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IGA NEWS

Newsletter of the International Geothermal Association

IGA ACTIVITIES

Message from the President

Ladislaus "Ladsi" Rybach

Manifold activities emerged from the decisions and action plans developed at the 44th BoD meeting in Reykjavik on 11 October 2007. First of all, the operational relations with the IGA Officers Ruggero Bertani (Vice President), Gestur Gíslason (Secretary), Colin Harvey (Treasurer), and last but not least Arni Ragnarsson (Executive Director) have been established and strengthened. The IGA Committees, as formed at the 44th BoD meeting and publicized in IGA News no. 70, had to be extended in order to comply with the IGA Bylaws, which prescribe their composition. This process is close to completion. Besides the publication and distribution of IGA News no. 70, the spearheads of the Information Committee, Eduardo Iglesias and Zbignew Malolepszy, were also active in updating the IGA website.

Participants in the 44th BoD meeting, Reykjavik

On 25 January 2008, the Chairman of the IGA European Branch (ERB), Orhan Mertoglu, turned in the list of further, newly elected Forum members: Vice Chairman: Miklos Antics, Secretary: Sanja Popovska Vasilevska, Treasurer: Christian Boissavy, Membership: Marcel Rosca, International relations: Burkhard Sanner, Education: Kiril Popovski. Further members, especially those responsible for Bylaws, Information, Program and Planning, will be announced soon.

The IGA Western Pacific Regional Branch (WPRB) prepared and will implement the IGA/INAGA Joint Technical Seminar *"Cost reduction through improved geothermal well targeting"* to take place at Melia Bali Hotel, Nusa Dua, Bali/Indonesia on 26-28 April 2008,

with lecturers Jim Lawless (SKM New Zealand) and Hiroyuki Tokita (WestJec Japan). IGA provided, through its Education Committee, financial support for this important event. The corresponding agreement was signed by WPRB President Jim Lawless, Education Committee Chairman Horst Rueter, and the IGA President on 10 February 2008.

A constantly important IGA task is to emphasize to politicians, decision makers as well as to the general public the great potential, the environmental advantages, and economic benefits of geothermal energy. It is of equal importance to have a strong voice within the chorus of the other renewable energies. A perfect platform for this is the affiliation of IGA with IREA, the International Renewable Energy Alliance, which assembles the world solar, wind, hydro, and geothermal associations. At a special IREA event, *"Community and Bottom-up Strategies Driving 100 % World Wide Renewable Energy Future"* – organized on 6 March 2008 along with WIREC (the Washington International Renewable Energy Congress) – the participants were addressed by IGA Vice President Ruggero Bertani, who also delivered a keynote speech at WIREC itself. Past President John Lund had a keynote lecture at the World Future Energy Summit in Abu Dhabi (22-23 January 2008). Invitations for keynote presentations have been issued to the IGA President for the World Renewable Energy Congress X (Glasgow/UK; 19-25 July 2008) and for Renewable Energy 2008 (Busan/ Korea; 12-17 October 2008).

Education Committee Chairman Horst Rueter and Finance Committee Member Gordon Bloomquist are now working intensively, along with Executive Director Arni Ragnarsson, to comply with the educational obligations towards the World Bank GeoFund. The following are currently in discussion and preparation:

- International Geothermal Workshop 2008 (exploration, development, economic, regulatory, and financial aspects of geothermal energy)
- Compilation and dissemination of state-of-the-art in mineral extraction from geothermal brines
- Geological Risk Insurance Workshop
- Case studies on best practices in geothermal development.
- Identification of barriers for geothermal development and provision of advisory services to ministries in priority countries.
- Assistance in evaluation of GeoFund project proposals.
- Further activities such as the establishment of a roster of experts and of a GeoFund website are also ongoing, expertly coordinated by our Executive Director.

In January/February 2008, a special Task Force of former and present IGA Officers (Past President John Lund, the current President, Vice President Ruggero Bertani, Executive Director Arni Ragnarsson, complemented by Ernst Huenges from GeoForschungZentrum Potsdam and led by Past President Ingvar Fridleifsson) prepared an important input document for the IPCC (=the Nobel Peace Prize-winning Intergovernmental Panel on Climate Change): *"The possible role and contribution of geothermal energy to the mitigation of climate change"*. This document will be a key reference text for the geothermal community.

Finally, the BoD is engaged in all the preparations for WGC2010 in Nusa Dua, Bali/Indonesia. The 45th BoD meeting (29 April 2008), preceded by Committee Meetings (28 April), will be held in Nusa Dua – along with the Joint WGC2010 Organizing Committee & WGC2010 Special Committee meeting (28 April 2008). At the Board meeting, the venues of the 46th BoD meeting as well as of the 2008 Annual General Meeting will be fixed.

New edition of international yearbook WIND ENERGY INTERNATIONAL 2007/2008

Eduardo Iglesias, IGA News Editor

IGA is a partner of the International Renewable Energy Alliance (IREA, www.ren-alliance.org). The other partners are the World Wind Energy Association (WWEA), the International Hydropower Association (IHA) and the International Solar Energy Society (ISES). IREA is a coalition advocacy group, building linkages of common interests within the renewable energy community and facilitating information and contacts to other relevant business, technical, conservation, research, civil society, governmental and international organizations.

As part of the alliance collaboration, our fellow partner WWEA has requested publication in IGA News of the following letter.

Dear international wind energy friend,

The second edition of the WWEA yearbook **Wind Energy International 2007/2008 is now available and can be ordered**. This international yearbook for wind energy gives an comprehensive and updated overview of the current state of wind energy utilisation around the world.

