GEOTHERMAL ENERGY

ERDING (Germany)

Geothermal energy rather takes a subordinate position among renewable energy sources. There are two possible sources for it: the radioactive decay of natural radio nuclides which causes the spreading of heat onto the earth surface, and the storage of solar energy in the top earth layers. For this reason, geothermal energy is available in many places and independent from the different seasons of the year, even if some regions do have a higher potential than others. This applies, for example, to the town of Erding in Bavaria, which uses water obtained from a depth of 2,000 m both as a heat source and as material. For this purpose, a district-heating system has been planned for several new neighbourhoods, as well as new thermal baths in the area.

THE CITY

Erding, the seat of the district authority, lies about 36 km north of Munich, very near Munich's new Franz Josef Strauß Airport. Erding was chartered in 1314, but its origins date back to the ninth century, when there was already a royal estate there. Due to its location on the southern edge of the Erdinger Moos, a bogland area, food and medicinal plants are grown; but light engineering companies and machinery works are also located here.

Climatic data:
Average mean temperature: 11.8 °C.

CONTEXT

In Erding, an unsuccessful oil exploration well in 1983 produced thermal water of about 65°C at a depth of 2,350 m from the Upper Jurassic karst of the South German molasse basin. Even at the time, the town and county of Erding considered whether this deep water might be exploited commercially. A continuous pumping test demonstrated a high yield and a chemical composition corresponding to that of the mineral springs in the spa towns of the Bavarian *Bäderdreieck* ["Spa Triangle"].
In the early Nineties, the town of Erding planned three new developments with a total of 2,000 homes, in which about 5,000 people will live in the near future, in a radius of one kilometre around the well. About 500 m from the spring lies the Erding County Hospital, with a heat consumption of 2.2 MW, and other municipal facilities, which formed the core of the potential consumers, and make the implementation of the project possible. Such a consumer structure would have resulted in a large demand for heat in winter and a low utilization ratio in summer. Therefore, the plans were extended to include thermal baths, which forms a permanent base load (heat demand ca. 4.7 MW) and an ideal application for the thermal spring, namely as thermal water. In 1994, concrete planning commenced with an investor who is to plan, build and operate the thermal baths.

EXPERIENCE OF ERDING

In order to push ahead with geothermal applications jointly, the town and county of Erding formed the *Zweckverband für Geowärme Erding* ["Erding Geothermal Special-Purpose Association"] to co-ordinate and promote the planning. They also looked for competent associates to implement the district-heating and thermal-baths projects. The ones chosen were Saarberg-Fernwärme GmbH and the Wund group from Friedrichshafen on Lake Constance.

Water extraction

The "Ardeoquelle" deep well has an output of 55 litres per second, of which 24 l/s are supposed to be used in the final stage of the project. This equals an output of 540,000 m³/a with an energy content of 28,000 MWh/a, corresponding to the energy of about 3 million litres of heating oil. The water is pumped to the surface by means of a deep-well pump located at a depth of 230 m. At the surface, it is filtered and then used in various ways.

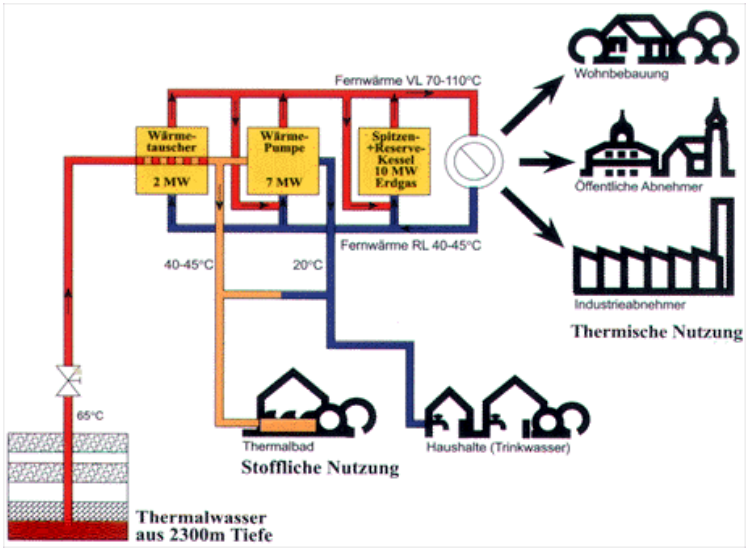
Multiple use of the thermal water

In the best case, the water obtained from the Ardeoquelle can be used for four different purposes:

- for district heating
- for thermal water
- for drinking water
- for medicinal and mineral water (This possibility exists, but is not expected to be implemented in the near future.))

