Quarterly No. 58 October – Desember 2004

IGA NEWS

Newsletter of the International Geothermal Association

IGA ACTIVITIES

Message from the President

John W. Lund, President

The new Board of Directors met for the first time in Antalya, Turkey on October 10th. A record turnout of 24 members helped to get us off on the right foot for the next three years. Antalya is a beautiful and peaceful site for WGC2005, over looking the Mediterranean Sea. We all were impressed with the work of the Organizing Committee and the friendliness of our Turkish hosts. One of the accomplishments at this meeting was the appointment of committee chairs by the Board of Directors. These persons are:

Program and Planning Chair: Toshihiro Uchida of Japan (uchida-toshihiro@aist.go.jp)

Finance Chair: Gordon Bloomquist of the USA (bloomquistr@energy.wsu.edu)

Information Chair: Edurado Iglesias of Mexico (iglesias@iie.org.mx)

Membership Chair: Ruggero Bertani of Italy (ruggero.bertani@enel.it)

Education Chair: Marcel Rosca of Romania (mrosca@uoradea.ro)

The above persons, along with the President, Vice President, Secretary and Treasurer, form the Executive Committee of the Board. In addition, the following committee chairs were also appointed:

Nominations Chair: Sakir Simsek of Turkey (ssimsek@hacettepe.edu.tr)

Audit Chair: Antonio Yee of the Philippines (ayee@unocal.com)

By-Laws Chair: John Garnish of the United Kingdom (john_garnish@yahoo.co.uk)

(this latter is a newly formed committee)

These committee chair are now soliciting members for their committee – and I would like to see at least half of the members be other than Board members – thus, if any of you from the general membership have an interest in working on one of these committees, please contact the chair directly.

An ad hoc committee to investigate and make recommendations for the World Geothermal Congress 2010 was also formed by the Board. At present, we have two formal proposasl for hosting the WGC2010 from Iceland (Samorka) and Indonesia (Indonesian Geothermal Association), with a tentative third proposal from Germany. A draft MOU has been prepared by James Koenig and is being edited by the committee. The ad hoc committee consists of:

Jim Lawless of New Zealand (chair), Burkhard Sanner of Germany, Joseph Ng'ang'a of Kenya, Manuel Ogena of the Philippines, Paul Brophy of the USA, and Rosa Maria Barragan of Mexico, with James Koenig of the USA as the technical advisor.

The ad hoc committee will solicit information from each of the proposed host organizations and make a rec-

ommendation by early 2005. The Board of Directors will then vote and select the site in time for it to be announced at WGC2005.

Finally, the Board has given approval to the President and the Finance Committee chair to continue negotiation with World Bank representatives on our funding proposal for financing fellowships for several short course and conferences, hosting the website and developing technical and educational publications for the GeoFund, providing geothermal experts to the World Bank, and assisting the International Summer School. The details of the final contract, approved by the Board, will be presented in the subsequent IGA News.

We have an exciting year ahead of us – and I hope to see all of you at the World Geothermal Congress 2005 in Antalya in April.

New Secretariat

Valgardur Stefansson, Executive Director

The IGA Secretariat has moved from Pisa in Italy to Reykjavik in Iceland. Samorka, the federation of energy and waterworks in Iceland has made a contract with IGA to operate the Secretariat of IGA for the next five years. Samorka has employed Valgardur Stefansson to serve as the Executive Director of IGA and to head the Secretariat for the same 5 years time period. He will be assisted by Anna Ingolfsdottir and Oddny Ögmundsdottir at the Samorka's office.

The Secretariat started operation on September 1st, 2004, but for the first weeks, both the office in Pisa and the office in Reykjavik were in operation. At the 15th Annual General Meeting in Antalya, Turkey, Ruggero Bertani handed formally over the responsibility of the Secretariat to the new Executive Director, Valgardur Stefansson.

Formally, we are on our own now but we are in the good position to be able to ask Ruggero for advice at any time. We will certainly use this opportunity and I hope that Ruggero will bear with us for some time. It has been a stimulating work to set up the IGA office and to try to get it into operative shape. We can hardly say that we are there, but we are close. I hope that our initial difficulties have not been very noticeable to the members of IGA.

Running international business is of course not the same as running a domestic business. Everybody agrees on that. But some small operational details in business operation are frequently only adopted for the domestic requirement. Therefore, we have in some cases to design our own working methods resulting in that some of the procedures that are automatically solved within the Icelandic society become an issue for the IGA Secretariat.

IGA is incorporated in New Zealand and this fact puts additional restrain on the operation of its Secretariat outside New Zealand. We are trying to circumvent these difficulties by running the Secretariat as part of Samorka's office. So far it seems that this procedure will work, but I suppose that we need a real operation for some months before we can be convinced.

Our intention is to serve all the members of IGA in an effective and reliable way. We would like to urge the members of IGA to help us to make the Secretariat an effective worldwide forum for all geothermal issues. We appreciate all kind of messages from the members and we will try to solve all problems that will be presented to us. Please do not hesitate to send us a message. The most effective way of communication is most likely to use our e-mail address:

iga@samorka.is

but the telephone (+354-588-4437) and the fax (+354-588-4431) can also be used.

Update on WGC2005

Trevor Hunt, Chairman WGC2005 Publications and Information Subcommittee

Planning for the next World Geothermal Congress, to be held in Antalya next April, is progressing well. The Organizing Committee met in Antalya in October 2004 and it was reported by the various sub-committees that:

- The total number of papers submitted is close to 700, and all the reviews have been completed.
- Work has started on the congress program and it is planned that this will be available on the website in January.
- Five Technical Sessions of oral presentations will be run concurrently, except during the opening/closing ceremonies, plenary sessions, keynote addresses, and poster presentations.
- The website continues to be updated at regularly and more than 11,000 "hits" have been recorded.
- A hard copy of the Second Announcement has been printed and will be distributed to persons and organizations who may not have access to the website.
- Planning for the Short Courses is well advanced with all lectures and lecturers assigned.
- An Exhibition Prospectus has been printed and distributed.
- Some exhibition space has already been sold and a plan showing remaining spaces can be viewed on the website.
- A special "Turkish Night", comprising whirling dervish dances, folk dancing and a concert by the Antalya Philharmonic Orchestra (guest conductor Prof. Ladislaus Rybach), will be held on the evening of Tuesday 26 April.
- The Congress Dinner, to be held on the evening of Wednesday 27 April, will include special Turkish cuisine and performances by a group of classical Turkish musicians.

Remember that "early bird" discounts for registration finish on 31 December 2004.

Note that no further Announcements (Third Announcement) will be made, and that participants and prospective participants should visit the website for further details as they become available. The website is:

www.wgc2005.org

A Congress Programme & Guidebook will be printed, and a copy given to each participant when they complete Registration in Antalya at the start of the Congress. Advertising space is available in the Programme & Guidebook; companies interested in advertising should visit the website or contact the organizers.

EUROPE

Russian Geothermal Association and Geothermische Vereinigung intend to improve mutual co-operation

On May 28, 2004, the president of the Geothermal Energy Society of Russia (GES), Prof. Oleg A. Povarov, and the president of Geothermische Vereinigung e.V. (GtV), Dr. Burkhard Sanner, signed a Memorandum of Understanding between both organisations in order to enhance the exchange of information and to promote application of geothermal energy in their respective countries, to facilitate the networking in science, engineering and business, to act towards the economic co-operation between the geothermal industry of both countries, and to look into further co-operation opportunities like joint workshops, conferences, publications, etc.

Figure 1: *Signature of the Memorandum of Understanding to enhance co-operation between GES and GtV in Hannover, Germany, May 28, 2004 (centre: Povarov, left: Sanner)*

The ceremony for signature was done at an exhibition of the Russian region of Krasnodar held at Hannover, Germany (fig. 1). The German state of Niedersachsen (Lower Saxony), the capital of which is Hannover, is a partner to Krasnodar region. Krasnodar is located to the Northwest of the Kaukas mountains, and in the underground the Northern Kaukas Molasse Basin provides excellent opportunities for geothermal energy development. A separate agreement was signed that included the energy office of Krasnodar region, in order to support the joint development of geothermal projects in that region.

