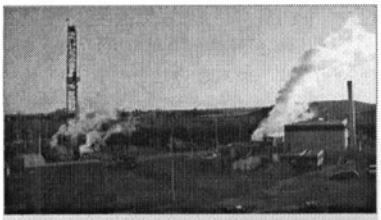
Hydrothermal Geothermal Energy for Heat Supply

With the introduction of the new subsidy strategies by the German Federal Government for the exploitation of geothermal energy, an increased number of geothermal deep well drilling projects have been designed since 2003, and some of them have been implemented. In the Munich area, the Munich public utility company (Stadtwerke Muenchen), as well as the municipality of Pullach i. Isartal, among others, have decided to use geothermal heat as a renewable heat source.

Heat Supply for the Trade-Fair Town of Riem

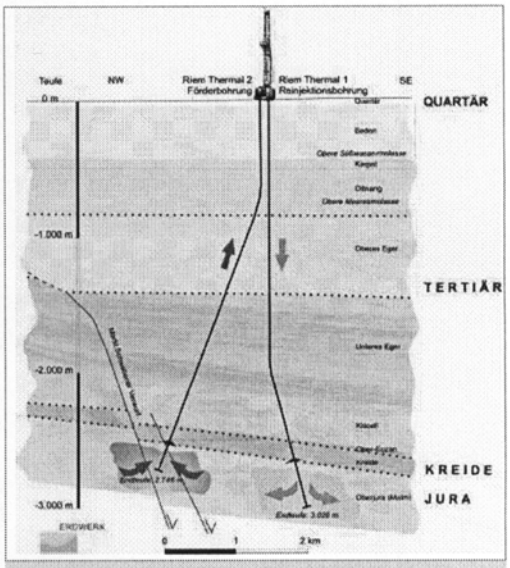
At the site of the old Munich-Riem airport, a new neighborhood for 16.000 residents has been under construction for a number of years, which includes not only residential and industrial areas but also a landscaped green zone in which the federal garden show was opened on April 28, 2005. To supply heat to this part of the city, a district heating network with a projected final connected load of approximately 45 MW was put into place by the Munich public utility company. The base-load heat supply is provided through the environmentally friendly use of hydrothermal geothermal energy; natural gas-fired boilers are kept on stand-by for peak loads and as a reserve. Geothermal energy is providing a thermal output of 7 to 9 MW and – in the final stage of completion – will provide over 50% of the annual requirement of approximately 80 GWh.



Drilling site in Riem with drill rig and heating plant ■

Project Progression

After initial concept studies in 1994, which were originally based on an approach of supplying geothermal energy in parallel with energy generated by a CHP plant, the green light for geothermal energy was given only in the fall of 2001, when the permit that is required by Mining Law was issued for prospecting for geothermal resources. Before drilling work could commence, another two years were spent conducting detail planning of the doublet, an EU-wide invitation to tender, and additional preparatory planning work. The drilling operations for the geothermal doublet with a cumulative length of 6,500 drilled meters were completed after five months. The production pump, which was tailored to the hydraulic conditions of the Riem wells and had been specifically constructed for Riem, was installed in the well Riem Th 2 in the fall of 2004. After a long-term pumping and reinjection test and successful trial run, continuous pumping operations have been ongoing since early 2006.



Drilling schematic Riem Th 1 / Th 2 ■

Drilling of the Geothermal Wells

For this ambitious deep well project by the Munich public utility company, a combined drill site of approximately 6,000 m² was prepared next to the heating plant. The above-ground drive-in points of the two wells are located only 15.5 m apart. Beginning at a vertical depth of approximately 2,510 to 2,625 m below ground, the wells, which are deviated asymmetrically to the north-northwest and south-southeast, respectively, open into the aquiferous limestone of the Upper Jurassic formation (deep Malm aquifer). ■

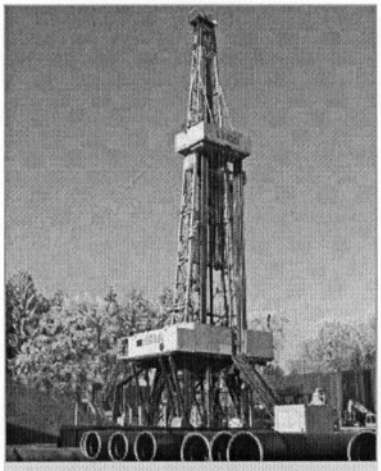
District Heating Supply for the Municipality of Pullach i. Isartal

The municipality of Pullach i. Isartal, through its subsidiary, Innovative Energie für Pullach GmbH (IEP), which it founded in late 2002 speci-

fically for the purpose of locating geothermal heat, is pursuing the supply of heat to municipality-owned property and buildings, as well as to private customers, through environmentally sound and regenerative use of hydrothermal geothermal energy. A geothermal doublet provides for the regenerative use of geothermal heat from the deep Malm aquifer. The drilling operations, which were conducted by rotary drilling, were completed in just under seven months.

