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Rödl & Partner

Status Quo of the Geothermal Project Unterhaching Significance of a Professional Project Management

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1. INTRODUCTION AND PRESENTATION RÖDL & PARTNER

In the meantime deep seated geothermal projects do not fail predominantly due to technical and geological problems. It appears more and more that the success of geothermal energy generation projects depends strongly on qualified answers in the field of risk management, financing models, project organization, profitability and contract law.

As the first large auditing, tax and legal consulting enterprise in Germany Rödl & Partner was engaged early on with the challenges of development, implementation and financing, as well as finding special public and private solutions for the utilization of deep-seated geothermal energy. In these areas we have developed significant successful standards for the whole sector. Rödl & Partner is also a member of the Geothermal Energy Advisory Board of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and consulting the World Bank.

2. STATUS QUO OF THE GEOTHERMAL PROJECT UNTERHACHING

Figure 1: Successful pump test of the second drilling in Unterhaching. The temperature of the water found in more than 3 km depth is about 130°C.

The municipality of Unterhaching near Munich will be the first community in Germany, which uses geothermal energy for district heating as well as for power production under purely economic points of view.

The aquiferous layer, the Malmkarst, should secure the supply of the municipality with approx. 22,000 inhabitants with heating in the long-term. In addition, 3.36 MW_{el} gross power output are fed into the public grid according to the renewable energy act (EEG) with a feed-in tariff of 15 €Cent/kWh_{el}.

Rödl & Partner is responsible for the overall project management of the geothermal project in Unterhaching. Currently work is going on in the community at various installations of the geothermal projects.

The production and reinjection well as well as the thermal water pipeline (length approx. 3.5 km) were completed successfully. Furthermore the heat plant (approx. 40 MW) has been commissioned and the Kalina plant is in the production phase. The first construction phase of the district heating network with a length of approximately 10 km was completed successfully. The second construction phase is currently in the stage of planning and the construction will be beginning shortly.

2.1 Innovative drilling conception

The courageous helps the luck. At the beginning of the innovative project the most optimistic forecast data (150 liters per second / 120°C) were qualified among experts nationwide as being „theoretically conceivable but practically impossible“. The municipality of Unterhaching together with Rödl & Partner did not permit to be irritated by this statement. The result could be seen in September 2004: 150 liters per second with a temperatures of 122°C were recorded. On 18 January 2007 the second drilling of the geothermal project was completed in Unterhaching with the determination of an excellent drilling success. The productivity exceeds a multiple of the results of the first drilling. Exact test evaluations will be available shortly.

Before the project in Unterhaching no deep-seated geothermal drilling in Germany was designed for such dimension, in particular these flow rates. For the energetic use of thermal water at least two drillings are necessary in principle, one well for the production of the hot thermal water, as well as one reinjection well to insert the cooled down water into the aquiferous layer.

Production and reinjection well are connected with a thermal water pipeline. Using two heat exchange systems the thermal water is cooled for the heat and power production from 122°C to about 60°C at the “Grünwalder Weg” in Unterhaching. Afterwards cooled down thermal water flows through the thermal water pipeline to the second drilling to be reinjected into the water reservoir at a depth of 3,577 m.