However, the MoU between GES and GtV does cover all of Russia on one side and the countries represented by GtV (Germany and Austria) on the other side. The excellent relations between the countries go back a long time into the past, when the trade axis from Hamburg, Leipzig, Vienna to Moskau and St. Petersburg was buzzing, and German technology was helping to develop early Russian industry when the Tsars reigned. Despite two bitter wars, and a cold war (with Germany itself divided), the friendship between the countries never became totally extinct. GES and GtV hope to jointly support the geothermal energy development, and thus add to the general economic development in Russia (and Germany and Austria also, of course).

SWITZERLAND

Deep Heat Mining: Development of a cogeneration power plant from an enhanced geothermal system in Basel, Switzerland.

Markus O. Haring, Geothermal Explorers Ltd, Basel
haring@geothermal.ch - www.geothermal.ch

Introduction

In Switzerland, power is generated by hydropower and nuclear plants. In the search for alternative resources it has been recognised that wind and solar are insufficient to provide a reliable power supply beyond the age of fossil fuels. Switzerland is also a densely populated country and land prices are high. New power plants should require as little space as possible. The most striking part of geothermal plants are the cooling units. Water is abundant in Switzerland and cooling of thermal power plants can be achieved in general with running water from large rivers like the Rhine. Hence it is understandable that research into geothermal technologies is supported by power producers, the public and the government. The purpose of this paper is to demonstrate that it is possible to develop geothermal power plants in areas outside known geothermal fields, when local geological characteristics, infrastructural advantages and commercial requirements are addressed and dealt with in an integrated approach.

Pilot Plant

In Basel, Switzerland a pilot plant is being developed to use energy won by EGS technology for co-generation of electrical power and heat for local district heating. The core of the project called Deep Heat Mining Basel, is a well triplet into hot granitic basement at a depth of 5000 metres (Figure 1). Two additional monitoring wells into the top of the basement rock will be equipped with multiple seismic receiver arrays. They will record the fracture induced seismic signals to map the seismic active domain of the stimulated reservoir volume. Reservoir temperature is expected to be 200°C. Water circulation of 100 l/s through one injection well and two production wells will result in gross 30 MW thermal power at wellheads. It has not yet been decided what conversion cycle will be used for electric power production. The plant is located in an industrial area of Basel. The waste incineration of the municipal water purification plant provides an additional heat source. In combination with this heat source and an additional gas turbine, a combined co-generation plant can produce annually up to 108 GWh electric power and 39 GWh of thermal power to the district heating grid.

Geology

Basel is situated at the south-eastern end of the Rhine Graben, a failed rift feature cutting from north-east to south-west through central western Europe. This part of Europe is characterised by strike-slip faulting dominated by compressive forces of the alpine collision (Reinecker et al., 2003).

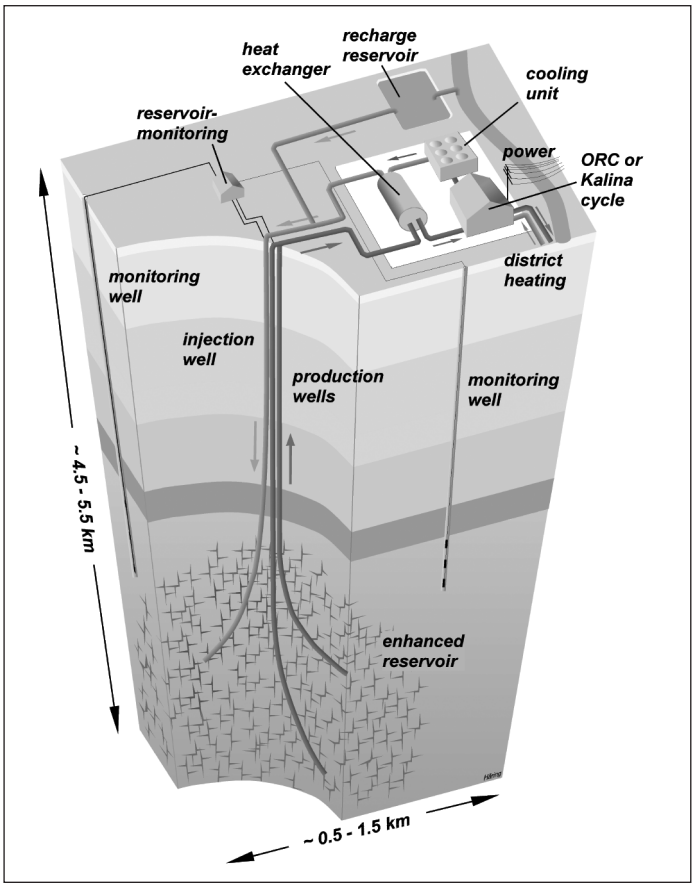


Figure 1: *Concept of EGS cogeneration pilot plant in Basel, Switzerland.*

Rifting of the Rhine Graben during the Oligocene has resulted in a thinned crust. Refraction seismic data indicate buckling of the Moho with a minimum of 24 km below surface at the centre of the Southern Rhine Graben (Bonjer, 1997). Strike slip faulting along the graben boundary fault system led to vertical hydraulic circulation in various locations. Geothermal maps of the area are not very detailed and are based on a restricted number of shallow observations. They show however throughout the region an increased heat flow of at least 100 mW/m^2 with values up to 130 mW/m^2 (Medici and Rybach, 1995).

Basel is not only situated at the south eastern end of the Rhine Graben but also at the northern front of the Jura mountains, the outermost expression and youngest part of the alpine fold belt. The peculiar coincidence of north-northwest trending compression and west-northwest extension creates a seismically active environment. Historically the worst earthquake occurred in 1356 with an estimated magnitude of 6.5 to 7 (Weidmann, 2002). Hypocentres are characteristically at a depth of around 15 to 20 km, a depth at which the main boundary faults are believed to sole out. Although depth allocation of the regional seismic monitoring array is not very precise, it appears that substantial seismic events may occur as shallow as 5 km (Figure 2).

The geothermal reservoir and the power plant will be

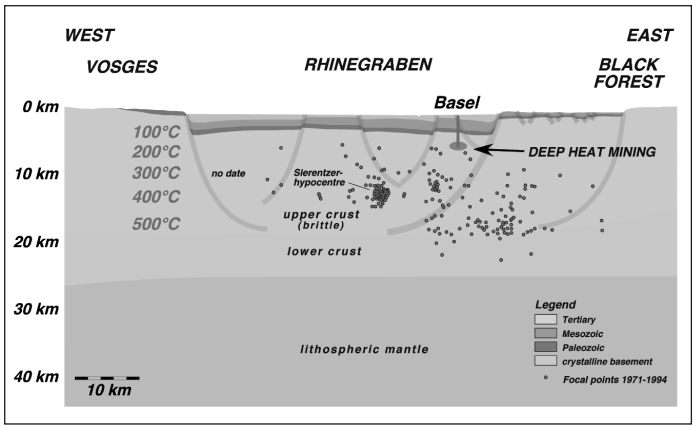


Figure 2: *E - W section through the Southern Rhine Graben with focal points (1971 - 1994).*

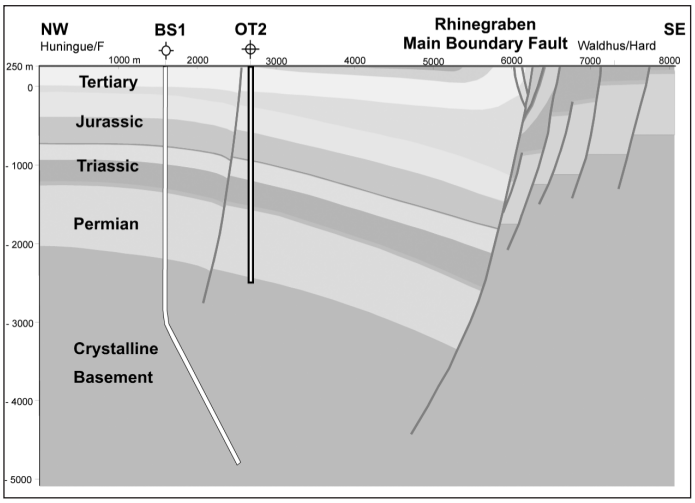


Figure 3: *SE - NW section across main Eastern Rhine Graben fault and situation of geothermal wells Otterbach 2 (OT2) and Basel 1 (BS1, planned).*

located within this seismic active area (Deichmann, 2003). It is therefore indicated to record and understand the natural seismic activity as accurately as possible, prior to stimulation of a deep reservoir volume, characteristically accompanied with induced seismicity. The first exploration well, Otterbach 2 was drilled in 2001 into granitic basement at 2650 metres to a total depth of 2755 metres (Vuataz and Häring 2001). The well is planned to become a monitoring well equipped with a seismic cable. The cable with a total length of 3000 metres consists of twelve mems sensors installed into three tetrahedral (four components) sondes, twelve geophones likewise installed into three tetrahedral sondes and a temperature sonde at the bottom. The purpose of the monitoring is to detect and locate the induced seismic signals generated by hydraulic fracturing as well as natural regional seismic events.

