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GEO ENeRGY

Promoting *R&D capability* in the service of European Industry

Geothermal Exploration in Hungary

Last year MOL Hungarian Oil and Gas Plc. and its partners launched a Geothermal Project that aims to develop the first geothermal power plant in Hungary.

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 facilities in this country, and the majority of them are operated on a less environmentally sound basis by not re-injecting the water. This pilot project looks to use this large geothermal resource in Hungary.

The site of geothermal exploration is near a small village Iklódbördöce in the South-Western region of Hungary. The site will be fully investigated to establish if it is possible to produce and reinject thermal water of appropriate temperature. Then the decision on the location of the planned geothermal power plant, construction and the type of the power plant will be made based on these findings.

During the formation of the geological concept at the beginning of the project the project team made some significant decisions, based on the geology, technical feasibility, environmental legislation and costs:

- There would be 100 % re-injection of the produced thermal water into the same reservoir, not only because of the environmental regulations but also because of technological causes.
- The project would focus on fractured karstic reservoirs (instead of sandstones), which would provide a better chance of re-injection.
- Risk optimisation will be preferred to fluid temperature dominance to increase the feasibility of the project.
- Existing hydrocarbon wells would be used in order to save costs and gain the existing geological information.
- The well doublets will be tested in order to establish if they can be utilised for re-injection.

The investors in the project wanted to utilise existing hydrocarbon wells. By using the existing wells a large amount of existing geological and thermal data could be exploited. These wells will also be re-used for injecting thermal water, if they are proved to be suitable when tested. The two existing wells designated for testing purposes in the thermal energy exploration phase were originally hydrocarbon exploratory wells. The wells targeted the potential hydrocarbon resources, not the aquifer this project is investigating for geothermal energy. Therefore the aquifer at three kilometres depth is poorly understood.

In order to determine what the output of the power plant will be, well testing will be necessary. The wells are 2500–3200 m deep and the water temperature was expected to be above 135°C at well-heads. These parameters enable the investors to establish the reservoir could sustain a 2–5 MW geothermal power plant.

By utilizing the abandoned hydrocarbon wells, the unusual depth of the reservoir, the fairly high temperature (for the European continent), 100 % re-injection of the cooled thermal water in closed system and the focus on power plant establishment is a new approach for Hungarian geothermal exploration.

Fig. 1: The first well tests in South-Western part of Hungary in January 2007

Progress on the project so far is that in early 2007 the operator performed the necessary well completions and testing (Fig. 1) on the selected two wells. The testing consisted of two main phases. Firstly thermal water was produced with nitrogen gas lifting into a 2000 m^3 pit. This phase was followed by the re-injection of the produced water into the same reservoir. The test results are currently being evaluated. The preparation of the Feasibility Study is expected in June 2007.

The project is risky from geological point of view. Therefore three companies, the Hungarian MOL Plc, the Icelandic Enex hf and the Australian GreenRock Vulcan Energy Kft formed a consortium for financing the project in which MOL is the operator. The conclusion of an Exploration Grant Agreement with the World Bank – Global Environment Facility serves the risk management as well.

This is a pilot project and partners are investigating the feasibility of a medium-long term geothermal concept. If this project is successful the first Central-Eastern European geothermal power plant can be established in Hungary.

Considering the fact that MOL has thousands of wells of hydrocarbon, more than one hundred of which “are capable of” producing or re-injecting thermal water, current estimates based on pre-feasability studies show that it would be possible to construct 3–4 power plants by 2012. In this case the electricity production from geothermal energy could prove to be prospective in the long run.

Attila Kujbus

Geothermal Fields of Greece

Greece is one of the most favored countries of Europe regarding geothermal energy. The deep tectonic structures and the young to recent volcanism have created a large number of shallow geothermal fields both of low and high enthalpy.

According to national legislation, geothermal fields are divided to high enthalpy when temperature exceeds 90°C and to low enthalpy when the temperature ranges from 25° up to 90°C. Below 25°C they are considered groundwater and ground suitable for Ground Source Heat Pumps (GSHP).

Fig. 2: “Proven” and “possible” geothermal fields in Greece

Fields are characterized as “proven” when their features are known with a level of confidence greater than 90 % and “possible” when this level is between 70 and 90 %. The rest of the fields are considered as “unexplored” areas or “unknown”. The procedures for the licensing of fields are different for the three groups and for GSHP.