Highlights/Basic contents of Wind Energy International 2007/2008:

- Country Reports with basic and up-to-date information on 66 countries providing a comprehensive overview of the status of wind power in the world regions, including information country by country on electricity sector, market situation, legal conditions, wind resources, and more.

- Special Reports on the most important aspects of the international wind energy deployment: education and training, policies, economies and markets, integrating renewable energies, small scaled wind and hybrid systems, grid connected systems and wind farms onshore and offshore, financing as well as research and development of technology.

- Contributors are leading wind energy experts from national wind energy associations, international organisations, industry, science, and governments.

- 344 pages, numerous tables, pictures, graphics.

- Price: 90 EUR, rebates for WWEA members and bulk orders.

Statements on the first edition:

• *"This book should not be missing from the bookshelf of any self-respecting wind turbine stakeholder. Make sure you get one!" (Book review from Windtech International) .*

• *"It is a great work you have done that gives many necessary contacts and good overview of wind market around the world" (Jaan Tepp, Chairman Estonian WPA) .*

• *"Just received Wind Energy Intl 2005/2006 (...) very interesting ... been reading it four last hours... The interesting thing is that it comes from different authors so it gives you more room to project & imagine wind power's future" (Khalid Benhamou, Managing Director Saharawind, Morocco).*

More information, the table of contents and an order form is available at: www.wwindea.org. You may order also directly at the WWEA bookshop: http://www.wwindea.org/home/index.php?option=com_performs&formid=3&Itemid=78

We are looking forward to your order.

With kind regards
Stefan Gsänger
- Secretary General -
Frank Rehmet
- Director Publications -
World Wind Energy Association
WWEA Head Office

Charles-de-Gaulle-Str. 5
53113 Bonn
Germany
Tel. +49-228-369 40-80
Fax +49-228-369 40-84
secretariat@wwindea.org
www.wwindea.org

New editorial team in Geothermics

From January 2008, Elsevier Ltd (www.elsevier.com) is now the sole publisher and owner of *Geothermics* - International Journal of Geothermal Research and its Applications. The journal was previously published by Elsevier for Istituto di Geoscienze e Georisorse (IGG-CNR) (Institute of Geosciences and Earth Resources), Pisa, Italy. IGG remains affiliated with the journal, as does The Geothermal Research Council and the International Geothermal Association.

Marcelo Lippmann (editor) is joined by a new board of editors: Sabodh Garg of SAIC is co-editor of the journal with Dr. Lippmann and also has responsibility for submissions from the Americas. Greg Bignall of GNS Science, Wairakei Research Centre, New Zealand, and John Garnish (former Program Manager, European Commission, Brussels) are the Associate Editors for Asia/Pacific and Europe/Middle East/Africa, respectively. Elsevier would like to thank the outgoing editorial team of Marnell Dickson, Joe Moore and Stefano Bellani for their many years of dedicated work on the journal.

Geothermics will continue to be available in print and online through ScienceDirect (www.sciencedirect.com) with the first 2008 issue published in February 2008. For more information on any of the topics raised here please contact Clare Lehane, Publishing Editor, (c.lehane@elsevier.com) or Henri van Dorssen, Publisher (h.dorssen@elsevier.com).

Geothermics aims to publish high quality, relevant papers and we encourage you and your colleagues to continue supporting the journal through further submissions of your work.

EUROPE

The Soultz EGS power plant: from the concept to power production

Albert Genter, Daniel Fritsch & Nicolas Cuenot. EEIG Heat Mining

Abstract.
The European EGS project at Soultz-sous-Forêts (France) has been under investigation since 1987 with the aim of producing power by the extraction of heat stored in deep, fractured crystalline rocks. Extensive research and development contributed to a better understanding of the geothermal reservoir: large-scale hydrothermal circulation occurs within a network of large permeable faults developed within a Tertiary graben. Three deep wells have been drilled from the same platform to 5 km where the rock temperature is 200°C. At depth, the horizontal distance between the producing wells is 1.3 km, with the injection well located midway between them. Several hydraulic and chemical stimulations have been performed and combined in order to reactivate the system of fractures, which are often sealed by natural hydrothermal deposits. This led to improvement of the injectivity and productivity of the wells. After a successful 5-month circulation test carried out in 2005, we are now building a pilot power plant. Two types of production pump will be tested for this purpose, and the first ORC conversion module of 1.5 MWe will be installed and tested at the beginning of 2008. If the results are promising, a second ORC module should be installed.

Introduction
The European EGS (Enhanced Geothermal Systems) project located at Soultz-sous-Forêts, Alsace, France started 20 years ago to develop non-conventional geothermal resources for power production. It was instigated by a French and German team, and, more recently, a Swiss team, with the support of the European Commission. The aim of the project is to produce electricity from the heat stored in deep crystalline rocks. As the geological conditions are very specific, meaning that there is no evidence of thermal activity on surface compared to other conventional high enthalpy geothermal fields,

Table 1: Milestones during the implementation of the Soultz EGS project between 2001 and 2008.

Year	Milestones
2001	Decision to build an EGS Pilot Plant at Soultz.
2002	Drilling of well GPK3 to 5000 m, 6 m from the GPK2 wellhead. Horizontal distance at TD between the GPK2-GPK3 open holes is about 650 m.
2003-2004	Open-hole stimulation in GPK3 and circulation tests between GPK3 and GPK2. Drilling of well GPK4 to 4985 m.
2004-2005	Open-hole stimulation in GPK4, followed by circulation tests between the central injection well (GPK3) and the two lateral production wells GPK2 and GPK4.
2006	Improvement of the hydraulic performances of the wells by chemical stimulation.
2006-2008	Geothermal energy production and power generation.

the project needed extensive research and development.