The Otterbach exploration well, drilled in 2001 is located on the downthrown side, about two kilometres east of the main boundary fault. It is the first well in this area penetrating the entire sedimentary sequence down to basement (Figure 3). This sedimentary sequence consists of Tertiary clastics, Mesozoic carbonates, shales and evaporites and Permian sandstones, whereas the top granitic basement is located at 2649 m. The temperature gradient reaches 40 °C/ km and the heat flow and heat production measurements in the outcropping granites on the flanks indicate that the same gradient is likely to persist down to the target depth.

Borehole deformation logging with acoustic and electric borehole televiewer tools shows induced fractures pointing predominantly in a NNW direction and induced borehole breakouts in the perpendicular direction. This trend is completely in line with the regional stress field (Plenefisch and Bonjer, 1997). No pressure tests were performed. The well was drilled with a balanced mud system. The fact that induced fractures are observed already in a balanced well, indicates that fracturing in the granite will not require large hydraulic pressures.

The EGS project of the European Community at Soultz-sous-Forêts, 150 kilometres north, situated in the Rhine Graben too, experienced similar conditions. In an injection test over a period of 126 days with flow rates around 25 l/s through a reservoir at 3.5 km depth, injection pressures averaged 30 bars (Baumgärtner et al., 1998).

Project plan

The next well is planned to the targeted reservoir depth at 5000 metres. It will be drilled on a industrial site in the city of Basel. It is intended to deviate the well at a depth of 3000 metres to the east with an angle of 15° in order to improve chances to penetrate open fractures associated with the main boundary fault system.

When the main targets of a minimal temperature of 190°C and a fractured reservoir rock is found in a favourable stress field, the well will be suspended. A second monitoring well two kilometres to the east will then be drilled and equipped with a similar seismic array like the Otterbach well. The two extended seismic arrays provide a series of locally independent receiver points sufficient to compute the location of a seismic source with the required accuracy. Subsequently injection tests will be conducted in the deep well in order to develop an enhanced reservoir. The final two deep wells will be drilled deviated from the same location. The conversion cycle for power production will be selected upon proof of circulation.

The exploration phase (proof of circulation) should be completed within two years. Beside the technical challenges to stimulate a fracture system along a fault system in a seismically active area, other environmental challenges, like drilling noise mitigation in a city, have to be met.

The project is carried by a partnership of regional utility companies and subsidised by the local government. All investors are aware of the pilot character of the project, but in view of the chances to gain a leading know-how in harvesting an old but hitherto unreachable resource is worth the well-known exploration risks.

References

Baumgärtner, J., A. Gérard, R. Baria, R. Jung, T. Tran-Viet, T. Gandy,

L. Aquilina, and J. Grarnish, 1998. Circulating The HDR Reservoir at Soultz: Maintaining Production and Injection Flow in complete balance. -Initial results of the 1997 circulation experiment. 23rd Workshop on Geothermal Reservoir Engineering, Stanford.

Bonjer, K.-P., 1997. Seismicity pattern and style of seismic faulting at the eastern borderfault of the southern Rhine Graben. Tectonophysics, v. 275.

Deichmann, N., 2003. Seismicity Basel 1975 - 2002, in epimap-Basel.cvx, ed.

Medici, F., and L. Rybach, 1995. Geothermal Map of Switzerland 1995 (Heat flow density). Beiträge zur Geologie der Schweiz, v. Geophysik Nr. 30.

Plenefisch, T., and K.-P. Bonjer, 1997. The stress field in the Rhine Graben area inferred from earthquake focal mechanisms and estimation of frictional parameters. Tectonophysics, v. 275: 71 - 97.

Reinecker, J., O. Heidbach, and B. Mueller, 2003. The 2003 release of the World Stress Map (available online at www.world-stress-map.org).

Vuataz, F.-D. & M. O. Häring, 2001. The Swiss Deep Heat Mining (DHM) project: Drilling of the first exploration borehole in Basel. IGA News, 45: 9-12.

Weidmann, M., 2002. Erdbeben in der Schweiz. Verlag Desertina, Chur.

Romania

Legal and regulatory framework for geothermal exploitation in Romania

Marcel Rosca, Chairman Education Committee

1 Legal and institutional framework

The governmental institutions with activities related to geothermal resources in Romania are: the Romanian Geological & Geophysical Survey (exploration and resources information), the National Agency for Mineral Resources (resource database, award of exploration and exploitation licences), and the Ministry of Industry (Energy Department).

At present, the Romanian legislation relevant to geothermal development is harmonized with European Union principles and supports renewable energies, among which geothermal is specifically mentioned. In 2003, the Romanian Government approved the "Strategy for the development of renewable energy sources", which sets short and medium term targets in accordance with the EU principles and directives. The Kyoto objectives imply a reduction by 8% of the greenhouse gases emission for the European Union between 2008 and 2012, compared to the 1990 level (corresponding to about 600 million tons per year of CO2 equivalent). The European Council Resolution on renewable energies of 8th June 1998 seeks a doubling of the share of renewables from 6% at present to 12% in 2010. These targets are also assumed by Romania, as it intends to join the European Union in 2007.

The mineral resources (including geothermal) are owned by the State, their exploration and exploitation being regulated by the Mining Law issued in 1998 (English translation attached). The National Agency for Mineral Resources is the Governmental institution in charge of issuing exploration and exploitation permits (long term concession).

There are two companies in Romania currently exploiting geothermal resources, Transgex S.A. and Foradex S.A., which have the long term concession for practically all known geothermal reservoir.

Transgex S.A. was established in 1970. Its main activities are prospecting and geological exploration for mineral resources by well drilling and mining works. To date the company has drilled about 150 wells for geothermal water. The Transgex S.A. Company was privatised in 2000 and the social capital was increased.

At present Transgex S.A. is developing the use of geothermal energy for district heating as basic activity in the towns of Oradea, Beius, Salonta, Marghita, and Stei, as well as in the villages Livada, Sacuieni, Cighid, Sinicolau de Munte, and Sintion. Geothermal energy is delivered in towns to blocks of flats, administrative institutions and economic agents. In smaller communities it is delivered to blocks of flats and administrative buildings. The first projects carried out by S.C. Transgex S.A. are: Oradea Geothermal Doublet (hot sanitary water for 13,000 people), Geothermal System at the University of Oradea Campus, Geothermal Energy in Calea Aradului Area in Oradea (hot sanitary water for 4,000 people), and Geothermal System at the Cighid Children's Hospital.

Transgex S.A. has an important group of specialists experienced in design, drilling, geology, mechanics, installations, and economics. The number of employees increased slowly but steadily after 2000, as geothermal is currently its main business. In the last five years the company also paid foreign experts for consulting whenever needed.

Foradex S.A. is a large state owned company. The main part of its activity is drilling (in Romania and abroad). It has a Geothermal Department, but no information was available regarding the employee structure. The project in Calimanesti for combustible gas separation was co-funded by the EC, and foreign consultants have also been partners in the project.

The University of Oradea is a state university established under this name in 1990, based on different higher education institutions of which the first started its activity in 1780. Some of its faculties have geothermal related training and/or research among their activities, such as the Faculty of Energy Engineering, the Faculty of Environment Protection, the Faculty of Electrotechnics and Informatics, and the Faculty of Medical Sciences. The Faculty of Energy Engineering currently offers B.Sc. training in Renewable Energy Resources and M.Sc. training in Geothermal and Solar Energy Utilisation. Five members of its current academic staff followed the six months UNU Geothermal Training Programme in Iceland. The university also has a number of research and training departments, including the Geothermal Research Centre and the International Geothermal Training Centre.

There are no public utilities actually operating geothermal systems. Geothermal district heating systems are operated only by the two companies mentioned before

(Transgex and Foradex). In all cases though, the distribution network is public property, according to the Romanian legislation. For this reason, the public utilities that have part or all their heat supplied form geothermal resources (e.g. the town of Beius) have at least one person in charge of supervising the operation and maintenance of the geothermal part of the district heating system.