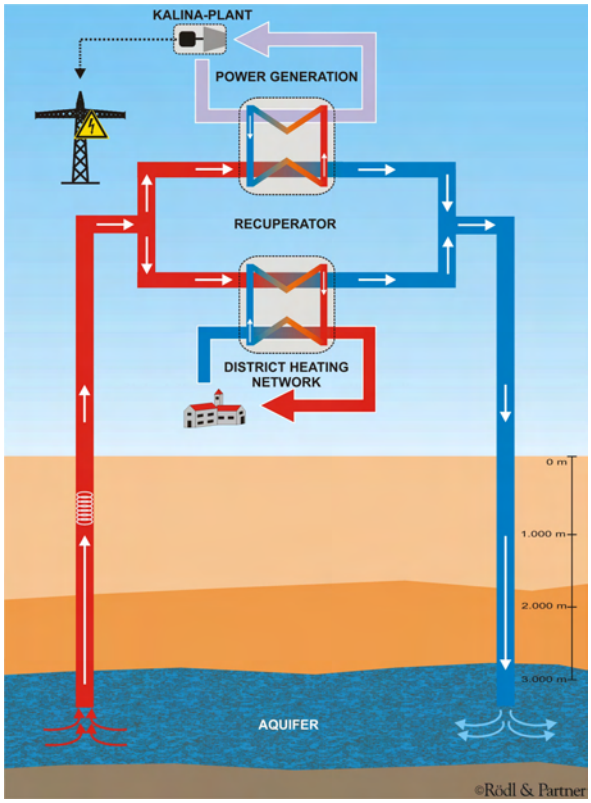

Figure 2: Concept Unterhaching: The pilot character of the geothermal project Unterhaching is visible because of the concurrent use of the deep-seated geothermal energy for electricity and heat supply. In the final construction phase 3.36 MW_{el} or almost 40 MW_{th} can be produced. Source: Rödl & Partner

2.2 Low priced and prize-stable heat supply

The geothermal energy delivers approx. 40 MW_{th} energy output whereas the construction of the district heating network takes place in two construction phases. Already in the first stage of extension 4,000 average households with a connected load of 28 MW_{th} can be supplied. In the second stage of extension the connected load increases up to a total of about 40 MW_{th}. In the long term a connected load of approximately 70 MW_{th} should be reached. The whole project is constructed as a heat-led installation, so that the power production is used as an additional source of income, however, in particular the heat customers will benefit from the advantages of geothermal energy. This constitutes a location factor increasingly gaining significance for communities.

For the project in Unterhaching an innovative pricing concept was developed by Rödl & Partner for the "Geothermie Unterhaching GmbH & Co KG" for the selling of district heat.

In contrast to the prices for the delivery of power or gas the prices for district heating are not regulated legally. However the legislator has taken into account the protective requirements of the customers in relation to a long-term development of prices. In 1967 he brought into force the AVBFernwärmeV (general terms and conditions for the delivery of heat) in which clear specifications for the adjustment of prices using sliding-price clauses were determined for district heating suppliers. According to the AVBFernwärmeV the development of district heating prices which is handed over to the customer using sliding-price clauses has to be orientated to the development of costs for production and supply of heat and has to take into account the circumstances on the heat market appropriately. These factors are in the case of a geothermal plant the investment and labor costs, the power consumption of the pump as well as expenditures for fossil fuels, which have to be used for bridging time gaps or during peaks of demand.

Therefore cost increases of fossil energy sources affect the energy rate in Unterhaching only to a fifth. The base rate in Unterhaching remains completely unaffected. Due to the almost entire isolation from fossil energy sources the heat supply through geothermal energy reaches therefore an enormous prize stability.

The following figure shows the comparison of the development of the energy rate in Unterhaching with the development of fuel oil and natural gas. To allow a comparison the figures were counted back for the last twenty years.

Figure 3: Comparison of the sliding-price clause of Unterhaching with fuel oil and natural gas; Source: Statistical Federal Office Germany

Originally the planning was designed for the fact that the power production has preference before the district heating production. In the course of the project the price spiral of oil and natural gas turned upwards. This also changed the economic bases of this pioneer project. The prices of the fossil combustibles reached a level on which geothermal heat supply became economically more attractive day after day. This led in Unterhaching to the fact that the priority of the power production was changed in favor of the heat production. Therefore Unterhaching can offer favorable and in the medium and long term prize-stable heat supply to its citizens.

The fact that already before commissioning of the district heating supply more than two thirds of the possible connected load of the first construction phase are bound by contract shows how much this is appreciated. Currently the second stage of extension of the district heating network is already in the stage of planning. With the geothermal district heating supply in combination with power production the community of Unterhaching invests for the future in a local advantage of location: favorable and prize-stable district heat supply.

2.3 Power production using the Kalina technology

On 18 November 2005 the "Geothermie Unterhaching GmbH & Co KG" and the Siemens AG signed the contract for the installation of the first Kalina plant in Germany with

an electric gross output of 3.36 MW_{el}. After the topping-out ceremony on 21 November 2006 commissioning is planned for the 3rd quarter 2007.

The advantage of the Kalina process is the more efficient heat transfer. Using a water ammonia mixture in binary circulation the evaporation can be optimized to dissipate part of the thermal energy into electric energy.

The German renewable energy act (EEG) offers an additional incentive for the entrance into geothermal energy. The power produced by geothermal plants (up to 5 MW_{el}) is remunerated by law with 15 cent/kWh_{el} for a period of twenty years.
An economic and environmental ideal utilization of the geothermal energy is reached by combined heat and power generation. Due to the combined use for power and heat generation the project executing organization reaches a high exploitation of the geothermal resource. Each year about 30.000 - 40.000 tons CO_2 are saved by the project in Unterhaching.

