



# LEGISLATION AND REGULATION ANALYSIS COUNTRY BROCHURES

## GERMANY

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The regulations applicable to the installation of GSHP and GHE at the Rehau test site of the real case study at Erlangen are presented below.

# GEOTHERMAL LEGISLATION

Geothermal Energy is defined by primary legislation in §3 Para., 3 No.2 Letter b BBergG, where geothermal energy is defined as a licensable mineral resource. A license under the BBerg is applicable for any exploration and extraction of geothermal energy from depths greater than 100m. Geothermal energy exploitation above 100m is not subject to the mining law. For larger projects a decision is made on a case by case basis.

## LOCAL LEGISLATION

The Water Management Act (WHG) in connection with the Water Acts of the Federal States is applicable where water extraction and open loop systems. The Bayerisches Wassergesetz (BayWG) is the responsible authority at the case study site location and implements the statutory state regulations in the case of the Water Management Act. The Regional Administrative Authority is the responsible authority for implementation of BBerg.

## LICENSING & PERMITTING PROCEDURES

### LICENSING AND PLANNING APPLICATION

A licensing system in the case of GHE in Bavaria is applicable. However different levels of permission need to be requested based on the extent of the works penetrating the ground.

Where GHE is to be installed above the groundwater table, a simple notification process is applicable; however where these intersect the water table a permit is required under WHG in accordance with Art. 15 & 70 of the BayWG. More complex licensing requirements are applicable to open loop systems where the extraction and injection of groundwater requires permission (§ 35 WHG in conjunction with article 34 BayWG; §3 Para. 1, No. 5 & 6 WHG). A typical processing time of 1 to 3 months and a cost of €100 to €500 (administrative costs only) is applicable depending on the size of the plant.

Additional licensing requirements in Bavaria include small plants to obtain

- a water management expert's ('PSW') report
- A TRT test (for local water authorities) & EED Simulation for plants larger than 50kW
- building service planner ('TGA-Planer') ,
- official expert for plant dealing with water endangering substances ('VAwS') for industrial plants

### DRILLING PERMITS

A drilling permit is typically required for the completion of boreholes. Where a geothermal borehole is less than 100m deep, a permission (§49 Para. 1 WHG in connection with article 30 BayWG) is required. The legislation requires this to ensure protection of groundwater resources. For boreholes of depths greater than 100m, a license under BBerg is also required. The typical processing time is 1 to 3 months and cost is variable based on the GHE size requiring permission. Strict requirements and regulations relating to the drilling contractor and the procedures for drilling and borehole construction are discussed

### EIA REQUIREMENTS

A requirement for an EIA/EIS to be undertaken is applicable to both open loop and closed loop systems. The main requirements are outlined in the VDI4640 Blatt part 2 guidelines which state that groundwater is to be treated carefully and measures for the prevention of hazardous substances entering groundwater needing to be must be implemented. The thermal use of the underground in drinking water protection areas, in catchment areas of drinking water extraction points and spa water conservation areas is prohibited (DVGW W101). Groundwater abstraction for drinking water supplies have unlimited priority over any other use of bodies of water. This principle also applies if the population is supplied via domestic wells for which there is no official protection area.

The requirements state that the groundwater close to the surface with a free water table should primarily be used for the purposes of thermal energy extraction and in the case of deeper groundwater levels being used, special protective measures are required. In addition, groundwater should only be used with GSHPs if no suitable body of surface water is available. The Bavarian legislation requires that GHE be completed within the first aquifer closest to the surface and a drilling and perforation of the first aquiclude below this is aquifer prohibited.

More complex requirements are in place for open loop systems where a pumping test may have to be completed in advance of permitted extractions. In the case of these systems, re-injection is required into the same aquifer and where these installations exceed 150kW installed capacity for both heating and cooling purposes, strict monitoring of flow and temperatures is required.

The responsible authorities for the case the study site are Regional administrative authority of Erlangen and the Bavarian Environmental Agency.

## MONITORING REQUIREMENTS

A monitoring requirements is applicable in many cases when a GSHP system is installed. For smaller plants monitoring is mandatory only if the owner has received a funding through government incentives. This typically requires temperature and heat production data to be collected through the heat pump controller unit. Larger systems (> 50 kW) are monitored by the local water authorities where the ground water level, temperature, temperature difference and flow rate of a specific plant have to be recorded.

