Quarterly No. 62 October – December

IGA NEWS

Newsletter of the International Geothermal Association

IGA ACTIVITIES

Editor´s Note

As our readers have noticed, we recently started delivering IGA News via Internet. The main advantages of this approach are lower printing and postage costs, and faster delivery. A disadvantage, perceived by many readers, is that the older two-column format is awkward to read in a computer screen. Therefore, by popular demand, we have switched to one-column format, as of the present issue.

Message from the President

John W. Lund, President

The Board of Directors met in Beijing, China on September 13th and 14th, hosted by the China Geothermal Energy Society (GCES), and organized by our wonderful host, Keyan Zheng. Fifteen board members attended along with two visitors from Hungary. The main issues discussed were the outstanding debts from the World Geothermal Congress 2005 (WGC2005) in Turkey, along with revisions of the bylaws. At this point, it appears that the WGC2005 is approximately US$40,000 in debt, mainly due to the delay in funding support from the World Bank/GeoFund for short course #4. The IGA is responsible for half of the debt, and this amount has been placed in reserve by the IGA board. The books for WGC2005 should be closed in November and hopefully the WorldBank/GeoFund monies will reimburse us later next year.

The Board of Directors also participated in the Opening Ceremony for the 20th Anniversary of the GCES and Chinese Geothermal Symposium on the 15th of September. The President gave opening remarks to the approximately 100 attendees, summarized as follows:

> " We are all here because we believe in geothermal energy, the domestic, renewable and green energy source that can provide many benefits to society. Worldwide geothermal energy saves an equivalent of 3.5 days of fossil fuel consumption annually and provides, for example, 15% of the energy supply in Tibet. China, of course, is a leader in this field, mainly in direct use applications such as space heating, greenhouse, aquaculture and pool heating. I encourage you to continue development of this important resource, and the members of the IGA are available to offer their support and services to China."

Invited lectures were then given by the President on *Worldwide Geothermal Development*, by Gestur Gislason of Iceland on *Geothermal Space Heating*, by Burkhard Sanner from Germany on *Geothermal Heat Pumps for Heating and Cooling*, by Valgardur Stefansson from Iceland on *Sustainable Use of Geothermal Resources* and by Ruggero Bertani from Italy on *Geothermal Power Generation*. Unfortunately, Eduardo Iglesias from Mexico had to cancel his trip at the last minute, but his paper on *Geothermal Reserves of Twenty Mexican States* was published in the Proceedings. The remainder of the board members were given a tour of geothermal heat pump installations in Beijing.

The following day, the board members were given a tour of the World Geothermal Natural Science Park – Nangong Village on the outskirts of Beijing. This village of 2,500 inhabitants is entirely heated with geothermal energy from 70°C water. Geothermal energy is provided for space heating, aquaculture pond and greenhouse heating and for a water park. The President wrote a greeting to the village in a special red-paged book that will be kept on display in their wonderful museum. Details of this remarkable village can be found in an article by Keyan Zheng in IGA News No. 61 (July-Sept 2005).

Gordon Bloomquist, the chair of the Finance Committee of the Board, in cooperation with the Russian Geothermal Association, organized the International Minerals Extraction Conference in Petropavlovsk-Kamachatka during the same week as the Beijing Board of Directors meeting (September 12-16). It was attended by approximately 100 persons, and papers were presented and discussions were held on extracting minerals from geothermal resources to enhance the utilization of the resource. A follow-up conference is planned to be held at the University of Arizona in conjunction with the Geothermal Resources Council Annual meeting in August, 2006.

Two papers written by IGA board members will be published in the next issue of Geothermics, edited by Marnell Dickson of the Istituto di Geoscienze e Georisorse in Pisa, Italy, and Marcello Lippmann of the Lawrence Berkeley Laboratory in Berkeley, California. These are the revised and updated versions of the papers originally presented at WGC2005. They are: *World Geothermal Generation 2001-2005, State of the Art* by Ruggero Bertani, and *Direct Application of Geothermal Energy: 2005 Worldwide Review* by John W. Lund, Derek H. Freeston and Tonya L. Boyd.

