Deep geothermal projects are mostly located in Bavaria, which benefits from favourable geological conditions. In addition, the city of Munich is very proactive in developing geothermal projects and increasing its use of this renewable resource for decarbonising the city’s heating supply.

The recent development of some innovation in geothermal electricity technologies (e.g. binary turbines) allowed Germany to become a geothermal electricity producing country.

### Main operators and developers in Germany

<table>
<thead>
<tr>
<th>Main operator/developer</th>
<th>Geothermal for Heating &amp; Cooling (in MWh)</th>
<th>Geothermal for Electricity (in MWe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnBW</td>
<td>N.A.</td>
<td>0.44</td>
</tr>
<tr>
<td>GeoEnergie Taufkirchen GmbH</td>
<td>40</td>
<td>4.3</td>
</tr>
<tr>
<td>E-On</td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td>GKT Geothermische Kraftwerkgesellschaft Traunreut</td>
<td>12</td>
<td>5.5</td>
</tr>
<tr>
<td>Pfalzwerke Geofuture GmbH</td>
<td>-</td>
<td>4.8</td>
</tr>
<tr>
<td>Stadtwerke (all)</td>
<td>48.25</td>
<td>11</td>
</tr>
<tr>
<td>Stadtwerke München</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Geovol Unterföhring GmbH</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Vattenfal</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Geoenergie Kirchweidach</td>
<td>30.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Daldrup &amp; Söhne</td>
<td>5</td>
<td>0.79</td>
</tr>
<tr>
<td>Erdwärme Grunwald</td>
<td>40</td>
<td>4.3</td>
</tr>
</tbody>
</table>

While the market for individual geothermal heating systems (e.g. geothermal heat pumps) remains dynamic, with over 23 000 new systems installed in 2018, it remains well below the market share of oil boilers, and much lower than gas technologies, highlighting the dominant position of fossil heating equipment on the German market.
RESOURCES

Germany’s identified deep geothermal resources are distributed in the North and the South of the country. Currently, the Rhineland and Bavaria are the areas where most of the deep geothermal capacity has been developed. More resources can be developed in the North of the country for heating and cooling production. Germany also has a good potential for developing geothermal power production, in particular in the Rhine area, where such technology can become competitive in the medium term.

Maps based on available geological data (GeoELEC, GeoDH)
POLICIES AND REGULATIONS

Legislative framework

Germany launched its national strategy for the energy transition (Energiewende) in 2010 with the intent of decarbonizing the German economy. The strategy is laid out in the Renewable Energy Sources Act (EEG): by 2025, 40% to 45% of Germany’s energy is to be produced from renewable sources and 55-65% in 2035, up to at least 80% by 2050.

Geothermal heating and cooling is mainly regulated by the Renewable Energies Heat Act (EEWärmeG) and by the Market Incentive Programme (MAP), which provide subsidies for the installation of efficient heat pumps systems in residential buildings, alongside other geothermal technologies providing space heating, hot water, cooling and process heat.

Support schemes

Electricity

Fixed feed-in tariff amount of 25.5 c€/kWh for 20 years. For projects commissioned from 2021 onwards this amount will decrease by 5%/year.

Heating and cooling

For heating, investment support is provided by the Federal Office for Economic Affairs and Export Control (BAFA) through the MAP for heat produced in existing building form different renewable sources, including geothermal.

The subsidies for geothermal are provided to private persons, freelancers, SMEs, municipalities/local authorities, non-profit organisation for the installation of efficient heat pumps up to and including 100 kW/nominal heat output.

Innovation

Regarding research and innovation, the 7th Energy Research Programme of the Federal Government, entitled “Innovation for the Energy Transition”, is the main instrument setting out guidelines for energy research funding. Managed conjointly by the German Federal Ministry of Economics and Technology (BMWi), the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Food and Agriculture (BMEL), the programme provides specific R&D funding for the development of geothermal heat and power.

In particular, it focuses on:

- Demonstration projects with an objective of replicability;
- Reduction of costs for geothermal technology developments, improvement of security and best practices;
- Heating and cooling storage underground;
- Mapping of resources and explorations;
- Research on the material use of extracted geothermal liquids;
- Modelling and simulation of geothermal systems to increase forecasting reliability and minimise financial risk

In 2017 the Federal Ministry for Economic Affairs and Energy provided approximately 36.49 million euros in funding in the field of geothermal energy.

In addition to the Federal programmes, the German Lander also provided funding for research in geothermal energy for 4.7 million euros in 2016, mostly in Lower Saxony (2.2 million euros) and Bavaria (1.5 million euros).

Furthermore, the Renewable Energies Programme of the German development bank KfW provides a repayment bonus and support for drilling costs for heat and power plants using geothermal energy.

Key public institutions

- Federal Ministry of Economics and Technology (BMWi), setting the legislative framework and federal objective
- 7th Energy Research Programme: financing RD&I projects
- Federal Office for Economic Affairs and Export Control (BAFA) managing the grants for “Heating with Renewable Energy” through the MAP
- KfW: German development bank
- German Energy Agency
- Stadtwerke München: public utilities at the center of geothermal development in Germany.
- Landers: large competencies on renewable energy developments in the heating and cooling sector.
- German Geothermal Association
PERSPECTIVE TO 2030, AND POTENTIAL DEVELOPMENTS

Germany is a European leader on deep geothermal, with a robust sector able to implement ambitious policy objectives, the National Energy and Climate Plan should set objectives consistent with an acceleration of geothermal energy deployment in shallow and deep installations for electricity and heating and cooling.

The right framework must be put in place to allow for the Germany geothermal sector to continue on this trend. This means:

- Guarantee for project developers (i.e. geological risk mitigation); Planning and identification of resources at the National, Regional and Local level
- Stability of support frameworks
  - Shallow geothermal: incentives aligned with the technology’s benefits compared to other technologies (i.e. higher investment, lower operating costs)
  - Deep geothermal: stable incentives in line with the degree of technology maturity.

**KEY RECOMMENDATIONS**

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**Ongoing or planned projects in 2018, to come online before 2030 as project development lasts 5-7 years**

<table>
<thead>
<tr>
<th>Capacity addition (2017-2030)</th>
<th>Baseline (ongoing projects, commissioned by 2025)</th>
<th>Market slow down</th>
<th>Current trend</th>
<th>Moderate market acceleration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Heating &amp; Cooling</td>
<td>+952MWh</td>
<td>+1619MWh</td>
<td>+2235MWh</td>
<td>+2902MWh</td>
</tr>
<tr>
<td>Electricity</td>
<td>+29MWe</td>
<td>+122MWe</td>
<td>+225MWe</td>
<td>+400MWe</td>
</tr>
<tr>
<td>Shallow geothermal</td>
<td>+234000 units</td>
<td>+270000 units</td>
<td>+325000 units</td>
<td>+416000 units</td>
</tr>
</tbody>
</table>

These projects reflect the current market trend in Germany, which is notably carried forward by the Munich area. It also underlines the strength of the German geothermal sector which is rapidly increasing the installed capacity in the country: indeed, for **geothermal district heating capacity has been growing at a 13% annual growth rate over the past decade.**

To maintain this market dynamic must be supported by clear policy objectives and a sound policy environment that provides guarantees to project developers.

The role of local authorities is also crucial in supporting developments, as illustrated by the case of Munich. While development is very localized at this point, ongoing projects in Baden-Württemberg, Saxony or North Rhine Westphalia show that the sector is able to further scale, and that German geothermal resources can be developed to meet a large part of Germany’s heating and cooling needs by 2030, and start to play a significant role in the electricity sector as well – notably at the regional level.

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