2 Licensing procedures

Long-term licences are awarded by the National Agency for Mineral Resources (NAMR) for either the exploration or the exploitation of mineral resources, including geothermal. The NAMR also authorises companies to carry out certain activities (exploration, exploitation, research, trade, etc.) related to each specific mineral resource. In order to be authorised, the applicant company has to prove its capability to actually perform the respective activities. The list of required documents is available from the NAMR.

2.1 Exploration licence

Initial data (geological, geophysical, hydro-geological, etc.) can be purchased from the NAMR for reasonable fees, but only by companies authorised by the NAMR to have and work with such data. In most cases though, the company applying for the exploration licence would be the one that actually carried out the preliminary exploration and, in most cases, even drilled the exploration wells (Transgex or Foradex). Therefore, these companies would already have the necessary data. The following documents are required when applying for an exploration licence:

1. Perimeter setting study;
2. Resource assessment study;
3. Technical and economic feasibility study;
4. Environmental impact assessment.

The Perimeter setting study should define the perimeter of the surface area under which the resource is located. All exploration activity should only be carried out inside the set perimeter. When deep exploration wells have to be drilled, the NAMR can award, from the State Budget, the necessary funds for drilling such wells, as part of the national geological exploration program. For this, the company has to submit an application based on significant and reliable data justifying the need and opportunity to drill the exploration well. The wells are usually designed, drilled, and completed as potential production wells.

The resource assessment study is usually compiled after at least one deep exploration well has been drilled. Based on all available data, sometimes including a rather simple computer model of the reservoir, the study estimates the long-term sustainable exploitation potential of the geothermal resource, for one or more exploitation scenarios (i.e. with and without reinjection).

The technical and economic feasibility study should comprise: the geothermal energy supply available from the existing (exploration/production) wells; the potential users in the area and their annual heat demand; the proposed utilisation system (conceptual design); the economic feasibility assessment (discounted cash flow analysis) and financing scheme (i.e. source of funds for the capital investment). These are usually small-scale projects, operated mainly in order to monitor the behaviour of the reservoir during short-term exploitation. The exploration licence is usually awarded for a few years only (typically two).

The environment impact assessment study should be carried out for the proposed project during the exploration phase. As any EIA study, it should comprise: the base line (status of the environment parameters before the project start); impact of the proposed project on all environment factors and comparison with other possible projects for the same operation, including the "no project" case.

2.2 Exploitation licence

The documents required for an exploitation licence are essentially the same as those required for the exploration licence. The main differences are:

1. The concession is applied (and awarded) for a longer period of time, usually no less than 20 years;
2. The proposed project is usually larger in size, designed to utilise the resource up to its maximum sustainable capacity;
3. All studies carried out have to be more detailed than those submitted for the exploration licence;
4. A very important item is for the company applying for the exploitation licence to prove it has the financial capacity to complete the project.

In certain circumstances, when the geothermal resource is intended to be mainly or only used for district heating, the local community may apply and be awarded the exploitation licence for the resource. There is no such case yet in Romania, but the NAMR regulations specifically mention this possibility.

Any entity exploiting a geothermal resource (as well as any other mineral resource) has to pay a royalty based on the unit mass or volume extracted annually. Royalties are relatively low but they can be included in the unit energy selling price. This price is based on economic calculations, but its approval depends on the type of energy and in certain cases the type of customer.

For thermal energy sold to a private commercial customer, the unit selling price is usually fixed by direct negotiation between the two parties. When the customer is a public utility (e.g. district heating), the unit selling price has to be approved by the Local Council as well as the National Agency for Local Administration Regulation.

Current legislation on electric energy states that, TRANSELECTRICA, (the National Power Transportation Company) has to purchase the entire available power produced from renewable resources. The unit price is established by the Romanian Electricity and Heat Regulatory Authority (ANRE) based on the financial and economic assessment study.

Macedonia

Autumn workshop of Macedonian Geothermal Association MAGA on: LEGISLATION FOR GETTING THE CONCESSION FOR EXPLORATION AND EXPLOITATION OF GEOTHERMAL ENERGY

Strumica (Macedonia), December 10, 2004

On December 10, 2004 the regular autumn workshop of the Macedonian Geo-thermal Association MAGA shall be organized in Strumica (South of Macedonia), devoted to the legislation for getting the concession and exploitation of geothermal energy and in connection to the procedure for issuing the concession licence for the Bansko geothermal field and system and the public discussion about necessary changes of the existing Mining Law. About 50 participants from Macedonia, Bul-garia, Greece, Serbia & Montenegro, and Slovenia are expected, like it was the case with the last 6 regular spring and autumn workshops.

The workshop shall be opened by the state under secretary for energy and re-presentatives of the Ministries for Environment, Economy and Science and Educati-on. Hosts of the workshop shall be the local owner of the geothermally heated green-house complex and Ministry of Science and Education.

Three introductory papers are planned, i.e. Concession legislation in Macedonia (Mr. Eftim Micevski), Concession legislation in some European countries and U.S.A. (Prof. Kiril Popovski) and Summary of proposals for changes of the existing Mining Law (Mr. Nikola Cerepnalkovski). It is expected that also foreign participants shall present the situation in their countries. After that, a wider discussion should follow and composition of a set of recommendations to the Ministry of Economy, as final result of the workshop. According to the previous experience, recommendations of MAGA have been always taken seriously. Several applicants for concession rights are expecting that the meeting shall resolve some unclear aspects of the procedure, which shall help them to get the final answers in shortest possible terms.

Geothermally heated greenhouse in Bansko (Strumica)

Regular workshops of MAGA are slowly becoming a regular meeting point of geothermal experts from Balkanian countries and several common projects proposals to EC have been agreed during their realization. The proceedings of the workshops are normally sent to the Macedonian ministries and universities but also to the geothermal centres of neighboring countries.

Kiril Popovski
President of MAGA

Germany

The 8th Geothermal Conference of GtV a great success

by Burkhard Sanner

With more than 300 participants, the 8th Geothermal Conference of GtV on Nov. 10-13, 2004, was the biggest event on geothermal energy ever taking place in Germany. This number of registrations exceeded all expectations, and albeit causing some logistical problems that had to be solved, the conference became a great success. The conference venue in the city of Landau is located in the Western part of the Upper Rhine Graben, an area buzzing with new geothermal development and being a kind of "hot spot" in the German geothermal landscape. Projects for geothermal power production (some including district heating) are studied in Landau itself and in neighbour cities like Offenbach/Queich, Speyer, Worms, Bruchsal, and others; the site of the European EGS project in Soultz-sous-Forêts is only some 40 km to the South of Landau.

The first day (Nov. 10) was dedicated to the political, technical and economical perspectives defining the „new role of geothermal energy" (as the sub-title of the conference said). Those perspectives were delineated by representatives from the federal ministry of environment, the ministry of environment of Rheinland-Pfalz (the German state the conference venue is located in), and by scientists from energy economy and other fields. During his opening words, the envoy of the federal ministry of environment announced that the minister, Jürgen Trittin, has decided to join the honorary committee of WGC 2005 to show his support for geothermal energy. Also in the opening session, the Patricius Medals of GtV for the years 2003 and 2004 were awarded to Prof. Dr. Kiril Popovski and to Prof. Dr. Fritz Rummel, respectively (see separate report).

Towards the end of the first day, a panel discussion among politicians, representatives from administration, business and science, and the auditorium allowed to see the perception of geothermal energy in the society. MPs from both sides of the political spectrum voiced their support for geothermal energy use in research, development and application. The day was ending with a reception hosted by the mayor of Landau.

On the two following days (Nov. 11-12), the technical sessions were held in two parallel programmes. The main conference on the „deep“ geothermal side thus was complemented by the 5th Symposium on geothermal heat pumps, which focussed on the shallow geothermal applications. The proceedings have been published by GtV and can be ordered through:

http://www.geothermie.de/literatur/gtvpubli.htm

Concerning geothermal power production, projects under development all over Germany were presented. The stimulation methods used in HDR are now in the process of being transferred to standard geothermal resources in order to enhance yield and open new regions, under the acronym EGS (Enhanced Geothermal Systems). Deep borehole heat exchangers are another option to widen the range of possible locations for deep geothermal energy use on the heating sector. Examples of projects have been shown and first results presented. Suitable conversion technologies for power production at low entering temperatures are as essential as legal and administrative project management, geophysical investigations, risk assessment and minimisation, and many other topics that have been covered in Landau.