The President was fortunate to be invited by the New Zealand Trade and Enterprise group to lecture in New Zealand. He was able to attend the University of Auckland Geothermal Institute's conference and gave a lecture on *Worldwide Geothermal Development*. He also attended the meeting of the New Zealand Geothermal Association (Colin Harvey, President) and gave a lecture on *Geothermal Direct-Use* and *Geothermal Heat Pumps*. The NZGA has recently hired Brian White as the Executive Officer. He is based in Wellington. The President had discussions with the Lake Taupo Development Company on the formation of a Clean Energy Center that will be constructed in Taupo, emphasizing the use of geothermal and biomass energy resources.

The President and Ladsi Rybach (past Vice-President of IGA) have been invited to make presentations at the closing meeting of the Centenary of Geothermal-Electric Industry Conference in Florence, Italy, on December 10th. IGA will receive a Recognition Award at the Conference from Unione Geotermica Italiana for contributions to geothermal development. The conference organizers will also present copies of the special volume: *Contribution to the History of Geothermal Energy in Italy*, edited by Raffaele Cataldi and Prof. Marco Ciardi, to all the IGA board members along with some 50 selected non-Italian IGA members.

EUROPE

Some recent political actions inside EU to foster renewable energy use

Burkhard Sanner, President EGEC, http://www.egec.org

6th Inter-Parliamentary Meeting on Renewable Energies and Energy Efficiency
Edinburgh, Oct. 6-8, 2005-10-08 Edinburgh Declaration 2005

The reporter had the honour and privilege to be invited to represent the geothermal energy sector at the panel for heating and cooling with RES at the Edinburgh meeting, and to address the politicians present (Members of the European Parliament – MEPs, and members of national parliaments). The discussion showed that there is great interest in geothermal energy, but too little common knowledge yet.

On the other hand, a MEP from Hungary was very well informed and asked questions about the need for re-injection, as the Hungarian Geothermal Association is pressing him to help cancel the relevant legislation. Here the geothermal community and IGA has to find a clear position; I voiced my personal opinion, that re-injection in most cases is crucial for sustainable use of the resource, but that the governments also need to allow for transition periods and to support the re-injection projects. I would like to appeal to our Hungarian colleagues not to fight against re-injection, but to fight for financial support for the drilling, from national and EU-sources. The MEP promised his help in that respect.

The event was organised by EUFORES, an association of parliament members. The result of the discussion, and the declaration, will hence be a direct input to the legislative process.

Link to EUFORES, where the declaration and the meeting programme can be found for download:
http://www.eufores.org

Activities towards a Directive for Heating and Cooling

An initiative report is under preparation in the European Parliament to call for a Directive to support heating and cooling from renewable energy sources. MEP Mechthild Rothe, Social Democrats, Germany, is the rapporteur on that report.

In spring 2005 the European Renewable Energy Council, of which EGEC is a member, prepared a position paper to support the idea of such a directive. The paper covers the main RES that can be used for heating and cooling, i.e. solar thermal, geothermal, and biomass.

The report is expected to be dealt with in the plenary of the European Parliament in January 2006, and it will, if passed, require the European Commission come up with a proposal for a legal text within about half a year. After being officially submitted, the proposal for the report will be available for download in the EU databases. A link will be put on the EGEC homepage.

An eventual EU-directive resulting from that process should help the market development of the heating sector as did the respective directive for electric power from RES (2001/77/EG) for the power sector.