Heat utilization

The foundation stone for the "Geo-Heating Plant" in Erding was laid in October 1996. At the end of 1997, it went on line, and it was officially inaugurated on 25 March 1998. It has a total thermal capacity of 18 megawatts, and consists essentially of a direct heat-exchanger unit with a thermal capacity of 2 MW, an absorption heat pump with a capacity of about 7 MW, and two hot-water boiler units of 5 MW capacity each. The entire district-heating network currently has a length of some 15 kilometres.



The filtered deep-well water heats the district-heating water, which circulates in a separate loop, by means of three heat exchangers. The well water, which has now cooled to ca. 48°C, is cooled down further to about 20°C by the absorption heat pump, heating the district-heating water to almost 80°C in the process. In the downstream boiler plants, the water in the advance leg is brought to its final temperature of up to 100°C. It now flows through an advance-leg pipe to the customer, and returns in a return-leg pipe to the heating plant after use, at 45°C.

Thermal water utilization

After the utilization of its energy content, which leaves the quality of the water unchanged, the thermal water passes into a degasification tank, where its methane content is reduced. Then it is treated with ozone in two stages, and passed through biological filtering units. Pressure relief in an open pure-water tank causes dissolved gases to be emitted. The conditioned water is pumped into the Erding municipal waterworks, mixed with Tertiary water there, conditioned again, and fed into the drinking-water system.

Financing

In 1990, the Geothermal Special-Purpose Association purchased the future site, including the well. As a part of the scheme, a specially zoned area was designated, intended for a hotel and a spa centre, with a medical centre, and health, therapy, and rehabilitation facilities, as well as recreation facilities and shops. The investment volume of the project is ca. EUR 15 million, not including the facilities in the specially zoned area. Its financing has been secured by the Association's budget and finance plans. Grants from various sources eased the financial burden on the Association:

- The State of Bavaria first subsidized the continuous-pumping test to assess the potential for utilization of the thermal well. Afterwards, the State subsidized the renovation of the well equipment and bringing it up to operational readiness to the amount of about EUR 204,000, corresponding to a 50% grant.
- In addition, as part of its subsidy programme for "Efficient Energy Production and Use", the State of Bavaria granted subsidies of EUR 3.39 million.
- The EU subsidized the absorption heat pump with ca. EUR 920,000 in 1992, and the thermal-water treatment plant with roughly EUR 300,000 in 1996, i.e. a grant of 40% of those costs that qualified for a subsidy.

At the start of building work in the new development areas in 1993-94, substantial investments in setting up the district-heating scheme were necessary, since the supply of heat had to be available as soon as the first housing units were ready for occupancy. For this reason, partial networks were operated at first by means of mobile gas-heated units, until the wells had been sunk and the heat pump and peaking boiler installed and taken into operation.

The heat winning and distribution facilities built and financed by the Association were then leased to the firm of Saarberg Fernwärme GmbH (SFW). SFW has thus assumed the responsibility for supplying heat to the customers and for collecting payments. It has undertaken to operate the entire facility for 25 years. The details of this were set out in an operating contract.

The construction and operation of the thermal baths, which will be located on property belonging to the Town, will be done on a private basis by the Wund group of companies.

EVALUATION AND OUTLOOK

In Erding, over 50% of the heat required is generated without pollution by utilization of geothermal energy. The remaining heat requirement is met by the heat pump, which is powered by natural gas and light fuel oil. This results in a reduction in emissions of:

CO_2:	ca. 70% (7,000 t/a)	No_x:	ca. 70% (5,600 kg/a)
SO_2:	ca. 87% (5,700 kg/a)	Dust:	ca. 80% (150 kg/a)

However, the problems with geothermal energy in Erding are not of a technical, but of a commercial market nature. The housing developments planned in the early 1990s were not built and occupied in the way expected, with the result that the project lacked the originally planned heat consumer volume. In 2001, the originally anticipated 23 MW were implemented, involving some 500 households in the new housing developments. The Association seeks to compensate for shortfalls in volume by acquiring existing residential areas and large facilities as customers.

When completed as currently envisaged, the consumer volume is intended to be 32 MW. At that stage, customers in the town centre, three new housing developments, and existing facilities such as schools, kindergartens, and a hospital, will be supplied by way of a 15-km-long district-heating network. A maximum thermal output of about 17.5 MW will then be produced in full-load operation. The necessary quantity of water (an estimated 24 l/s) will provide this from an energy content of 28 GWh , which corresponds to roughly 3 million litres of fuel oil.

The Erding project is very bold, for here a district-heating system has not been integrated into existing residential housing, as is commonly done, but rather new developments have been and continue to be added to the service area step by step. In the project, geothermal heat has proven its reliability as a source of energy.

Thanks to the large savings potential that it provides, the Erding geothermal heating plant was one of the schemes which the State of Bavaria presented at Expo 2000 in Hannover, under the heading of “Environment and Development”.

FURTHER INFORMATION

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