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New Approach in the Hungarian Geothermal Exploration

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The geothermal potential of Hungary is well over the world average and except the active volcanic areas it is one of the most prospective territories in Europe. In spite of this, there is hardly any geothermal energy facility in this country, and those few are operated on a less environmentally sound basis not injecting the 100% of the produced water back. No geothermal power plant facility exist in this country, moreover such technology can not be found in the entire Central Eastern European region.

MOL is an integrated oil and gas group in Central and Eastern Europe and one of the largest company in the region in terms of sales revenues. MOL Group is committed to contributing to sustainable development: supporting research, innovation and environmental protection, promoting best practices and complying with regulations.

In November of 2003 MOL decided to set up a team to develop a Geothermal Pilot Project to explore power plant opportunities offered by geothermal resources in Hungary. This team analysed potential geographical locations where the volume and heat of extracted water would be adequate for a geothermal power plant.

The Pilot Project has been set up with investor partners. In March of 2006 MOL, Enx of Iceland and Vulcan Kft. (its owner is Green Rock of Australia) established a consortium in which MOL is the operator.

According to MOL's present concept it is possible until 2012 to establish 3-4 geothermal power plants with 2-5 MW capacity. As a result, 10-15 MW power plant capacity and 100 GWh/year electric energy can be generated from geothermal energy. With such results further development is also possible in the years begin-

ning in 2012. This concept meets with the National Renewable Energy Concept that is under preparation.

The technical concept includes utilization of existing hydrocarbon wells in the South-Western part of Hungary for producing and reinjecting thermal water. The distribution of the existing 8000 hydrocarbon wells of Hungary is presented in Figure 1. However, the exact flow rate is yet unknown because the exploration drilling focused on hydrocarbons initially, therefore now thermal water production and reinjection tests are necessary. The potential wells are 2000-3300 m deep and the water temperature is expected to be above 125°C at well-heads.

The Pilot Project well completions started in December 2006, well tests were performed early 2007. The location of the tests was in the South-Western part of Hungary, near Iklódbördöce village.

During the exploration two currently out-of-order hydrocarbon wells were converted into thermal water production or

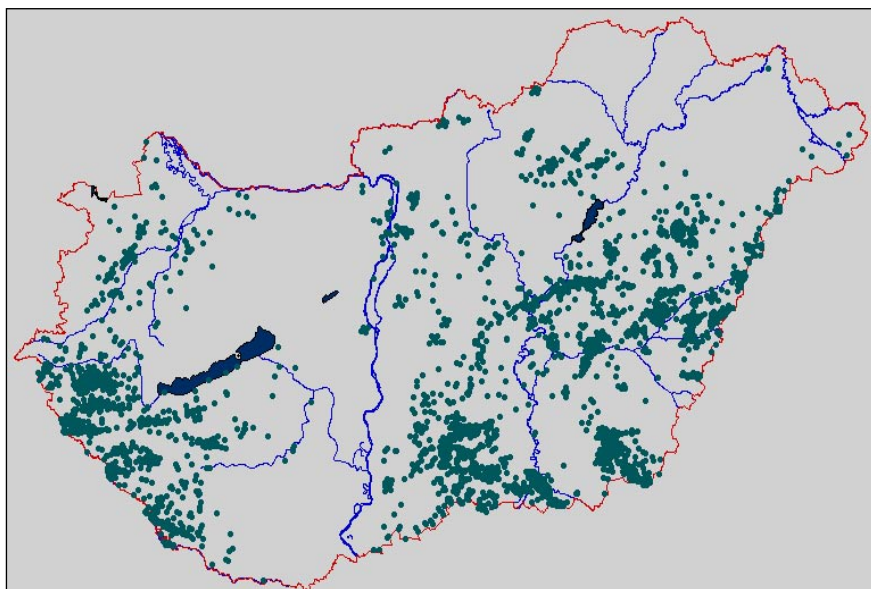


Figure 1. Distribution of the existing hydrocarbon wells in Hungary.



Figure 2. Well-head of an old hydrocarbon exploration well.

rejection wells. One of the well-heads is presented in Figure 2. From the wells thermal water was extracted into 2000 m³ pits near the wells. The construction of a pit is shown in Figure 3, the test production in Figure 4. Then the produced thermal water was reinjected back to its own aquifer through the same well. With this testing protocol, we obtained the data necessary for the construction and operation of the proposed geothermal power plant in terms of both the wells and the aquifers. From the data obtained the size and type of the technology to be installed on the geothermal energy can be determined. Based on the currently available data the output of the first geothermal power generating facility has to be above 1.5 MW in order to be profitable.

Utilizing abandoned hydrocarbon wells, establishing an international consortium for thermal water exploration, the unusual depth, the fairly high temperature (in the European continent), the focus on power plant establishment highlight a new approach in Hungarian geothermal exploration. The MOL-Enex-GreenRock pilot project started a new segment in the Hungarian geothermal exploration history. The main characteristics of this new segment are:



Figure 3. Construction of a 2000 m³ pit for well testing.