Link to EREC position paper:
http://www.erec-renewables.org/documents/RES-H/EREC_RES-H.pdf

Report on "The share of renewable energy sources in the European Union: proposals for concrete actions" adopted by the European Parliament

This report is also known as the "Turmes-Report", after its initiator, MEP Claude Turmes, Greens, Luxembourg. The preparation of the report was started in 2004 and the text was eventually adopted as a resolution of the European Parliament at the plenary meeting on Sept. 28, 2005. The main goal was to set targets for renewable energy sources beyond the existing target of 12 % by the year 2010. The resolution now calls for a binding target for all renewable energies of 25 % by the year 2020, and for national and sectorial targets to be developed. The needs for support in R&D and in application in order to reach that goal were also stressed. The resolution is a non-binding document, voicing the opinion of the European Parliament on that matter. Hopefully it will be taken very seriously by the European Commission and Council.

The press release from EU can be found under:
http://www.europarl.eu.int/news/expert/briefing_page/406-269-9-39-20050919BRI00405-26-09-2005-2005/default_p001c012_en.htm

From there, links are given to the report. The preliminary text as adopted (the final version will be published in the Official Journal of EU later) can be found directly at:
http://www.europarl.eu.int/omk/sipade3?PUBREF=-//EP//TEXT+TA+P6-TA-2005-0365+0+DOC+XML+V0//EN&L=EN&LEVEL=0&NAV=S&LSTDOC=Y&LSTDOC=N

Report of the European Economic and Social Committee on geothermal energy

This group, EESC for short, has worked on a statement on geothermal energy. The committee should not be confused with the committees of the European Parliament (the relevant committee there is called ITRE). EESC is a body created within the European administration to allow input from the citizens, as their website states at: http://www.ces.eu.int/index.htm. The reports of EESC are seldom considered important by the European Parliament and administration.

It is good to see that a quasi-official group in Brussels has dealt with geothermal energy, and with a generally positive attitude. However, the report focuses almost exclusively on the central European (German) options, and is full of inaccuracies. Neither EGEC nor GtV were involved in the preparation or were contacted by the authors. Judge for yourself, the report can be downloaded at:
http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2005/c_221/c_22120050908en00220027.pdf

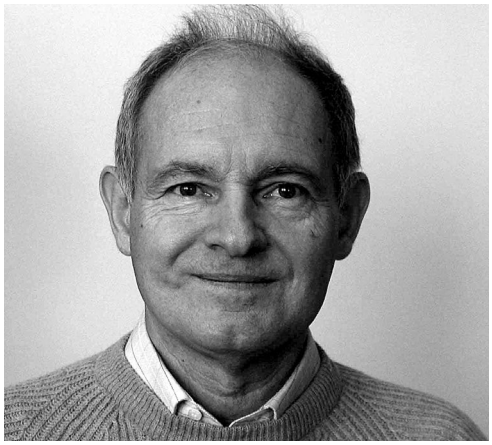
Conclusions

Seeing all these activities, and considering the results from the successful directive on electricity from RES as well as the threats from the traditional energy sector, a directive on heating and cooling from RES faces a number of challenges before eventually coming into existence. This strongly underlines the need for a powerful representation of geothermal energy in the heart of the European Union. EGEC, founded in 1998 and being a member of IGA since the year 2000, has such a position, and seeks for the co-operation of the European geothermal sector, and in particular IGA-EBF, towards that goal.

Sorry for the complicated links. They reflect somehow the complexity of EU bureaucracy. If not, and for those receiving the Newsletter as paper copy, please accept apologies for the inconvenience. Printing all the texts here would have exceeded any reasonable size limits.