The main objectives of the research were a better characterization of the underground geothermal reservoir leading to an optimization of the reservoir performance. This corresponded to the first phase of the pilot project, during which three deep boreholes were drilled between 2001 and 2005 to a depth of 5 km and subsequently tested by hydraulic and chemical stimulations. The second and current phase of the project consists of building a pilot power plant. A first demonstration module of 1.5 MWe is being installed, as well as all surface facilities (Table 1). The chosen heat-power conversion scheme is the Organic Rankine Cycle (ORC). This conversion module should be tested at the beginning of 2008 in order to get an estimate of the sustainability of the geothermal system, mainly linked to the long-term stability of the temperature of the produced fluid. The generated power will be injected into the French power network.

Geological context

Soultz-sous-Forêts is located in the north-eastern part of France in the northern part of the Upper Rhine Graben. This site was chosen because of the observation of a large thermal anomaly in the region and because of a good knowledge of the shallow geology, due to former oil exploitation in this Tertiary graben. The shallow geology (0 to 1400 m depth) consists of sedimentary layers, overlying the crystalline basement which consists of late-Palaeozoic granites containing hydrothermally altered and fractured zones related to graben normal faults. The geothermal gradient exhibits an irregular shape: around 10°C/100 m in the first 1000 m, then a decrease to 1.5°C/100 m to 2500 m depth and finally 3°C/100 m to 5 km depth. The variations of the gradient are related to the presence of convective cells and fluid circulation within the granite basement. It has been observed that deep fluid circulation is supported by the network of permeable fractures.

Extensive research has been done to characterize the properties of the fractures. Geophysical borehole measurements including borehole image logs, coring and cuttings analysis showed that nearly-vertical fractures, which show a low permeability, are oriented in an almost North-South direction. Moreover, it appears that most of the fractures are sealed by hydrothermal deposits, mainly calcite, silica and clays, decreasing the overall permeability of the system. Five deep boreholes have been drilled into the granite basement at the geothermal site: two exploration wells in an earlier phase of the work (TD 2200 m and 3600 m) and the three geothermal wells (5000 m depth). Most of them were stimulated at least once to improve their connection to the fracture network.

Enhancing the hydraulic performance

As the natural permeability is rather low, it is necessary to improve the hydraulic performance of the geothermal system by hydraulic and/or chemical stimulations. Hydraulic stimulations consist of injecting several thousands of cubic metres of water at high flow rates in order to increase the down-hole pore pressure, which tends to induce shearing along the fractures planes. This mechanism can help to create permeability within fracture planes, as the sealing deposits are removed, and also connect permeable fractures between them. The direct consequence of hydraulic stimulation is induced microseismicity. On one hand, this could have a negative impact on the population, as some of the earthquakes of larger magnitude (generally higher than 2) can be felt in the surroundings but, on the other hand, induced micro-seismicity is a method of monitoring the effectiveness of the treatment. Analysis of the extension and the density of the "microseismic clouds" can give insights about permeability improvement within the geothermal reservoir. More than 10,000 seismic events may be recorded in each test. At Soultz, the stimulated volume is around 2 km long, 0.5 km wide

Figure 1. The Soultz ORC power plant: installation of the generator

and 1 km deep. The highest density of microseismic events is observed in the vicinity of the bottom holes, meaning that hydraulic stimulations are most effective in that area. However, such a technique of reservoir development was deeply discussed, and the relationship between permeability enhancement and stimulation of fractured rocks as well as the physical mechanisms associated with stimulation are not yet fully understood.

As the hydraulic stimulations were not efficient enough, several tests of chemical stimulation were performed with the aim of both increasing the hydraulic performance and limiting the seismic activity. The goal was to try to dissolve the hydrothermal deposits sealing the fractures. Therefore a small proportion of chemical compounds, such as diluted HCl or HF, was added to the injected water. A programme was defined by selecting several products aiming to dissolve minerals like clays, feldspars, micas and calcite.

As a result of all the hydraulic and chemical stimulation tests, improvements of hydraulic performance of the boreholes were achieved:

- GPK2 well. The initial productivity value, before any stimulation, was estimated between 0.01 and 0.03 l/s/bar. After all stimulation tests, the productivity was increased to around 0.8 l/s/bar; this value was estimated during a circulation test and is close to the expected goal of 1 l/sbar.
- GPK3 well. An initial productivity value of around 0.3 l/s/bar was calculated. After hydraulic and HCl stimulation, this value remained almost unchanged at 0.35 l/s/bar. It rose up to 0.39 l/s/bar after chemical stimulation.
- GPK4 well. After two hydraulic stimulation tests, the productivity index has been increased from an initial value of 0.01 l/s/bar to 0.2 l/s/bar. The present stable value is around 0.5 l/s/bar.

Figure 2. The Soultz ORC power plant: the air-cooling system (on the right) and the turbine (on the left)

The geothermal ORC power plant

Based on the above exploration and reservoir developments, it was decided to test a first energy conversion module of 1.5 MWe. The different components of the power plant have been installed and power production should begin in April 2008 (Fig. 1). To reach this goal, it is necessary to install production pumps into the boreholes in order to boost the production flow. Two types of pump will be tested, a line shaft pump (LSP) and an electro-submersible pump (ESP).