In the field of shallow geothermal energy use, the following observations could be made concerning the current development. On the sector of realised projects, a growing number of interesting larger geothermal heat pump plants can be seen. New fields have been opened, e.g. for the use in schools, where several projects will hopefully result in students knowing about geothermal energy by knowing about their school's technology. For small plants, sales concepts and quality certification have to be done to sustain the market growth in the long run. GtV is co-operating with the German heat pump association (BWP) in that respect.

For ground investigation and design of geothermal heat pumps, the thermal response test did develop into a routine tool. German equipment meanwhile works even abroad, e.g. in China. Beside the "classical" response test, new developments with glass fibre temperature sensors or with a submersible p/t-sensor inside the pipes have been presented. Advances in design software try to bridge the gap between the fast methods based on analytical solutions and the more accurate, but long and tedious numerical simulation methods. The technology itself could be improved, mainly on the sector of borehole heat exchangers: New grouting materials reduce borehole thermal resistance, heat pipes using CO2 are on the market, and compact ground heat exchangers are under design and testing in Sweden. The concept of underground thermal energy storage (UTES) still is in the demonstration stage, at least for heat storage; however, important steps forward have been made.

In the evening of the second day, the geothermal family could recover from the hard work in the technical sessions at a buffet dinner highlighting the regional cuisine (tasty and rich, but not quite healthy, and definitely not made for vegetarians and members of some religions, with pork in all variations as the main ingredient). With the location of the dinner being inside an old brewery, the local beer was competing with the excellent wine from the region.

At the end of the conference, a wrap-up by rapporteurs from the two parallel sessions allowed to get a short overview of what happened in the sessions one could not have attended. In the closing session of the conference on Nov. 12, the chairman of GtV invited all persons attending to join the geothermal family in the family reunion at WGC 2005.

An excursion on Nov. 13 allowed to see some geothermal practise: Drilling for the second well of a doublet to supply heat (and some thermal water) to a water fun park in Weinheim could be visited, and the famous EGS site in Soultz was the destination in the afternoon.

Patricius-Medals of GtV for the years 2003 and 2004 awarded

by Burkhard Sanner

In the opening session of the 8th Geothermal Conference of GtV, held in Landau, Germany, Nov. 10, 2004, two well-known geothermal celebrities have been awarded the Patricius-Medal of GtV. This honour is presented since 1994; the name remembers the bishop Patricius of Prusa, who in the 4th century AD in the today city of Bursa, Turkey, explained the relevance and genesis of thermal springs:

"There are fire and water also ... beneath the ground, ... and some of it comes back to the surface, like through pipes, flowing for the use by the human beings. Such is the way how the thermal springs are made, some of them, being more remote from the fire, are colder according to the cautious preposition of god towards us, while others,, being closer to the fire, flow hot." Such thermal springs are existing in Bursa to this days, feeding water and heat to several spas (haman, fig. 1).

The two laureates are

For the year 2003: Prof. Dr. Kiril Popovski

From the text of the document: "The Geothermische Vereinigung e.V. awards the Patricius-Plakette for the year 2003 to Prof. Dr. Kiril Popovski, to honour his tireless efforts in the promotion of knowledge about geothermal energy and its use. In particular shall his merits be recognised in the founding and conducting of the International Summer School on Direct Applications of Geothermal Energy. His contributions to agricultural use of geothermal energy and to geothermal greenhouse heating should be mentioned also."

For the year 2004: Prof. Dr. Fritz Rummel

From the text of the document: "The Geothermische Vereinigung e.V. awards the Patricius-Plakette for the year 2004 to Prof. Dr. Fritz Rummel, to honour his contribu-

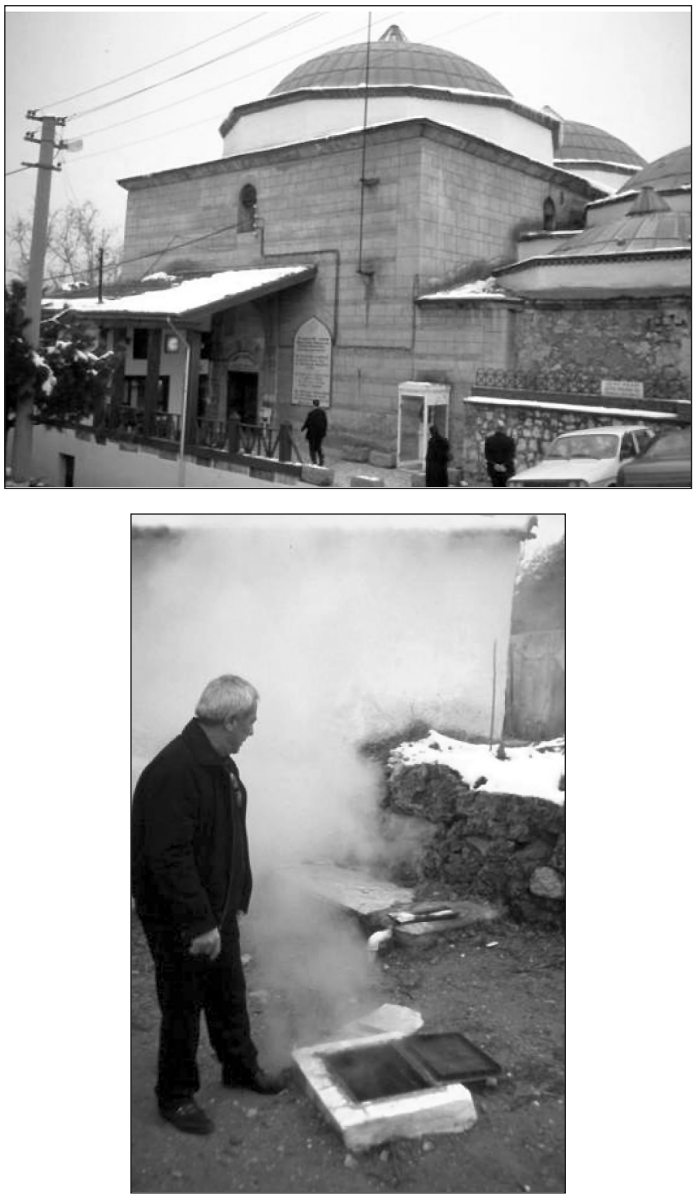


Figure 1: *Yeni Kaplica (the "new" bath) in Bursa, Turkey (Dec. 2001)*

tions over many years towards the scientific investigation of geothermal phenomena, and towards the application of this knowledge into the practical use of geothermal energy. A special mention should be given for his groundbreaking work on Hot-Dry-Rock technology, the fruits of which can be harvested today."

Both persons have been present to personally collect the awards.

Past holders of the Patricius Medal:

- 1994: Dr. Oskar Kappelmeyer
- 1995: Prof. Dr. Ralph Hähnel
- 1996: Prof. Dr. Ladislaus Rybach
- 1997: Dr. Herbert Schneider
- 1998: Dr. Vladimir _ermák
- 1999: Dr. Roberto Carella
- 2000: Dr. Ingvar B. Fridleifsson
- 2001: Dr. Rüdiger Schulz
- 2002: Ernst Rohner

Geothermal power project in Unterhaching on the way to success

by Werner Bussmann and Burkhard Sanner

With the first geothermal power plant in Germany operational since November 2003 in Neustadt-Glewe in the north-east of the country, also in the south of Germany development of geothermal power production is on a good way. Here also the step from the ca. 200 kW electric output of the first plant to a more substantial output of some MW of electric power will be made.

End of August the first drilling in Unterhaching, a small city just to the south-west of Munich, Bavaria, tapped the reservoir in 3446 m depth. The thermal water has an initial temperature of 122 °C with a yield of about 150 l/s (ca. 42 t/h), and as the project manager, Christian Schönwiesner-Bozkurt of Rödl & Partner said: „Even our most optimistic expectations have been surpassed. Now the conditions are given here to produce electric power and heating from geothermal water." The mayor of Unterhaching, Dr. Erwin Knapek, voiced his excitement about this development: „We do want an advanced, environmentally friendly supply of electricity and heat for Unterhaching. And we did put our hope on the geothermal resource. Now the results reward the efforts of all those who bravely and vigorously advanced this project."