3. CENTRAL ELEMENTS OF INVESTORS PROTECTION

Subject areas:

- „warranty and liability“ (e.g. for drilling contracts, power generation plant, etc.),
- „closing of necessary insurances“, especially insurance for drilling exploration risk with regard to a risk distribution among the project participants as well as
- an “independent, interdisciplinary risk and project management”

make up the central elements of the investor’s protection.

4. SIGNIFICANCE OF PROJECT AND RISK MANAGEMENT

To secure an optimal development of the utilization of geothermal energy potentials a firm and well-defined allocation of competences, risk management for an early identification of problems, permanent and restrictive cost control, optimization of workflows and securing a smooth communication among all involved persons is essential.

The overall project management has to include:

- form of contracts (e.g. articles of association, lease contract, contract for work and services, drilling contract; statutes, etc.)
- legal advice (water rights, mining law, immission control law, property rights, licensing procedure, insurances)
- tax consultancy (tax optimization, incorporation)
- financing (business planning, investment planning, public subsidies)
- organization (deadline monitoring, preparation of decisions)
- costs (cost control, comparison of offers)
- technology (steering and monitoring of planning and execution)

The deep-seated geothermal project in Unterhaching also set new benchmarks in the fields of risk strategies and risk instruments. The origin for some of the most essential, meanwhile available instruments is found in the project management approach of Rödl & Partner in Unterhaching.

In fact insurance companies and financing institutes can and will put on existing instruments as for example contractors’ and erection all risk insurances or loss of profits insurances. But inspired and carried from the results on the one hand and the difficulties on the other hand, the existing instruments were “limbered up” for geothermal projects by the project know-how of Rödl & Partner among others.

Basically counts that the financing by a bank puts high demand on the security and coverage of the whole project. This requires special conditions from insurance solutions as well as contract models.

The most essential mile stones were initiated, filled with life and made use of for the first time in Unterhaching. Thereof the most important ones are:

- For the first time ever successful closing of a private-enterprise insurance agreement for the drilling exploration risk.

Up to now the drilling exploration risk constitutes the biggest investment barrier for deep-seated geothermal energy projects. It describes the risk to reach the planned flow rate and temperature with a production drilling. In Unterhaching the drilling exploration risk was solved for the first time in the private sector by Rödl & Partner in cooperation with “Münchner Rück” through the closing of an insurance for the drilling exploration risk. In the meantime this led to many further developments in the insurance industry.

- Repeated closing of a drilling contract which protects the awarding autority to a large extent.

Outstanding importance - caused by the high portion of 30-40 % of the whole investment - comes up to the contract for drilling performances. Great importance has a risk allocation fixed by contract which takes the drilling company and also its subcontractor particularly regarding technical defects during the drilling clearly into liability. Furthermore the remuneration structure of the drilling contract - "daily rate" or “fixed price per meter” - is an important aspect concerning the estimation respectively control of drilling costs, as well as a basis for the conclusion of an insurance for the drilling exploration risk. The contractual habits of the hydrocarbon industry cannot be transferred offhand to geothermal projects. In Unterhaching the concluded drilling contract in combination with an insurance concept for the drilling performances for the second deep drilling provided a maximum of security for the awarding authority.

- Conclusion of a technical and partly geological drilling risk insurance.

On base of the project experiences of the first drilling, this concept was - together with the insurance industry - developed and specified further. The drilling or parts of it are insured against an incidental damage, no matter who has caused the damage respectively from whose risk sphere the damage results. Hereby an important aspect is the coverage of the geologic risk (underground-risk) which usually is born by the awarding authority, that is an insurance for

damages which result from the underground (stresses, pressure, temperatures, condition of stones, etc.).

5. CONCLUSION

The geothermal project Unterhaching is in all fields concerned innovative and has a considerable pilot character. Geologically, drilling-technically, concerning contracts, economically and administratively. A groundbreaking success of the project management focused on economic criteria of Rödl & Partner.

Such a pilot project, whose success will have great impact on the further development of deep-seated geothermal energy in Germany and Europe, naturally implicates almost every day new challenges. The following projects will profit from the daily experiences from the geothermal project Unterhaching.

“Our project management philosophy: Technology is a means to an end. Return on investment is the success factor.”