- The LSP itself is in the well, the electrical motor is at the surface and the connection is made with a shaft. The main advantage is that it avoids installing the motor in a hot brine, but the installation depth is limited and there are mechanical risks with the shaft, which has to be perfectly aligned. Issues related to corrosion and lubrication of the shaft should also be carefully studied. The pump will be installed into GPK2, which is the best producer, at a depth of 350 m in a section with good verticality .
- With the ESP, both the pump and its electric motor can be installed in the well at any required depth. The technology is well-known for standard conditions, but the problem is to adapt the pump to geothermal conditions: the high operating temperature and resistance to corrosion require a specific design. The pump will be installed in GPK4, which is a low producing well, at a depth of 500 m.

Due to the high salinity of the geothermal brine, the geothermal fluid cannot be directly vaporized into the turbine. Therefore we use a secondary loop involving a low boiling point working fluid (isobutane). As the primary purpose of

the project is to demonstrate the feasibility of power generation with such a binary system, the Organic Rankine Cycle (ORC) technology has been chosen. In that frame, the geothermal fluid (expected production temperature: 175-185°C) enters a first heat exchanger and transfers the heat to the working fluid, which is transformed into its vapour phase to feed the radial turbine. As there is no easily accessible shallow aquifer around the geothermal site, an air-cooling system was required for the power plant, which also limits the impact on environment. It consists of a 9-fan system. The turbine is radial and should operate at around 13,000 rpm. The generator is asynchronous and runs at around 1,500 rpm (Fig. 2). The generator will deliver 11 kV and the produced power will be injected into the 20 kV local power network.

When all the components of the plant have been installed and connected, the ORC unit is planned to run with the geothermal water produced by the LSP from GPK2 only. In parallel, the second production well GPK4 will be tested with the ESP pump but it will be connected directly to a cooling loop. It is also useful to have this secondary system in case of maintenance or shut-down of the power plant. As stopping the down-hole production pumps should be avoided, production can be transferred to this cooling loop. It involves other heat exchangers and a second air-cooling system to simulate the transfer of heat from the geothermal water.

The system is built so that the production coming from each well or both can easily be used to feed either the power production loop or the testing loop. If the sustainability of the production is established, then one additional ORC unit of 1.5 MWe could be added to increase the power production of the plant.

The Heerlen Minewater Project

(Compiled by the editorial team from information published by the Heerlen Minewater project)

In April 2006, following a Board meeting in Brussels, the IGA Board of Directors visited the Minewater project at Heerlen, in the Netherlands, to see the first stage in a European project aimed at establishing the practicality of using mine waters to supply district heating and cooling.

Heerlen is underlain by an abandoned and flooded coal mine.* When the mine was closed, the mine galleries flooded. The lower galleries filled with warm water and upper galleries with cool water. The local authorities had been concerned about the effect of rising mine waters on local potable waters, but at the same time recognized that the mine waters could be a natural and sustainable source of heating and cooling.

After feasibility studies lasting several years, Heerlen joined Midlothian, in the UK, in an EU-funded project to test the concepts; similar studies are now underway in Aachen (Germany) and Lorraine (France) within the same framework.

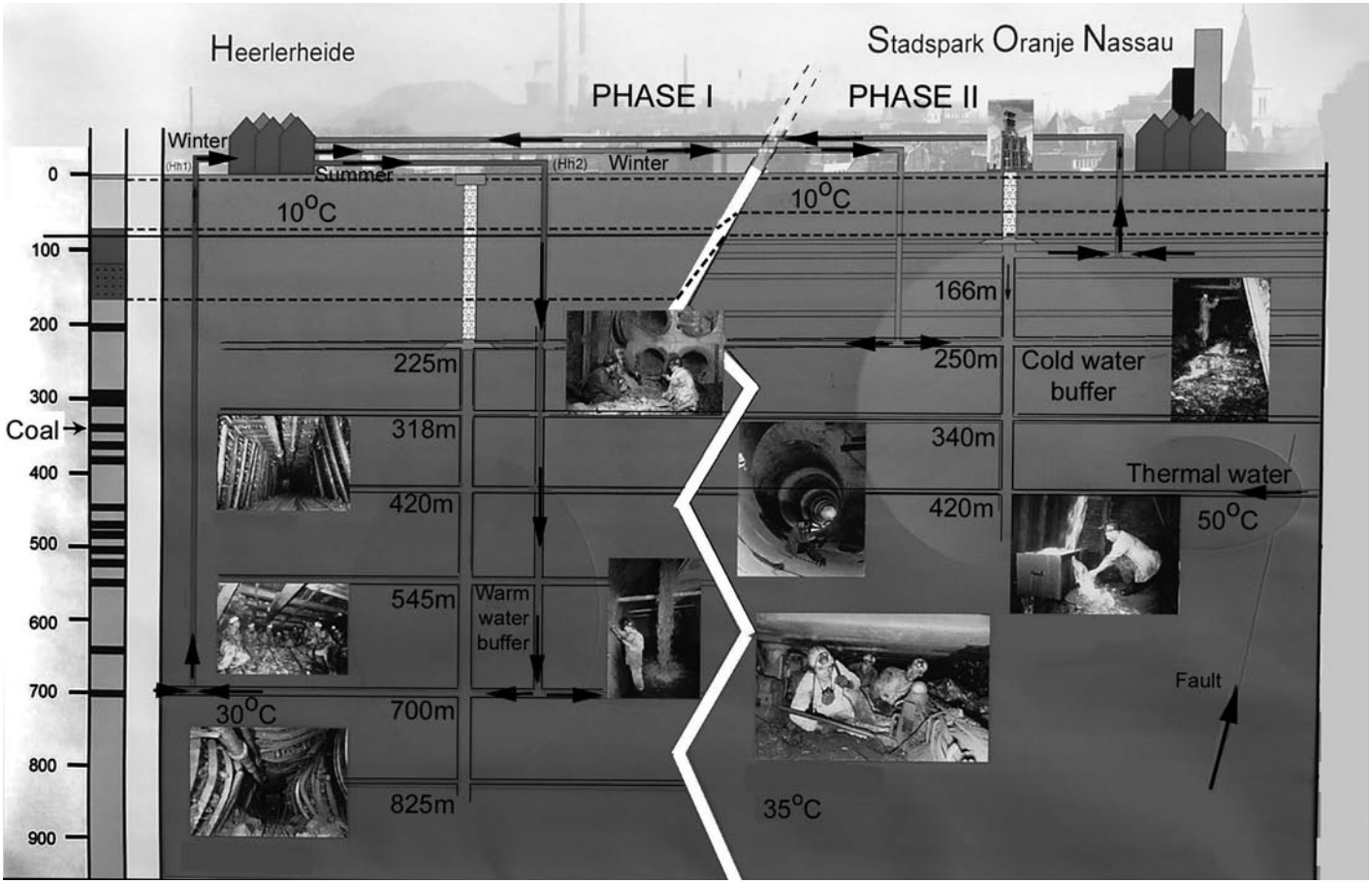
Phase I of the work at Heerlen covers the drilling of two wells to 720m and using the minewater to provide heating and cooling for 400 dwellings and 20,000 m^2 of other buildings in the town centre.