# REGULATIONS

## GSHP SYSTEM REGULATIONS

The regulations specify a number of limitations relating to shallow geothermal energy. In case of the depth of the resource a cut off 400m is considered based on the BBerg and further limitation of 100m is applied through the water regulations for licensing of GHEs. A further differential between open loop systems and closed loop systems is included in the regulations and sets out the minimum requirements for both. Whilst the open loop requirements are not discussed in this section, the regulations for closed loop system require a mandatory numerical simulation of the proposed collector to be undertaken.

In Bavaria, if the GHE system extracts the system extracts > 50 kJ/s of geothermal energy the local water authority give the permission to install the GSHP system (Article 15 BayWG). Where a GHE extracts < 50 kJ/s of geothermal energy an external expert's opinion has to be added to the application (Article 70, Para. 2 No. 2, sentence 1, No. 5 BayWG)

Planning guidelines for the construction of BHEs apply only for GHE with maximum installed capacity of 30 kW (Environmental Agency of Bavaria) for vertical closed loop systems where the annual heating extraction rate is limited between 100 and 150 kWh per annum.

Collector spacing is also provided as part of the regulations with a spacing of 5m for collectors between depths of 40 to 50m and a spacing of 6m for deeper collectors up to 100m. A minimum distance of 2 m from a building wall is required to ensure the stability of the building is not affected.

For larger systems (more than 30 kW) in an unclear geological-hydrogeological situation, a pilot borehole should be carried out. A geophysical log of the borehole must be undertaken. For systems with more than three boreholes per heat exchanger, the drilling contractor must provide a detailed method statement and all documents have been handed over. This implementation plan should be submitted to the client for the drilling, installation and completion of the boreholes, before the drilling works approval.

## ENVIRONMENTAL

The case study site requires the drilling operation to be declared at the local administrative authority (independent town of Erlangen). Drilling for GHE is restricted to the first (upper) groundwater aquifer. If the proposed collector does not affect groundwater aquifers, a permit may not be required subject to the local regulations and depending on the technical specifications of the installed system and hydrogeological conditions.

Restrictions are applicable in the case of any thermal use of the underground in drinking water zones and in the catchment areas where drinking water extraction plants and spa water conservation areas where GSHP systems are prohibited. Exceptions are applicable (drinking water protection zone III) but must be confirmed with the local water authorities.

In the case of open loop systems, groundwater should be used only in circumstances where surface water cannot be used. Open loop systems require that water be re-injected back into the aquifer from which it has been extracted. Contamination or changes to any of the properties of groundwater are to be avoided and restrictions on the use of materials for the construction of the boreholes of GHE as well as collector fluids are in place to ensure that no negative environmental impact is created.

The drilling process has to be documented by the drilling company and must include drilling progress, groundwater level, mud loss, cavities, jointing in accordance with DIN EN ISO 22475-1 DIN EN ISO 14688-1, DIN EN ISO 14689-1 and DIN 4023. An expansion plan ('as built drawing') that including drilling depth, probe depth, borehole diameter, type of probe, location of the inner spacers and notes regarding grouting must be completed and supplied to the relevant authorities. A pressure test using at least 6 bar for 60 min must be completed along with a flow test of the probe.

A detailed grouting methodology is specified in the regulations. This is aimed at ensuring that continuous grouting is completed as part of the installation to improve heat transfer from the collector and prevent any cross contamination. Strict requirements with respect to the materials used are also imposed. These require the choice of grout slurry to be suited for all operational collector temperatures. Bentonite, HOZ (high furnace cement), water, a bentonite-HOZ-sand-water suspension and the use of quartz sand are permitted provided that operational temperatures in the range of -15 °C can be achieved. Where collectors are installed in unconsolidated materials or in unstable ground conditions above the first aquifer, fine gravel or fine cuttings may be used. The grouting process must be carefully documented including mixing and injection, delivery notes, technical and environmental datasheets for the grout material and additives, mixing ratio, water/solid ratio, protocol for the slurry density testing (injected density = escaping density), variance analyses of the used amount of suspension, protocol of the grouting pressure, type of pumps & grouting pipe and details of grout sample taken.. A detailed photographic record of the major working steps should be kept. A formal Building inspection in accordance with Article 65 BayWG is undertaken following the completion of the work. Not later than 4 weeks after the building inspection, the documents are sent in duplicate to the regional administrative authority.