Project Progression

After initial geological, hydrogeological and economic investigations that were conducted in 2001 in the form of a feasibility study, the municipality of Pullach was granted its permit under the Mining Law in the fall of 2001 to prospect for geothermal heat. Identifying heat consumption customers, economic viability analyses, additional pre-planning, and the EU-wide invitation to tender took up an additional three years. The drilling work for the geothermal doublet was completed in early 2005, when the deviated well Pullach Th 1a was drilled and hydraulic testing demonstrated a sufficient flow rate. The geothermal plant has been in continuous operation since the end of 2006.



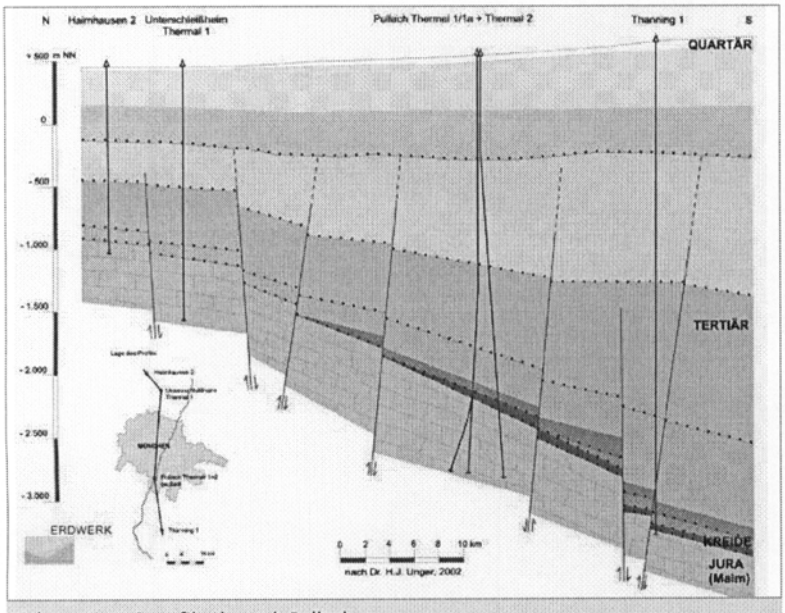
Drilling rig in Pullach ■

Geothermal Wells

The two wells, Pullach Th 1 and Th 2, were drilled north of the Pullach high school using comprehensive sound protection measures, as the drilling site was located immediately adjacent to a residential area. In order to attain the hydraulically and thermally required distance between the wells below ground, the wells were drilled deviated proceeding from a combined drill site, such that they are located approximately 2 km apart from each other at their landing points. The first well, Pullach Th 1, was deflected to the north and drilled to a final depth of 3,300 m MD. The second well, Pullach Th 2, was deflected to the south to a final depth of 4,120 m MD. The development target – the deep Malm aquifer – was reached starting at respective depths of approximately 2,820 m and 2,945 m below ground. The wells were drilled in telescope-like fashion and casings installed in four phases: the wells were started with a 16" drilling phase into which 13 3/8" liner casings were installed and cemented, and then continued deeper with a smaller drilling diameter, developing the deep aquifer of the Malm with a final drilling diameter of 6 1/8". Since the desired reinjection capacity was not achieved at first, a sidetrack well was drilled, which, at an inclination build-up to 72°, permitted a drilling distance of 1,116 m to the NNE. The Malm was accordingly developed over a total vertical thickness of approximately 550 m. The wells in the Malm were completed with a perforated 5" liner and a 4 1/2" liner in the sidetrack.

District Heating Network

The district heating network, which was designed for a geothermal capacity of 6.3 MW, initially had a total length of 6 km and was intended for a small number of large customers (the public swimming pool, schools, city hall, a youth hostel, arts center, multi-story apartment complexes, the municipality-owned residential construction company, etc.). By the end of 2006, after numerous private residences had been connected as well, the network had already reached a length of almost 10 km and it is still being expanded today. ■



Schematic N-S profile through Pullach ■

Kontakt:

Dipl. Geol. Dr. Achim Schubert
Managing Director

ERDWERK GmbH
hydrogeologie geothermie

Bonner Platz 1
D-80803 München/Germany
Phone: +49-89-38.88.74.88
Fax: +49-89-38.88.74.89
E-mail: office@erdwerk.com
www.erdwerk.com