Drilling of the first borehole had been underway for a month at the time of the BoD visit, and a month later the well successfully intersected the flooded gallery at 700m depth. This was a significant achievement, given that the gallery is only 2.5-4m in diameter, partially collapsed and still containing steel plates and 14cm steel pillars.

Since then, the second 720m well has been drilled; preliminary testing suggested that the water supply would be satisfactory.

The project then entered the second phase, in which 3 wells (one to 450m and two to 250m) were drilled beneath the Stadtspark Oranje Nassau to supply a further 300 dwellings and 120,000 m^2 of buildings. Work is currently underway on the surface network, involving more than 7km of triple pipeline - one insulated for warm water and two uninsulated for cold and returning water. As the diagram shows, warm water will be used for heating (either via a heat pump or directly for underfloor units) and cold water for summer cooling.

Because of the importance of the Minewater project for all former mining areas in Europe, the project has received European Regional Development Funding through the Interreg IIIB Community initiative of the European Union. The partners are Midlothian Council (UK), the Weller Wonen Housing Association (NL), the Building Research



Establishment (BRE; UK), the Municipality of Bönen and the Aachen Regional Development Corporation (Germany) and BRGM (France). The total cost of the project amounts to € 20 million, of which Interreg IIIB will contribute 48%.

The current status of the project will be presented at a two-day, two-centre conference in Heerlen and Aachen on 4-5 June 2008. See www.minewater08.info/index.php for more details.

*A short film, mainly about the mine and the surrounding area, can be seen on www.zebra-web.co.uk/media/minewater/minewater.html.

AMERICA

USA

DOE & National Laboratories Project Targets Commercial Viability for Enhanced Geothermal Systems

Condensed from Ormat's press release

Reno, Nevada, February 14, 2008 – Work has begun on the first application of an Enhanced Geothermal System (EGS) utilizing a production well at a commercial geothermal site. This project will demonstrate the viability of EGS and the technology's potential to generate clean, renewable baseload geothermal electricity in many areas throughout the country, Ormat Technologies, Inc. announced today.

Ormat, the US Department of Energy (DOE), GeothermEx Inc., and other stakeholders will apply EGS technology to increase geothermal production from well number DP 27-15 at Ormat's Desert Peak facility near Reno, Nevada. EGS technology enhances the permeability of underground strata making it possible to extract additional heat from a reservoir's rocks. Support for the project includes $1.6 million in direct DOE funding, more than two decades of development work at five national laboratories, working capital from Ormat, and the use of existing wells and facilities at the Ormat site.

"Ormat anticipates Desert Peak will be the country's first commercial project to tap into an EGS resource and produce substantial levels of electricity providing a rebirth for certain geothermal prospects in the U.S.," said Ormat Chairman and Chief Technology Officer Lucien Bronicki. "Our objective in the Desert Peak EGS project is to demonstrate that EGS technology can achieve its potential of providing 100,000 MW of clean, base-load power, as identified in last year's DOE study by Massachusetts Institute of Technology, and show that this technology will enable geothermal electricity to be produced in regions where it is not currently economically viable," he added.

11 MW Desert Peak 2 Geothermal Power Plant at Churchill County, Nevada

Bronicki noted that the participants in this R&D project, include, in addition to DOE and GeothermEx, also Idaho National Laboratory, Lawrence Berkeley National Laboratory, Sandia National Laboratory, University of Utah EGI, TerraTek, Pinnacle Technologies and US Geological Survey.

Commenting on the potential of the Desert Peak resource, Subir Sanyal, President of GeothermEx said: "The Desert Peak resource, which currently supports 11 MW of electricity production from a conventional geothermal resource, is likely to have the potential to support 50 MW or more from an EGS development."