Italy

Obituary Paolo Liguori



Paolo Liguori, friend and colleague of many in the geothermal community, died on 25 October 2005. Paolo discovered he was sick in June, just after his return from a business trip. Diagnosed with leukemia, he fought bravely for 5 months in hospital.
Paolo was born in Pesaro in November 1943, and graduated as a Mechanical Engineer (Thermodynamics) at the Polytechnic University of Milan, Italy, in 1968. After almost 40 years dedicated to work, many of which in geothermal projects, Paolo had travelled all over the world, from Brazil to Greece, Indonesia, Italy, Mexico, Kenya, Nicaragua, Panama, Philippines, Slovakia, Uruguay, Zaire and Zambia. He was in fact fluent in English, Portuguese and Spanish, and could speak pretty good French and Greek as well, so he was able to converse and empathise in almost any country. Many of us feel very privileged to have had the opportunity to work with Paolo and will remember his open smile, his kindness, his love of life. Paolo made friends wherever he went.
His great passion in life was sailing, and he had indeed written a guide to sailing entitled "Le Vele", which was published in Italy in 2002.
Paolo is mourned by his wife Clementina and his daughters Luisa and Francesca, but he will also be greatly missed by his friends the world over.

Spain

MOST RECENT EXPLORATION PROJECTS IN SPAIN. GEOTHERMAL RESEARCH OF THE LLUCMAJOR AREA, MALLORCA (BALEARIC ISLANDS)

Rosa M. Mateos-Ruiz and Jose M. Lopez. Instituto Geologico y Minero de España (IGME)

Jose Sanchez-Guzman. Tecnología y Recursos de la Tierra (TRT)

INTRODUCTION

The geological context of the *s Béticas Cordillera* located at the south and southeast of the Iberian Peninsula presents certain features suitable for the existence of abundant geothermal anomalies. The presence of substantial carbonate formations at great depths and the existence of recently created extensive fractures favour the circulation and storage of water in the permeable materials and, along with this, the existence of geothermal reservoirs. The Balearic Islands, which bear witness to the prolongation of the Béticas Cordilleras to the Mediterranean, constitute an environment with the same geological characteristics and therefore the existence of geothermal reservoirs in the subsoil.

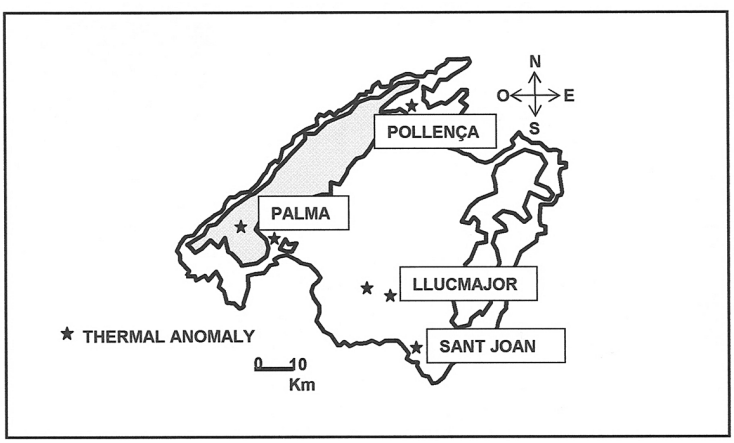


Figure 1. Thermal anomalies in Mallorca.

In 1984, the Spanish Mining and Geological Institute [*Instituto Geológico y Minero de España (IGME)*] conducted a preliminary study of geothermal manifestations on the Balearic Islands. Among others, two important points were located in Mallorca: Font Santa de St. Joan and thermal wells in Llucmajor (figure 1). These thermal manifestations are associated

with the normal and extensive Neogene faults that delimit the Llucmajor and Camps basin and facilitate the vertical movement of deep waters. Some studies conducted subsequently demonstrated a greater number of thermal wells in the Llucmajor area.

The possibility of finding low and medium temperature geothermal deposits at economically accessible depths led the *Instituto Geológico y Minero de España* and the Balearic Island Government's Department of Innovation and Energy to sign an agreement on *"Geothermal Research on the Island of Mallorca"*. This Project, conducted in 2002-2003, included two areas of study: Costitx-Lloret in the centre of the Island and Llucmajor in the southeast. At the latter, where the temperature range is higher and the possibilities of the existence of deep reservoirs are more evident, the research concluded with a exploratory drilling that reached an aquifer with water at 70ºC. What follows is a synthesis of the research conducted and the results obtained.

