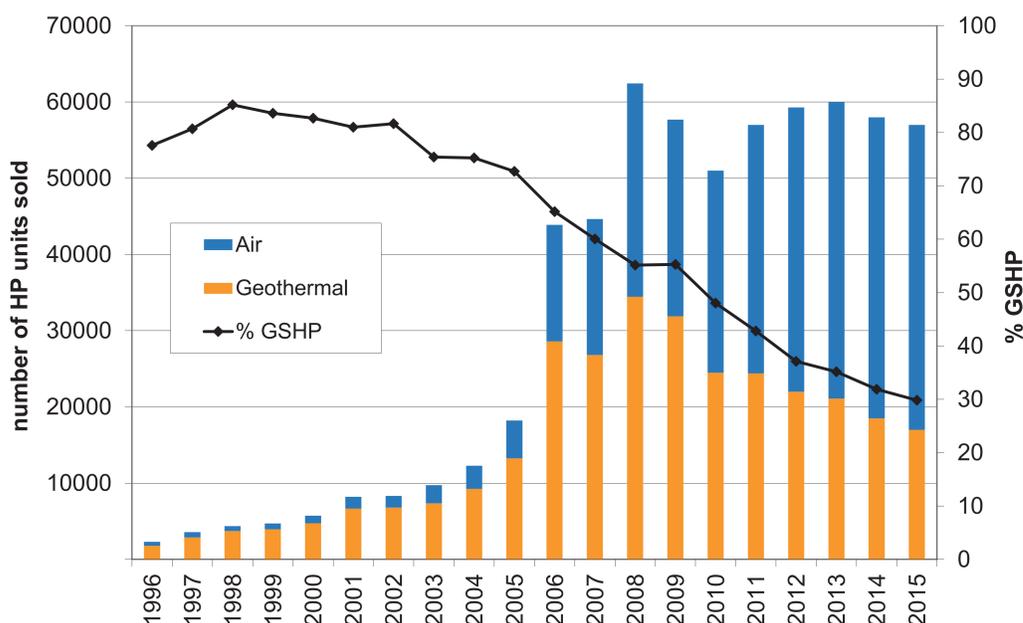


Figure 3: Development of sales figures for ground source (geothermal) and air source heat pumps in Germany (source: annual data from the German Heat Pump Association BWP).

Geothermal Heat Pumps

In Germany, heat pump systems for heating and cooling buildings are widespread. Common systems are horizontal heat collectors or borehole heat exchangers (brine/water systems) and groundwater systems with extraction and injection well(s) (water/water systems).

In 2015, the total number of all heat pumps including non-geothermal systems reached about 665,000 (BMW according to AGEE-stat 2016). The number of geothermal systems reached about 325,000 at the end of 2015 (installed capacity: 3,900 MW_t; geothermal heat production: 5,700 GWh). Brine/water systems are the most common installation with a share of about 85 % of the geothermal heat pumps.

However, sales figures for geothermal heat pumps have decreased in the last seven years. From a peak of 85.2 % of geothermal heat pumps in 1998 the decrease is accelerating steadily, reaching a low of only 30 % in 2015 (Fig. 3).