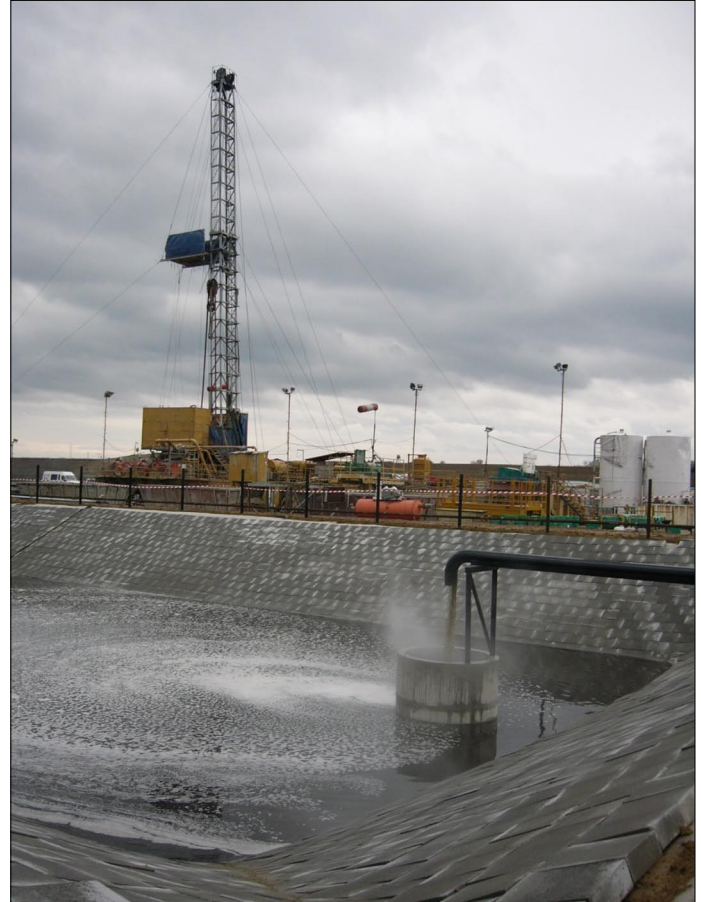


Figure 4. Well testing in South-West Hungary, February 2007.

- deeper wells (2-4 km)
- higher temperature(120-170 °C)
- reinjection 100% of the produced thermal water into its own reservoir.

Besides the technical activity the Project has some financial curiosities as well. Geothermal projects are not competitive with hydrocarbon projects, therefore all possible sorts of financial support and subsidy are inevitable.

Return may be ensured by the weighted average take-over price of 24.76 HUF/kWh (13.4 UScents/kWh) applicable for electricity generated by the use of renewable energy resources and to a small extent the sales of the so-called residual heat discharged by the power plant to direct consumption customers. Obligatory takeover price for electricity produced from renewable energy is regulated by the provisions of the Hungarian Electricity Act, as it is shown in Figure 5.

High productivity makes geothermal projects competitive among the renewable energies. Operating time is over 7000 hours/year. It means HUF180 – 200 million income per year.

According to the calculations, breakeven point of a power plant project is 1.6 MWe plant capacity + 2 MWt thermal heat sales without any external support.

Table 1. Development of the takeover price of the electricity produced from renewable energy. (1 USD ~ 190 HUF)

Issue date of regulation	Dec. 2002	Dec. 2003	August 2004	January 2005	July 2005	Calc. 2007	Germany
Weighted average takeover price HUF/kWh	17,45	18,46	18,01	18,89	23,00	24,76	40,00

The costs of the exploration phase (about 5 million USD) is necessary to confirm that the power plant is feasible at all (in case of successful exploration this amount is absorbed by the project). This is the main risk factor of the project. Key question in financial concept is the handling of this geological risk by financial method (Exploration Risk Guarantee).

These are the reasons why the geothermal power plant project is exposed to high level of risk. In order to mitigate

this risk an Exploration Grant Agreement has been signed with Worldbank-Global Environment Facilities. In case of the exploration fails because of low thermal water flow rate, Worldbank refunds a significant rate of the financial loss.

The MOL-Enex-GreenRock Pilot Project finished its well completion and testing activity. Evaluation of the data is going on now. The Operator collected all measured information and provided the documents for the international consultant team that contracted to prepare the Feasibility Study. Based on the Feasibility Study partners will make decisions not only on the Pilot Project, but also on a middle-term program. Independently from the final result of the Pilot Project a Middle-term Geothermal Program is under planning with several projects that aims small-scale power plants as well as direct-heat technologies. This program can be a stable basis of the development of Hungarian geothermal energy industry.