Beside being one of the first geothermal power projects in Germany, there are some other "firsts" in the project design:

- For the first time in Germany, power production using the Kalina-process shall be done on an industrial scale
- A large submersible pump will be used in the production well
- A turbine inside the re-injection well will add to the power production

To realise the project, a company "Geothermie Unterhaching GmbH & Co. KG" was founded in August 2002, with the municipality of Unterhaching being the 100-%-owner. The location of the city is quite favourable in the area where the target formation ("Malmkarst", Upper Jurassic limestones) is already rather deep and thus quite warm (fig. 1), but the location is still close enough to the population centre around Munich.

After completion and testing of the first well, a re-injection well in some 2.5 km distance will be drilled, and then the thermal water pipeline connecting the wells. The system is planned as heat-and power-co-generation (CHP), with up to 41 MWth for district heating and up to 3.7 MWel of electric power, and might be operational for power production in 2006.

The total project cost are estimated to ca. 36 million Euro, the financing of which are covered by own capital of the municipality, by a grant of up to 4.8 million Euro from the federal ministry of environment (BMU), and by bank loans. The seismic investigations preceding the project have also been subsidised by BMU. The electric power that will be generated one day in Unterhaching from geot-

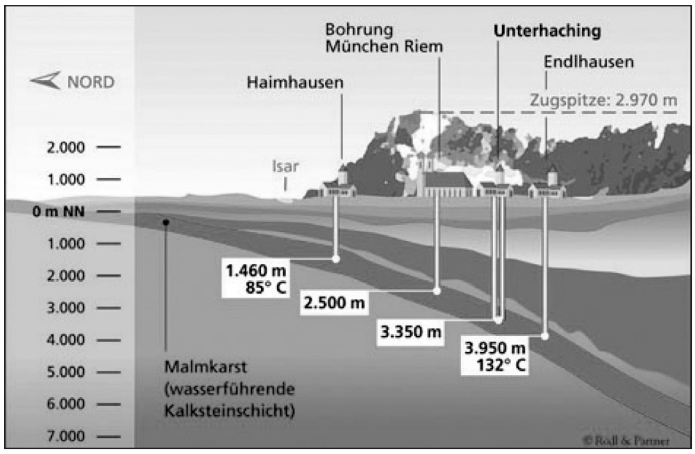
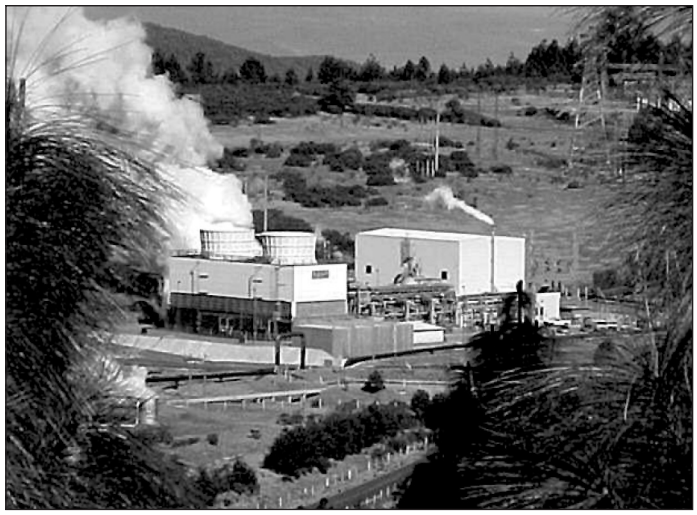


Fig. 1: *North-South-cross-section through the Bavarian molasse basin, with the karstic Malm layer and some drillings tapping that layer (drawing from Roedl & Partner, Nuremberg)*



One of the four 25-MWe units of the project Los Azufres II

hermal heat can be sold to the regional utility for a price of 150 Euro/MWh, according to the Renewable Energy Law (EEG), for plants below 5 MW electric output.

THE AMERICAS

Geothermal-electric capacity in Mexico reaches 953 MWe

Luis C.A. Gutiérrez-Negrín

Between April and July 2003 four additional geothermal power units were commissioned in the Los Azufres geothermal field in Mexico,. These units were a part of the Los Azufres II Project with an installed net capacity of 100 MWe. Each one of the 25-MWe units is composed by a condensing-turbine of single flow, an electric synchronous generator, a direct-contact condenser, a counter-flow cooling tower, and a hybrid gas-extraction system. They work at 8,0 bar (absolute) inlet steam pressure and consume 195 tons per hour (t/h) of steam at the design average wet-bulb temperature (19°C). The power output of each one is 27.5 MWe gross (25 MWe net).

Fig. 1. *Geothermal fields in Mexico*

The Comisión Federal de Electricidad (CFE, one of the two public utilities in charge of generation and distribution of electricity for public service in Mexico) issued an international tender for the construction and installation of the whole project in 2000. The bid was won by Alstom, which financed the project during the construction period. Once the units passed the acceptance tests, CFE paid the total cost to Alstom, and took on the operation and maintenance of the units. Presently, the units are being operated by CFE, which also supplies the steam. Only five new production wells were required, since there was some excess of steam from previously drilled wells.

The geothermal-electric installed capacity in the Los Azufres field has reached 188 MWe, integrated by seven back-pressure power units of 5 MWe each, one 50-MWe condensing unit, two binary-cycle units of 1,5 MWe each, and four 25-MWe each units of the Los Azufres II project. The CFE currently operates 35 production wells, which produce an average of 1650 t/h of steam and 600 t/h of brine. The latter is reinjected through 5 injection wells.

Los Azufres is one of the four geothermal fields in operation in Mexico, and is located in the central part of the country, within the Mexican Volcanic Belt. Other fields in operation are Cerro Prieto, Los Humeros and Las Tres Vírgenes (Fig. 1).

Cerro Prieto, located at the northern portion of Mexico, presents an installed capacity of 720 MWe with 13 condensing power units. The CFE manages 150 production and 9 injection wells and supplies an average rate of 5500 t/h of steam.

Los Humeros is also located in the Mexican Volcanic Belt and has an installed capacity of 35 MWe, with seven back-pressure power units. These units are fed by 18 production wells, supplying an average of 500 t/h of steam.

Las Tres Vírgenes is the more recently developed field, and is found in the middle of the Baja Peninsula. The CFE

operates two condensing units of 5 MWe each, whose steam is supplied by two production wells also operated by CFE, and one injection well.

The total geothermal-electric capacity in Mexico is currently 953 MWe, which places the country third worldwide behind the US and the Philippines.

There is one more geothermal field in Mexico, the Cerritos Colorados field located within the La Primavera volcanic caldera at the western part of the Mexican Volcanic Belt. There CFE has drilled six production wells, has assessed a geothermal-electric potential of 75 MWe, and is currently planning the construction of the first power units.

Nicaragua

Nicaragua opens an international public bid of the geothermal areas Hoyo-Monte Galan y Managua-Chiltepe.

Ariel Zúñiga, Nicaraguan Institute of Energy

The government of Nicaragua through the Nicaraguan Institute of Energy (INE) started the bid process to explore and develop the geothermal areas of Hoyo-Monte Galan and Managua-Chiltepe. INE is the institution that regulates the country's electric sector. This institute is charged (by the Nicaraguan exploration and exploitation law of the geothermal resources [No. 443] and its regulation) with calling for public bids to grant geothermal concessions in areas which the presidency of the republic declares open for exploration and exploitation.

El Hoyo –Monte Galán, located to the west of the Momotombo volcano, has an estimated capacity of 200 to 250 MWe.

Managua-Chiltepe, located about fifteen kilometers from the capital city Managua, has an estimated capacity of 150 to 200 MWe.

The Central American region is in a process of integration of their electric markets, through the implementation of the project Electric System for Central America (SIEPAC) and the multinational Puebla-Panama Plan (subscribed by the Central American countries as well as Panama and Mexico). The main objective of these programs is to promote the economic development of the region, taking advantage of economies of scale. It is expected that these will result in higher electricity demand and in increased exploitation of renewable energy resources.

The government of Nicaragua, aware of the importance of the development of their geothermal resources whose potential is considered the highest of Central America, developed a master geothermal plan for the country and elaborated, with the approval of the national assembly, a law of geothermal resources. The objective of this law is to create the necessary conditions to attract the private, local and international, investors whose support will allow toachieve the sustained development of Nicaragua's geothermal resources.

The opening of the international public bid of the areas Hoyo-Monte Galan and Managua-Chiltepe took place September 16th 2004, at the hotel Intercontinental Metrocentro, Managua.

The eight companies that so far have shown interest in the development of these geothermal areas must present their offers before December 10th 2004.