## BUILDINGS

The EEWärmeG are the main regulations for the integrations of renewables in buildings at the case study locations with the main level of integration of renewables in heating and cooling set at 14%. The following targets are specifically set for geothermal energy where 50% of the H&C contribution from electrically driven heat pumps require a COP of 3.5 (air/water; air/air) or 4.0 (other heat pumps). Producing DHW the COP has to be 3.3 (air/water; air/air) or 3.8 (other heat pumps). The heat pumps have to have a heat meter and an electricity meter to calculate the corresponding COP values. These regulations apply if the flow temperature of brine/water, water/water heat pumps exceeds 35 °C. These are applicable to new residential buildings and new non- residential buildings.

As similar requirements but with a minimum contribution of 15% of the H&C contribution is applicable in the case of retrofit buildings. No specific regulations are applicable in the case of integration of technology in renovation or conservation of historical buildings.

# HEATING & COOLING PLANTS

The current Energy Saving regulation for Buildings in Germany (EnEV) along with several DIN and EN standards are applicable for ground source heat pump equipment as part of these regulations. Electrically driven and fuel driven heat pumps have to be certified and labelled with the 'Euro-blume', 'Blauer Engel' or 'European Quality Label for Heat Pumps' eco-label.

The EC F-GAS (EC517/2015) regulations are implemented at national level to promote the transition from CFC to chlorine free HFC working fluids in heat pumps and minimising any potential environmental impacts from leaks. The regulations have specific set targets for the use of R290, R1270, R717 and R744.

## POLICY CONTEXT

The number of geothermal systems in Germany is about 286,000 at the end of 2013, with closed loop (brine/water) systems representing the largest share of about 85 % of all ground source heat pumps. The total number of heat pumps is close to 555,000 units, producing up to 7.5 TWh of heat in 2013 (Weber et al, 2015). A target contribution of renewable heat from geothermal heat pumps of 521 ktoe by 2020 has been set in the NREAP for Germany. The recently published progress report in 2015 showed that the expected target for 2014 of 374ktoe was not achieved with a total contribution of 334ktoe reported. No specific targets beyond 2020 have been set.

Underground spatial planning policy is integrated with the Water and BBerg legislations and provide at federal state level a guide as to the potential for development of shallow geothermal resources. Areas are classified based on local existing geological and hydrogeological information, the location of other systems and the other underground and groundwater uses. The applicable restrictions are mapped and updated on a regular basis by the regional administrative authorities or the local water management agency.

## STANDARDS & GUIDELINES

The main standards and guidelines in Germany for GSHP systems are included in the new VDI 4640 guide-lines. These cover collector types and installation, equipment and in the case of Bavaria are complemented by the W120 for drilling equipment, the Leitfaden Bayern for GSHP systems and the SKZ & TÜV-Süd associations for equipment and material labelling.

## TRAINING & CERTIFICATION

Training and certification schemes are provided at a national level through the GeoTrainet initiative where two national well drilling schools have been established. Local training for drillers and site managers in accordance with DVGW (German Technical and Scientific Association for Gas and Water) W 120 is applicable and drilling contractors must be registered as specialist firms in accordance with DVGW W 120 and must have the DVGW certificate for drillings and constructing groundwater wells. The certification is valid for 5 years after which a refresher course is required. A separate certification scheme (W 120-2) where drillers providing services under government incentive scheme must be registered.

GSHE equipment must have SKZ HR 3.26 (Geothermal Probes, Pipes and Fittings made of Polyethylene, PE 100, for Geothermal Products) certification or TÜV Süd MUC-KSP-A 3000 certification (examination and certification of BHE produced out of PE 100 & PE 100-RC) or have another comparable certification.

## OTHER INFORMATION

Information on shallow geothermal energy resources is available through several web based GIS systems as well as through the Geological Surveys and the Environmental agencies for the different federal states. These include [www.infogeo.de](http://www.infogeo.de); LfU (IOG); ThermoMap (vSHGP); [geothermie.de](http://geothermie.de). Separate initiatives such as LfU, [geothermie.de](http://geothermie.de), bwp, [erdwarme gemeinschaft Bayern](http://erdw%C3%A4rme.gemeinschaft.Bayern) provide information on the benefits of GSHP technology.

Financial incentives in the form of grants and tax incentives are provided, based on plant size by the Federal Office of Economics and Export Control. A basic subsidy applies of up to € 100 per kilowatt of installed nominal heat output, but at least €4,000 per installation for all electric heat pumps with geothermal heat sources or water and €4,500 per plant for the construction of electric heat pumps with geothermal heat source. The drilling company should adhere to the quality requirements of the technical regulations DVGW W120-2 and be certified. The applicant must submit evidence of a no-fault insurance against unforeseen damage.