Twenty-three “proven” and “possible” fields are known (see Fig. 2), two of which are of high enthalpy. The high enthalpy fields are located in the South Aegean Volcanic Arc, and are related to Quaternary volcanism in the islands of Milos and Nisyros. The exploitable potential of the existing wells exceeds 25 MWe of installed electric capacity and the possible potential exceeds 250 MWe. The temperatures reach 400°C. At present they are not in use. One more prospective area is close to Argenos, Lesvos Island, where deep drilling is under preparation by the Public Power Corporation (P.P.C.).

There are twenty-one “proven” and “possible” low enthalpy fields located all over the country. The geological environments are: Tertiary volcanic areas, deep water circulation along structures in grabens, and areas with diapiric evaporites. Their potential exceeds 200.000 T.O.E. (tons of oil equivalent) per year. A small percentage of those (~ 20 % of the potential) are exploited for various uses, such as balneology (50 % of them) in more than 50 spas, heating in greenhouses, some fisheries, space heating, vegetables drying, and special aquacultures such as Spirulina algae.

The “unexplored” or “unknown” fields are potential prospects where hot springs are known and amount to more than fifty all over the country.

One sector with fast development is the GSHP. During the years 2006 and 2007 some tens of units have been installed mainly in houses and the number is increasing rapidly.

George Hatziyannis

Carbon Sequestration Leadership Forum

The international Carbon Sequestration Leadership Forum (CSLF) is a voluntary climate initiative of developed and developing nations. It focuses on development of improved cost-effective technologies for the separation and capture of carbon dioxide for its transport and long-term safe storage. The purpose of the CSLF is to make these technologies broadly available internationally; and to identify and address wider issues relating to carbon capture and storage.

The CSLF charter was signed on June 25, 2003 in Washington, DC, USA. Current members are: Australia, Brazil, Canada, China, Colombia, Denmark, the European Commission, France, Germany, Greece, India, Italy, Japan, Mexico, the Netherlands, Norway, Russia, Saudi Arabia, South Africa, South Korea, the United Kingdom and the United States. At present, the membership accounts for 75 percent of all manmade carbon dioxide emissions. Membership is open to national governmental entities that are significant producers or users of fossil fuel and that have a commitment to invest resources in research, development and demonstration activities in carbon dioxide capture and storage technologies.

CSLF members engage in cooperative technology development aimed at enabling the early reduction and steady elimination of emissions that account for more than 60 percent of the world's CO_2 – those of electric generation and other heavy industrial activity. Pending business includes the first direct involvement of the developing nations, like China and India, in matters relating to the potential curtailment of industrial carbon dioxide. CSLF marshals intellectual, technical and financial resources from all parts of the world to support the long-term goal of the United Nations Framework Convention on Climate Change – the stabilization of atmospheric CO_2 concentrations in this century. Members are dedicated to collaboration and information sharing in developing, proving safe, demonstrating and fostering the worldwide deployment of multiple technologies for the capture and long-term geological storage of carbon dioxide at low costs. As well as establishing a companion foundation of legislative, regulatory, administrative, and institutional practices that will ensure safe, verifiable storage for as long as millennia.

Collaborative projects may be undertaken by the CSLF. This includes projects involving information exchange and networking, planning and road-mapping, facilitation of collaboration, research and development, demonstrations, public perception and outreach, economic and market studies, institutional, regulatory, legal constraints and issues and support to policy formulation.

The latest Annual Meeting of the CSLF took place in Paris on 26–28th March 2007. In addition to the normal governmental meetings involving the 22 member countries, some 200 delegates attended a special open workshop on overcoming the barriers to the deployment of carbon capture and storage. The workshop was opened by a keynote presentation on the European Zero Emission Fossil Fuel Power Plants (ZEP) Technology Platform, emphasising the importance of this initiative and its impact on the EU Energy Package published in January 2007.

Vit Hladik &
Niels Peter Christensen
(with the aid of www.cslforum.org)

This article is a Link & Liaison activity of the CO2NET EAST project.

ENhanced Geothermal Innovative Network for Europe

The contribution of geothermal energy will be a key factor to achieve the objectives of the European Commission for the development of renewable and sustainable energy.
The European Commission support for geothermal energy research has been constant since the end of the eighties, significantly increasing in the 6th Framework Programme for research and technological development.
The ENGINE Coordination Action (ENhanced Geothermal Innovative Network for Europe) started in November 2005.
Its main objective is to co-ordinate present R&D initiatives for Enhanced Geothermal Systems (EGS), ranging from the resource investigation and assessment stage through to exploitation monitoring. Thirty-five partners are involved in ENGINE, representing 15 European Countries plus Mexico, El Salvador and Philippines.