ASIA/PACIFIC RIM

Asian geothermal "fellows" joined in autumn in Korea

Yoonho Song, KIGAM, Hirofumi Muraoka, Toshihiro Uchida and Kasumi Yasukawa, GREEN, AIST

On 26-27 October 2004, the 6th Asian Geothermal Symposium was held at Jurassic Hall, KIGAM, Daejeon, Korea under the co-sponsorship of GREEN, AIST, Japan and KIGAM, Korea (Figure 1). The number of the participants was 105 in total, including 23 geothermists from abroad who were welcomed by great hospitality of Korean colleagues and beautiful autumn leaves in the best season in Korea.

Although Korea does not have high-temperature geothermal resources related to young volcanoes, it has numerous hot springs related to high heat flow anomaly, particularly in its southeastern part. KIGAM is now enthusiastically conducting a geothermal direct-use project in one of them, Pohang City, southeastern Korea. The research update of this project was a central topic of this Symposium.

The Symposium was kicked off by the greetings of Dr. Tai Sup Lee, President of KIGAM and Dr. Isao Matsunaga, Director of GREEN, AIST. Out of 21 technical papers presented in total, 17 papers were oriented to the low-enthalpy or direct-use of geothermal resources.

Distinct from the previous Asian Geothermal Symposia, we invited three special lecturers: Prof. Ladislaus Rybach (Switzerland) on direction of geothermal resources development in a non-volcanic country, Dr. Franciska H. Kármán (Hungary) on scale and corrosion problems, and Prof. Takumi Hashizume (Japan) on low-temperature power generation technology. These lectures made the Symposium deeper and more fruitful.

The Symposium was finally closed by Dr. Tetsuro Noda, AIST, adopting the following declaration:

1. Participants in this Symposium shall be "fellows" to disseminate the priority of clean geothermal energy to citizens, governments and world hereinafter.
2. Participants in this Symposium shall assist the fellows in promoting the dissemination purpose to each other.
3. Participants in this Symposium shall try to enlarge the fellows' circle.

On 28 October, we visited the Pohang project site as a post-Symposium excursion. At the first stop, we observed a 1500 m deep pilot well that had been already drilled and

Figure 1. *Group photograph of the 6th Asian Geothermal Symposium, Jurassic Hall, KIGAM, Daejeon, Korea (26 October 2004)*

was producing 300 ton/day of 47.5 ºC hot water by pumping. The bottom hole temperature reached 70 ºC, which is close to the highest hot spring temperature of 72 ºC at Bugog in Korea. At the second stop, we observed a 2000 m deep production well, which had been drilled to a depth of approximately 400 m (Figure 2).

On the way to Seoul on 29 October, all the participants very much enjoyed two World Heritages in the historical city of Gyeongju, under beautiful autumn leaves: Seokguram Grotto, which holds an old stone buddha, and Bulguksa Temple, both built in the Shilla Dynasty some 1250 years ago. The latter is a type locality of the Cretaceous Bulguksa Granite in southeastern Korea.

This Symposium was closed with an entire success and steady enlargement of the fellows' circle. Chinese colleagues, Prof. Keyan Zheng and Dr. Liu Jiurong, kindly offered to hold the next Symposium in China. We would like to announce the details of the next Symposium as soon as it will be confirmed. The name will still be "Asian Geothermal Symposium," however it will absolutely be open to all the countries in the world like this time. Therefore, you should not miss the next Symposium that will be held in China where you could easily find the Asian geothermal synergy to the future!

Figure 2*. 2000 m deep production well in the Pohang project site, Korea (28 October 2004)*

References

KIGAM (2004), Proceedings of the 6th Asian Geothermal Symposium, KIGAM, Daejeon, Korea, 157p. (All the papers in this Proceedings are available in pdf on http://geothermal.kigam.re.kr/eng/)

Philippines

UPDATE ON THE FIRST PHILIPPINE GEOTHERMAL 1 CONTRACTING ROUND

Restituto G. Taganas Jr. and Edvin D. Butiu, Philippine Department of Energy, Geothermal and Coal Resources Division

The Philippine Department of Energy (DOE) formally launched, in formal ceremonies on March 11, 2004 in Manila, the First Philippine Geothermal Contracting Round (GEOTHERMAL 1), which aims to attract investments in the exploration and the development of the country's most prospective geothermal resources. By introducing a different mechanism in the offering and granting of new Geothermal Service Contracts through a bidding process, GEOTHERMAL 1 anticipates to generate investors' interest, either in the exploration and development of new prospects/areas, or in projects for the expansion or optimization of existing production fields.

GEOTHERMAL 1 offers ten areas or projects that were painstakingly selected based on their technical, environmental and legal merits:

- Tanawon-Rangas sector BacMan Project, Sorsogon — 40-80 MW *
- Mindanao Optimization North Cotabato Project — 20 MW *
- Manito-Kayabon sector BacMan Project, Albay — 20-40 MW *
- Cabalian, Southern Leyte — 60-110 MW *
- Dauin, Negros Oriental — 40-80 MW *
- Biliran — 20-40 MW
- Amacan, Compostela Valley — 20-40 MW
- Natib, Bataan — 40 MW
- Mabini, Batangas — 20 MW
- Montelago, Mindoro Oriental — 20-40 MW

The first five areas (marked with asterisk) are covered

by existing Geothermal Service Contracts (GSCs) and are thus subject to Farm-In Agreement with the holder of the GSCs while the other fields require the application for a GSC with the DOE.

To promote further the First Philippine Geothermal Contracting Round, a road show presentation was conducted in Japan on May 24-29, 2004 that was headed by former DOE Undersecretary Eduardo V. Manalac. The visit was aimed to introduce to potential investors in Japan's power industry these geothermal projects.

Presently, four (4) foreign companies and two (2) domestic firms have signified keen interest in participating in the Contracting Round.

Originally announced as 30 July 2004, the deadline for the submission of bid applications was extended to 29 November 2004 to give interested companies sufficient time to fully evaluate the technical merits and investment potential of the geothermal projects.

Philippine Geothermal, Inc. is now Unocal Philippines, Inc.

Edgar P. Sevilla, UPI

Philippine Geothermal Inc. (PGI), Southeast Asia's pioneer geothermal developer, announced it began doing business as Unocal Philippines, Inc. (UPI) effective October 1, 2004. This new name better links the company with the worldwide operations of parent company Unocal Corporation. UPI remains an indirect wholly-owned Unocal subsidiary, reflecting the company's long-term commitment to the Philippines and the region.

UPI builds on a strong legacy. This includes more than 33 years of partnership with the Philippine government to pioneer geothermal development and meet the growing energy needs of the country. The Philippines now enjoys the distinction of being the world's leading consumer of geothermal energy, and the second leading producer of this clean, renewable energy source, after the United States.

The name change coincides with the beginning of a new commercial agreement that is now in place, representing the settlement between UPI and the National Power Corporation (NPC), resolving an eight-year dispute over the operations of the Tiwi and Mak-Ban geothermal steam fields.

China

Geothermal Utilization in Tianjin Olympic Sport Center
– As A Part of the 2008 Beijing Olympic Games

Tingshan Tian, Geothermal China Energy Society

In order to saving fund and playing a bigger role of the Olympic facilities, a part of items of the 2008 Beijing Olympic Games will be taken place in Tianjin, the neighbor city of 140 km away. Tianjin Olympic Sport Center will fully utilize local geothermal resources plus heat pump system to carry out winter space heating, summer cooling and hot water supplying. The Tianjin Olympic Sport Center consists of stadium, international sport exchange center, boating center, sport museum and complex building. Its planned land area is 44.5 hectares with a construction area of 267,000 m^2 including stadium of 155,800 m^2, sport exchange center of 50,000 m^2 and boating center of 50,000 m^2 etc.