The Technology & Site

The Ormat/GeothermEx-DOE program at Desert Peak follows on research started over two decades ago at the DOE's National Laboratories, and joins Europe, Australia and Japan, which have made significant progress with EGS over the past few years. This first phase of the DP 27-15 project will use the shared funding to field test the technology in an existing sub-commercial well. Any additional fluid produced from the well will then be used in the existing Ormat power plant at Desert Peak to efficiently generate commercial electricity for sale into the Northern Nevada power grid. In addition, the parties are planning to utilize the EGS facilities at Desert Peak as a potential test site for future technology developments.

AMERICA

Mexico

Device developed in the Los Humeros geothermal field, Mexico, for alignment of polyethylene pipes

Luis C.A. Gutiérrez Negrín

Los Humeros is one of the four geothermal fields under exploitation in Mexico to produce electricity. It is located in central Mexico, at the eastern portion of the Mexican Volcanic Belt, and presently has an installed capacity of 40 MWe. There are 20 production wells in operation, with a combined production of 510 tons per hour (t/h) of steam and 140 t/h of brine that is injected back into the reservoir through three injection wells.

Collection and conduction of the brine to the injection wells is made by means of high-density polyethylene pipes with diameters of 203 mm, 152 mm and 106 mm, and a total length of 29 kilometres. Replacement of damaged sections of pipes by new or repaired sections, and the repair of broken joints, is made by joining the sections through thermal fusion. This is a process that involves the preparation of the surfaces to be melted, heating of these surfaces to the melting point, joining the melted surfaces and chilling under pressure. The process implies special tools and movable elements for aligning the pipe sections and thermal plates.

Taking advantage of experiences of several years of operation, personnel of the Comisión Federal de Electricidad (CFE, the governmental facility in charge of electricity in Mexico, which also manages and operates the geothermal fields in this country) working in the Los Humeros field, designed and constructed a device called a *pipe-alignment car.* This device is moved by pneumatic jacks, and allows the melting under controlled conditions of polyethylene pipes of diameters between 106 and 203 mm.

The *car* is 77 cm long, 71 cm wide and less than 50 cm high, and is designed to be operated by one person alone (Fig. 1). The device is already in use to repair damaged or broken polyethylene pipes in Los Humeros, with important savings of time and effort.

Following its official introduction at a recent internal event of the CFE geothermal division, the *car* will be used in the other geothermal fields of Mexico. CFE also has plans to offer the car on a commercial basis anywhere polyethylene lines are used to conduct water or brine.

IGA Membership Dues

IGA Membership dues for individual and corporate members for the year 2008 **shall be paid before the 30st of April**. In order to keep your membership status, we advise you to pay as soon as possible! See the application form on the back cover of this issue for renewal details.

ASIA/PACIFIC RIM

New Zealand

Geothermal Energy Progress

New Zealand Geothermal Association

Geothermal energy is renewable energy generated from heat naturally stored beneath the surface of the earth. Generation and heat supply technologies are well-established in New Zealand and are a sound, low maintenance alternative to fossil fuel energy sources.

This form of energy generates a minimal environmental impact and, compared to other renewable sources such as wind, it has a much higher availability factor (>90%) as it is not dependent on climate.

'Because of the continuing positive progress by New Zealand geothermal developers, what can only be described as a geothermal renaissance is occurring as geothermal energy can provide reliable baseload renewable electricity at competitive prices,' says Dr Colin Harvey of the New Zealand Geothermal Association.

Several operations are taking great strides in the renewable energy stakes. Top Energy is progressing its 15 MW expansion of the Ngawha power station. This is a strategic investment and gives Northland a strong base of local generation.

Mighty River Power is making good progress on the 90 MW Kawerau power station. This station will sit beside the second largest industrial load in New Zealand associated with the Kawerau pulp and paper mills.

The Kawerau mills continue to be supplied geothermal steam for industrial needs. This supply is now in the ownership of Ngati Tuwharetoa Geothermal Assets (NGTA). NGTA has a progressive attitude so announcements of future development are awaited with interest.

Developments to come will be Contact Energy's Centennial Drive Tauhara 20 MW development and the 130 MW Rotokawa expansion by a joint venture between Mighty River Power and Tauhara North No 2 Trust. Both of these have resource consents in place.

One of the largest geothermal developments will be Contact Energy's 220 MW Te Mihi development. This will eventually replace the 50 year old Wairakei Power Station and will divert steam from that station. The Te Mihi power station will possibly be the largest geothermal development in the pipeline and will generate another 60 MW more than the current stations through more efficient use of the resource.

'The NZGA is pleased that the government has been responsive to Contact Energy's requests to have this project called-in for consenting purposes. A Board of Inquiry will soon hear evidence associated with this project and make decisions using the planning framework established by Environment Waikato and Taupo District Council. Contact believes that this process will be timelier than the normal consenting process which can be delayed by appeals,' says Dr Colin Harvey.

At around 220 MW of baseload generation, the Te Mihi project will be the largest geothermal project in New Zealand's history. Before this, Wairakei itself was our largest project, although developed in stages, with initial

commissioning 50 years ago. The next largest geothermal station could be Contact's proposed development at Tauhara (though this may be staged), followed by the recently consented Rotokawa expansion at around 130 MW. This could be rivalled by further possible expansion at Mokai by Tuaropaki Power Company, or by a new development on the Nga Tamariki field. The scope of these projects is enormous.

Other parties (especially Maori Trusts) are actively looking for opportunities often in partnership with Mighty River Power or others. Based on published information, there are more fields that have favourable conditions.