GEOLOGY

The geological research conducted focused on the regional structure and definition of the stratigraphy of the different materials so as to make it possible to propose a geological model for the area under investigation. These studies have made it possible to define tectonic graben-type structures produced by the action of the normal faults in a ENE-WSW direction reactivated in the post-alpine extensive phase which commences in the Tortonian Age. These faults or some of the vertical structures subparallel to them permit hydraulic communication between the Mesozoic carbonate reservoir and the aquifer of the Upper Miocene where thermal anomalies occur.

HYDROGEOLOGY AND GEOCHEMISTY

The geothermal manifestations appear in a shallow aquifer known as Llucmajor-Camps, with limestone and reef calcarenite contents from the Tortonian-Messinian. The water table is 115-125 metres deep with a high rate of exploitation. There are more than twenty wells with anomalous temperatures. Sampling of the underground water was conducted for geochemical analysis. As a result, four different classes of water were defined (figure 2):

1. - Calcium-sulphate waters with temperatures in the order of 40-50 ºC
2. - Calcium-bicarbonate and chloride waters. Cold and typical of the shallow aquifer
3. - Sodium-chloride waters. With minor thermalism and sea water influence.
4. - Mixture of classes 1 and 2.

The distribution of the so-called "geothermal indicators" (temperature, sulphates, silica, fluorine and lithium) reveals the existence of an important NE-SW fracture that allows the deep thermal water to migrate to the upper reef aquifer (figure 3). This fracture acts as the preferential flow direction for the thermal water. In the perpendicular direction, i.e., NW-SE, there is a slow diffusion of geothermal indicators in the shallow aquifer.

The isotopic studies reveal the deep origins of the thermal water. The chloride/oxygen-18 ratio demonstrates that the thermal water is not influenced by sea water, its salinity coming from the dissolution of salts. The analysis of dissolved gases in the water reveals a sharp CH_4 anomaly in the hottest water which may be due to the hydrocarbon traces in the deep Mesozoic deposits.

GEOPHYSICS

The subsoil was studied using magnetotelluric methods. A total of 46 MT soundings were conducted. Based on the

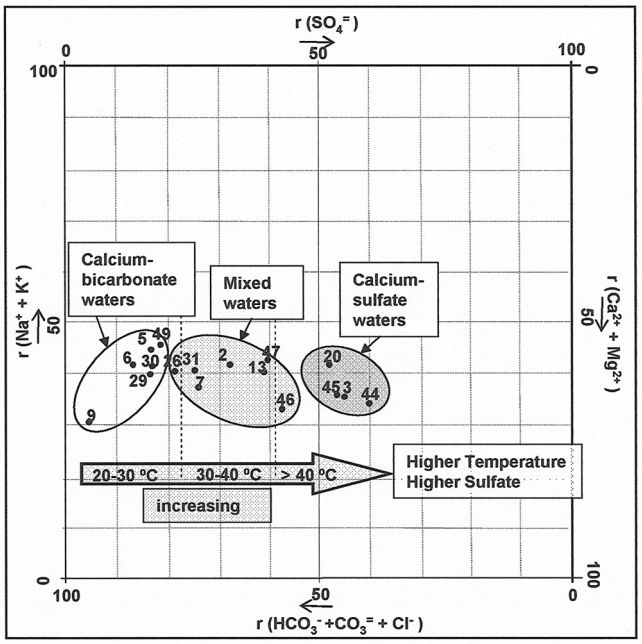


Figure 2. Langelier & Lugwig of Groundwaters.