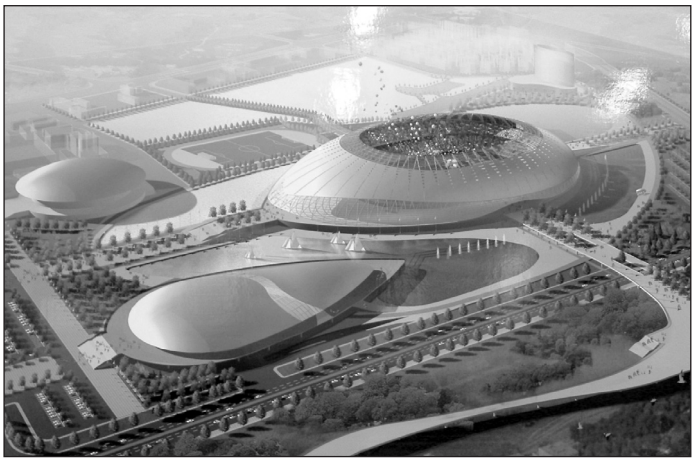


Figure 1. *A bird view of the Tianjin Olympic Sport Center*

Overall sport constructions of the Tianjin Olympic Sport Center will show a subject of 'dewdrop'. It is coordinated with surrounding green lake, blue sky and greensward in this sport center. These facilities will be constructed using metal and glass materials. The roof will fit in with the variation of four seasons annually. It is able to adjust the effects of light, heat and wind to create an ideal athletic environment. So the Tianjin Olympic Sport Center gives expression to the 3 substances of the 2008 Beijing Olympic Games in 'Green Olympics', 'High Technology Olympics' and 'Humanistic Olympics'. It integrates smoothly into the city environment of Tianjin, concentrates new achievement of high technology research. It will become the first class level of sport center worldwide.

There are 175,000 m^2 of construction area need winter space heating and summer cooling. And hot water supply is additional demand. According to concerned design the heat loads of space heating and cooling are 14,840 kW/h and 18,565 kW/h respectively. Then the heat load of hot water supply is 1,400 kW/h. Space heating will keep a room temperature of 18°C in winter, and temperature 16°C and 27°C for stadium and boating center respectively. However, the summer cooling will keep a temperature of 26°C for all demands.

The project design considers environment protection, energy saving and reliability of operation. The heat source for the project is geothermal water mainly. There are 3 geothermal wells drilled already as 2 for production wells and one for reinjection well. Geothermal water of 78°C at wellhead will be passed through 2 stages of heat exchanger of titanium plate type. Then the used water goes through heat

pump system to contribute more heat extraction. Finally the wastewater with temperature of 10°C will be injected into reinjection well. In addition, abundant lake water in this sport center will be used for summer cooling through the same heat pump system. And the middling-water from the sport center area will be as supplementary cool source.

Therefore, this is a multi-source heat pump system. The total investment for the heating and cooling system is estimated as 23.95 million yuan (1 USD equals about 8.28 yuan). And the operation cost will be 25.49 yuan per square meter. This is much cheaper than a common district heating system.

UPCOMING EVENTS

30th Stanford Workshop on Geothermal Reservoir Engineering. Stanford University, CA, USA, 31st January – 2nd February 2005. Contact: Laura Garner, email: lgarner@pangea.stanford.edu http://geothermal.stanford.edu/WorkshopPages/

Power-Gen Renewable Energy. Las Vegas, NV, USA, 1 –3 March 2005. website: www.power-generation.com

26th Annual PNOC-EDC Geothermal Conference. Manila, Philippines, 9-10 March 2005. Contact: Arnel Mejorada, email: geothermalcon@energy.com.ph

The Cairo 9th International Conference on Energy and Environment. Cairo and Sharm El-Sheik, Egypt, 13-19 March 2005. Contact: Abdel Latif El-Sharkawy, email: president@sat-eng.com wwbsite: http://ee9.sat-eng.com

World Geothermal Congress WGC2005. Antalya, Turkey, 24-29 April 2005. website: www.wgc2005.org

International Geothermal Conference "Renewable Energy: Problems and Prospects". Makhachkala, Republic of Daghestan, 19 – 22 September 2005. Contact: Alibek Alkhasov, email: danterm@xtreem.ru website: http://www.geoterm.iwt.ru/info-e.htm

GRC Annual Meeting. Reno, NV, USA, 25 – 28 September 2005. website: www.geothermal.org

Erratum

The article "Philippines, PGI Corporate News" at page 12 in IGA-News #57 was taken from the PGI Corporate News. Sylvia Ramos contributed the article but did not write it.

This issue of IGA News was edited by Eduardo Iglesias and Gestur Gislason, and produced by the IGA Secretariat: Valgardur Stefansson. Layout and printing by Gutenberg, www.gutenberg.is

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 consist of the IGA Information Committee:

Eduardo Iglesias, Mexico (Chairman)
Werner Bussmann, Germany
Alimin Ginting, Indonesia
Gestur Gíslason, Iceland
Luis Gutiérrez-Negrín, Mexico
Roland Horne, USA
Jim Lawless, New Zealand
Marcelo Lippmann, USA
Zbigniew Malolepszy, Poland
Adele Manzella, Italy
Rosa María Prol-Ledesma, Mexico
Sylvia Ramos, Philippines
Tingshan Tian, China
Francois-David Vuataz, Switzerland
Kasumi Yasukawa, Japan

Note: The Information Committee is seeking new members from regions of the world not represented by the above membership. If you would like to join us and are ready to collaborate as indicated below, please contact Eduardo Iglesias at iglesias@iie.org.mx

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.

Send IGA News contributions to:

IGA Secretariat, c/o Samorka
Sudurlandsbraut 48, 108 Reykjavík, Iceland
fax: +354-588-4431
e-mail: iga@samorka.is

Contributions to the next issue of IGA News must be received by 10 February 2005.

APPLICATION FOR MEMBERSHIP

Please complete the following form and return it with payment to:
International Geothermal Association Secretariat
c/o Samorka
Sudurlandsbraut 48, 108 Reykjavik, Iceland
tel: +354-588-4437; fax: +354-588-4431; e-mail: iga@samorka.is
IGA Home Page: www.geothermal-energy.org

❒ Enrol me as a new nember of IGA ❒ Renew my membership to IGA

Dr Mr Mars Ms (circle) _____ (family name(s)) _____ (first name(s)) Profession _____

Business/Organization/Enrolled at (for students) _____

Address: ❒ Work ❒ Home _____

phone (area code) _____ fax (area code) _____ e-mail _____

MEMBERSHIP CATEGORY

❒ Individual / USD 30 ❒ Corporate / USD 300 ❒ Sustaining: individual / USD 100
❒ Student / USD 5 ❒ Institutional / USD 750 ❒ Sustaining: corporate / USD 1000

Note: the information you provide will be held on the IGA database and only used to update you on the activities of the Association. It may be changed or cancelled at any time upon your request. If you do not wish your details to be used for this purpose, please tick the box **(in which case your ame will not be printed in the IGA Directory)**: ❒

REPRESENTATIVES (Corporate and Institutional only. Both are entitled to three representatives.)

Name (contact person) _____

Name (other) _____ Name (other) _____

All payments must be made to the International Geothermal Association by:

❒ International Wire Transfer in USD to the Secretariat of the International Geothermal Association (Please notify the Secretariat by fax or e-mail when you wire funds).
Account # 1154-38-100550, SPRON - Skeifan 11, P.O. Box 1150, 121 Reykjavik, Iceland.
SWIFT Code: LSIC IS RE IBAN IS94 1154 38 100550 460395 2679

❒ Bank draft, company or personal check in USD.

❒ Master Card ❒ American Express ❒ Visa

Card # _____ Expiration date _____
Signature _____ Date of signature _____

2004 dues USD _____ 2005 Dues USD _____ 2006 Dues USD _____ 2007 Dues USD

Contribution USD _____
TOTAL USD _____

These data will not be stored on a database, and will not be recorded in any electronic form.

REDUCED SUBSCRIPTION RATES FOR *Geothermics*

Elsvier Science-Pergamon is pleased to offer members of the IGA a preferential subscription rate to the journal Geothermics.

Geothermics is published six times a year, with a normal 2004 subscription rate of USD 1124. IGA members, however, are eligible for one of the following yearly rates:

Individual / Student member USD 76
(saving USD 1048)
Corporate / Institutional member USD 175
(saving USD 949)

For more information on Geothermics and other publications by Elsevier, please check our Internet page "Elsevier Science Complete Catalogue of Journals and Books" (more than 12,000 at: *http://www.elsevier.nl*

Please make your check payable to "Elsevier Science" and send it with your name and address to:

Elsevier Science Boulevard-Langford Lane,
Kidlington, Oxford OX5 1GB, UK

Rates for advertising in GA *News*

Space/Format	Size mm	Number of Issues	
		1	4 (per issue)
Full Page	185 x 245	USD 450	USD 350
Half Page (horizontal)	185 x 120	USD 310	USD 215
Half Page (vertical)	90 x 245	USD 310	USD 215
Quarter Page (horizontal)	120 x 90	USD 195	USD 155
Quarter Page (vertical)	90 x 120	USD 195	USD 155