NZGA notes that geothermal energy development will be critical to achieving the New Zealand Government's goals in terms of electricity generation, given the heavy reliance placed on renewable energy within its Energy Strategy.

Contact: Brian White (Executive Officer of the NZGA) phone 0274 771 009, email brian.white@eastharb.co.nz or Colin Harvey (President of NZGA) phone 021 597 432, email c.harvey@gns.cri.nz

The **New Zealand Geothermal Association (NZGA)** is an independent, non-profit industry association with a wide membership covering developers, regulators, researchers, consultants, Maori interests, suppliers, etc. It provides information on geothermal phenomena and utilisation for industry, government and educational organisations. The NZGA supports appropriate sustainable development of geothermal resources, and works with industry and government to achieve this. Website www.nzgeothermal.org.nz

ASIA/PACIFIC RIM

Australia

Update on the Australian Habanero 3 well

Eduardo Iglesias, Editor IGA News

Geodynamics claims this is the largest well of this depth ever drilled onshore in Australia. And that it is the first commercial scale Hot Fractured Rock production well to be drilled. Therefore, we thought this update should be of interest to our readers.

On August 15, 2007, Geodynamics announced that drilling of Habanero 3 had commenced, 500m from Habanero 1. Since then, they posted drilling updates in their website with a frequency of about two weeks. In Fig. 1 we have plotted the progress of drilling, as reported in the press releases.

The target depth (TD) of 4,221 m was reached January 22nd, 2008. In addition to reaching TD, the target fracture zone was intercepted at 4,180 m.

The intersection of the target fracture zone was confirmed through pressure excursions in monitoring devices in both Habanero 1 and Habanero 3 wells. These excursions confirmed the existence of a hydraulic connection between the two wells.

Completion of the well was announced February 5th, 2008 (last point in Fig. 1).

On February 26, 2008, the company announced Habanero 3 had flowed steam and water as part of the well clean up program prior to flow testing. During this operation the hydraulic connection with Habanero 1 was reconfirmed with good indication of well productivity. The well flowed at approximately 23 kg/s (Fig. 2).

Following the well clean up program an open circulation flow test is planned. This will be followed by a closed loop test to be commenced at the end of April.

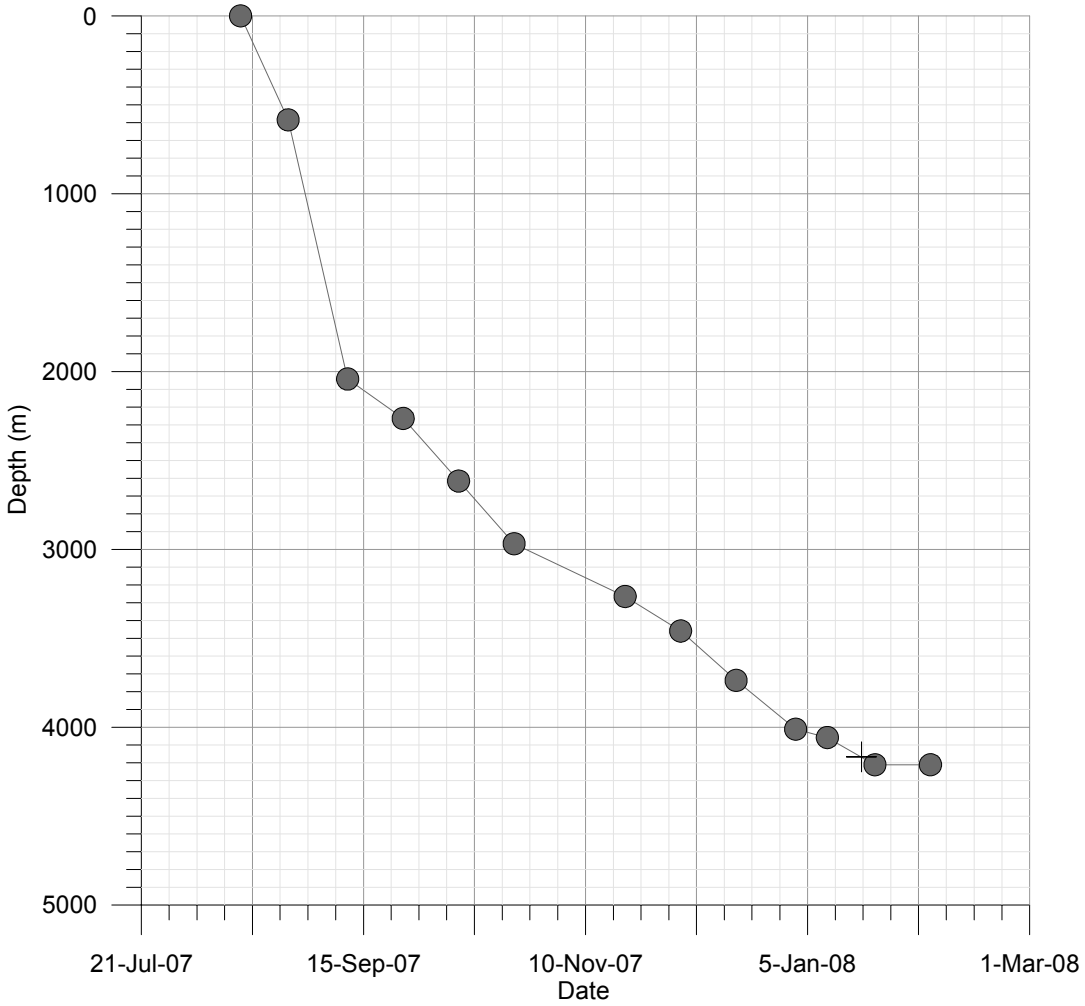


Fig. 1. Drilling progress of Habanero 3; the cross marks the depth at which the target fracture zone was intercepted.