The project has reached its mid-point. During this time it has organised 2 conferences and 3 specialised workshops. Information available on the website http://engine.brgm.fr already show the work that has been completed. Synthesis concerning 'Electricity generation from EGS', 'Environmental impacts by the use of geothermal energy', 'Stimulation of reservoir and microseismicity' and 'Defining, exploring, imaging and assessing reservoirs for potential heat exchange' reveal a strong motivation of the scientific community for updating the framework of activities, preparing a Best Practice Handbook and defining new ambitious research projects. Already, an innovative project dedicated to the role of induced seismicity in EGS has been prepared following the 1st call for proposal of the 7th Framework Programme and is considered as a spin-off project from ENGINE.

In relation with the increasing price of energy and limitation of greenhouse gas emission, there is a noticeable increase in interest from industry in geothermal energy. ENGINE is now well known as a scientific exchange platform, for promoting past and on-going experiences by making them visible and reproducible. Through a recently established stakeholder committee, ENGINE could also become a "political" platform. It aims to establish a permanent working group that would have the technical and economic background to set up an industrial and public European consortium. This consortium could then define an ambitious strategy up to 2030, which could see shared-risk projects at a European scale. The proposal to evaluate the geothermal potential of former oil and gas fields could also be one way to limit the risk and start new demonstration projects.

Patrick Ledru

Fig. 3: Part of geothermal power plant of Larderello – Italy (120 MWe capacity)

EU 7th Framework Programme & GeoEnergy

The broad objectives of FP7 have been grouped into four categories: **Cooperation, Ideas, People** and **Capacities**. For each type of objective, there is a specific program corresponding to the main areas of EU research policy. All specific programs work together to promote and encourage the creation of European poles of (scientific) excellence.

Cooperation (budget 32 billion €)
Across all these themes, support to trans-national cooperation will be implemented through:
- Collaborative research
- Technology Platforms
- Joint Technology Initiatives
- Coordination of national research programs

Capacities (budget 4 billion €)
Support to research infrastructure, SMEs, science & society, research policy and international cooperation.

Ideas (budget 7.5 billion €)
A program that aims to enhance dynamism, creativity and excellence in European research at the frontier of knowledge by supporting 'investigator-driven' research projects across all fields by individual teams competing at a European level.

People
The FP7 programme's activities will be based on the long and successful experience of the **Marie Curie actions** and will cover all stages of a researcher's professional life, from initial research training to life-long learning and career development.

First call for ENERGY
The call was announced in December 2006, with a deadline for applications in May of 2007. The call covered a wide range of topics. Zero Emission Power and CCS was the main area of relevance for geo-energy while two topics were identified within geothermal energy (heat pumps and down-hole equipment).

CO2 Capture and Storage included a range of topics:
- CO2 Capture - four topics on capture and separation
- CO2 Storage - one topic on geological (saline aquifer) storage

Clean Coal Technologies included:
- Three coal-related topics including gasification and poly-generation

Cross-cutting actions between CCS and Clean Coal
- Integrated Zero Emission solutions – three topics on integration, socio-economics, CO_2 value chain
- Cross-cutting & regulatory issues – four topics on regulations CCS and ZEP plants, value chain for other greenhouse gases, international collaboration

The Work Programme will be updated annually. The European Technology Platform for Zero Emission Power (www.zero-emissionplatform.eu) will provide contributions towards these regular updates. The 'Annual Work Program for 2007' (cooperation theme 5: Energy) can be downloaded at www.cordis.europa.eu/fp7.

Niels Peter Christensen

Award: ENeRG Student Prizes

Two ENeRG Student Prizes for the best presentations in the field of geo-energy applications were first announced in 2006 for the EAGE/SPE EUROPEC conference in Vienna. Francois Schaub (Ecole des Mines de Paris, Department GSYS/ Geophysics) in the category "Best Student Paper", with his paper entitled "Geostatistical Impedance Simulation after Pre-Stack Depth Migration", and Milana Ayzenberg (Norwegian University of Science and Technology, Department of Petroleum Engineering and Applied Geophysics) in category "Best Student Poster", with her poster entitled "3D Seismic Diffraction Modelling in Multilayered Media in Terms of Surface Integrals", won the prizes in Vienna.

The ENeRG Steering Committee announces ENeRG Student Prizes worth Euro 1,000 for research in one of the applied fields of geo-energy for the second time. At the EAGE/SPE EUROPEC London Conference (11–14 June 2007) the ENeRG board will select Best Student Paper and Best Student Poster. The prizewinners will be chosen on the basis of the evaluations carried out by EAGE. The awards will be given to the students who are the primary authors of the best contributions from a student in one of the applied fields related to geo-energy.

Alla Shogenova & Patrick Corbett

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