This commercial-scale well was drilled through a high-pressure reservoir, at a depth of 4,200 m, and reached a temperature of 250°C. This, in a country which not long ago was believed to have little if any high-temperature geothermal potential. These characteristics make its completion an important milestone for geothermal development in the world.

The data for this article were compiled from Geodynamics (www.geodynamics.com.au) press releases.

Fig. 2. Habanero 3 discharge during clean up operations.

WESTERN PACIFIC
REGIONAL BRANCH

International Geothermal Association/INAGA
Joint Technical Seminar
Melia Bali Hotel, Nusa Dua, Bali
26-28 April 2008
"Cost reduction through improved geothermal well targeting"

Lecturers: Jim Lawless of SKM New Zealand and Dr Hiroyuki Tokita of WestJec Japan

plus presentations from Indonesian geothermal companies:
Pertamina Geothermal Energy,
Chevron,
Star Energy

This is a teaching course. It is aimed at Geoscientists and Engineers with some knowledge of geothermal science and technology. It will include lectures and practical exercises.
The course fee includes full printed lecture notes and lunches. Participants will be expected to provide their own accommodation and other meals. The course is open to all geothermal professionals living or working in the Western Pacific Region.
There is a wide range of accommodation at a range of cost available in Bali, as well as at the Melia Bali Hotel itself, where a discounted rate of US$100/night has been arranged for participants. The registration committee is not making accommodation bookings but can provide advice on options available. Please book directly with the hotel.

Course Fees:	**WPRB Members*:**	**US$ 200**
	Non Members:	**US$ 300**
	Students:	**US$ 100**

***Note: all members of INAGA are automatically members of WPRB**

Please register by contacting Novi Ganefianto at:
novig@chevron.com

Registrations close 31 March 2008
Numbers are strictly limited to 40 participants: "First come, first served"

Please note: there is also a separate joint INAGA/WPRB Regional Conference at the same venue on 30 April. Attendance to that is free for all WPRB and IGA members.

UPCOMING EVENTS

4th International Geothermal Conference: Risk Management, Financing, Technology, Implementation. Freiburg, Germany 24 April 2008. Contact: agentur@enerchange.de

Agriculture and Commercial Application of Geothermal Heating and Cooling . Budapest, Hungary, 25 April 2008. Contact: Diana Roehm Diana.roehm@energie-server.de

SEMP-AAPG Meeting, Poster Session on Geothermal Resources. 20–23 April 2008, San Antonio, TX, USA. Website: http://www.aapg.org/sanantonio/sanantonio1.pdf

Minewater08, the international conference on the geothermal use of minewater from abandoned mines. Heerlen/Aachen, The Netherlands/Germany, 4-5 June 2008. Contact: Denice Kern D.Kern@ibcnet.nl

International Interactive Seminar - Workshop on Geothermal Fields Development, Dubrovnik, Croatia, 09-13 June 2008. Website: www.rgn.hr/ljetna

IAHR International Groundwater Symposium, June 18-20, 2008, Istanbul, Turkey. Website: http://www.iahr-gw2008.net

XVII International Conference on Computational Methods in Water Resources, Special session on Mass and Heat Transport in Geothermal Systems, San Francisco, California, 6-10 July 2007. Website: http://esd.lbl.gov/CMWR08/special sessions/index.html

ENERGEX 2008, 6–10 July 2008, Vienna, Austria. Website: http://www.energex2008.com

33rd International Geological Congress, Oslo, Norway, August 6-14, 2008. www.33igc.org

GRC 2008 Annual Meeting/2008 Geothermal Energy Trade Show, 5–8 October 2008, Reno, NV, USA. Website: http://www.geothermal.org

World Energy Engineering Congress (WEEC), 8–10 October 2008, Washington, DC, USA. Website: http://www.energycongress.com/

New Zealand Geothermal Workshop and Celebration of 50th Anniversary of the Wairakei Power Station. 10-16 November 2008. Contact: wairakei.50th@contact-energy.co.nz

8th Asian Geothermal Symposium, Hanoi city, Vietnam, December 9-12, 2008,
contact: http://unit.aist.go.jp/georesenv/event/asia8.html

IGA News

IGA News is published quarterly by the International Geothermal Association. The function of IGA News is to disseminate timely information about geothermal activities throughout the world. To this end, a group of correspondents has agreed to supply news for each issue. The core of this group consists of the IGA Information Committee:

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The members of this group submit geothermal news from their parts of the world, or relevant to their areas of specialization. If you have some news, a report, or an article for IGA News, you can send it to any of the above individuals, or directly to the IGA Secretariat, whatever is most convenient. Please help us to become essential reading for anyone seeking the latest information on geothermal worldwide.

While the editorial team make every effort to ensure accuracy, the opinions expressed in contributed articles remain those of the authors and are not necessarily those of the IGA.

Send IGA News contributions to:

IGA Secretariat, c/o Samorka
Sudurlandsbraut 48, 108 Reykjavík, Iceland
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e-mail: iga@samorka.is

Contributions to the next issue of IGA News must be received by 10 May 2008.

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Please complete the following form and return it with payment to:
International Geothermal Association Secretariat
c/o Samorka
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