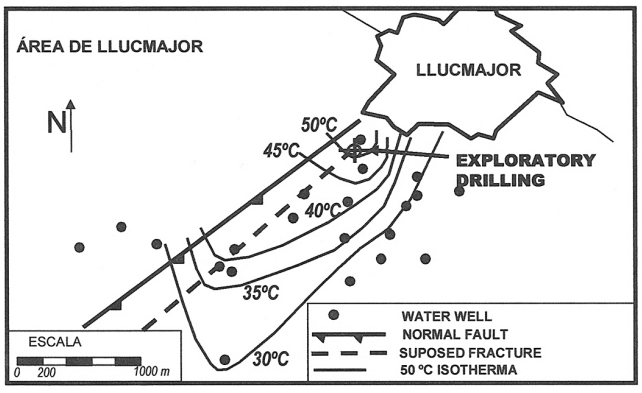


Figure 3. Llucmajor area. Geothermal anomaly.

resistivity curves obtained, a geophysical interpretation and geological model were drafted (figure 4). In the centre of the graben, three geoelectrical layers – R1-C1-R2 – were identified while, toward the NE in the raised block, the C1 conductor layer disappears with the two resistive layers, R1 and R2, remaining. An important NE-SW discontinuity can be delimited. The R1 resistive layer is associated with the reef calcarenites of the Upper Miocene. The C1 conductor is associated with a formation of marls from the Miocene underlying the calcarenites. Finally, the R2 resistive layer is identified with the detritic and carbonated materials of the Paleogene. The important tectonic structure detected (normal fracture or fault) constitutes an area where the thermal water migrates from the deep reservoir.

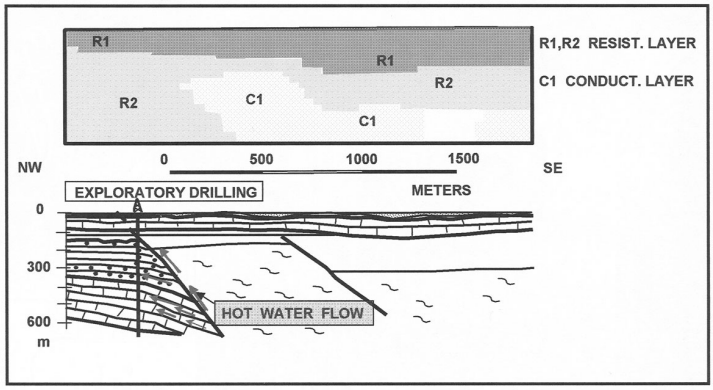


Figure 4. MT-section and Geological interpretation.

EXPLORATORY DRILLING

The final phase of the research plan consisted of a deep exploratory drilling in the area with the greatest thermal anomaly. The stated objectives were: a) verification of the geological and geophysical model, b) examination of deep formations and aquifers and the most relevant geological structures and c) a study of the evolution of temperature in the subsoil.

The drilling reached a depth of 700 m. Down to a depth of 131 metres, the drilling perforated post-orogenic materials of the Upper Miocene and Pliocene. Between 131 and 700 metres it perforated pre-orogenic detritic and carbonated materials of the Paleogene period. These materials showed abundant fractures and mylonite that reveal traces of hydrothermal circulation, especially at depths between 250 m and 365 m.

Two different aquifers were examined, the first in reef limestone between 115 and 131 metres deep with the water table at 117 metres, and the second with fractured limestone areas from the Paleogene period between 340 and 540 metres deep with the piezometric level at 100 metres.

The temperature at depths down to 220 metres is 50ºC, similar to that of the upper aquifer. Between 220 and 380 metres, the temperature rises quickly to 55-57ºC, exceeding 60ºC at a depth of 400 m. Between 400 and 500 metres the temperature remains more or less constant and rises again at 500 metres, reaching a temperature of 70ºC at the bottom of borehole (figure 5).

It was therefore possible to identify a first aquifer with a temperature of approximately 60ºC at a depth of 340-540 metres. The existence of other aquifers at temperatures of 70ºC and more can be predicted at greater depths. These aquifers, in carbonated materials, are fed laterally by hot water from the NE-SW fault or fracture.

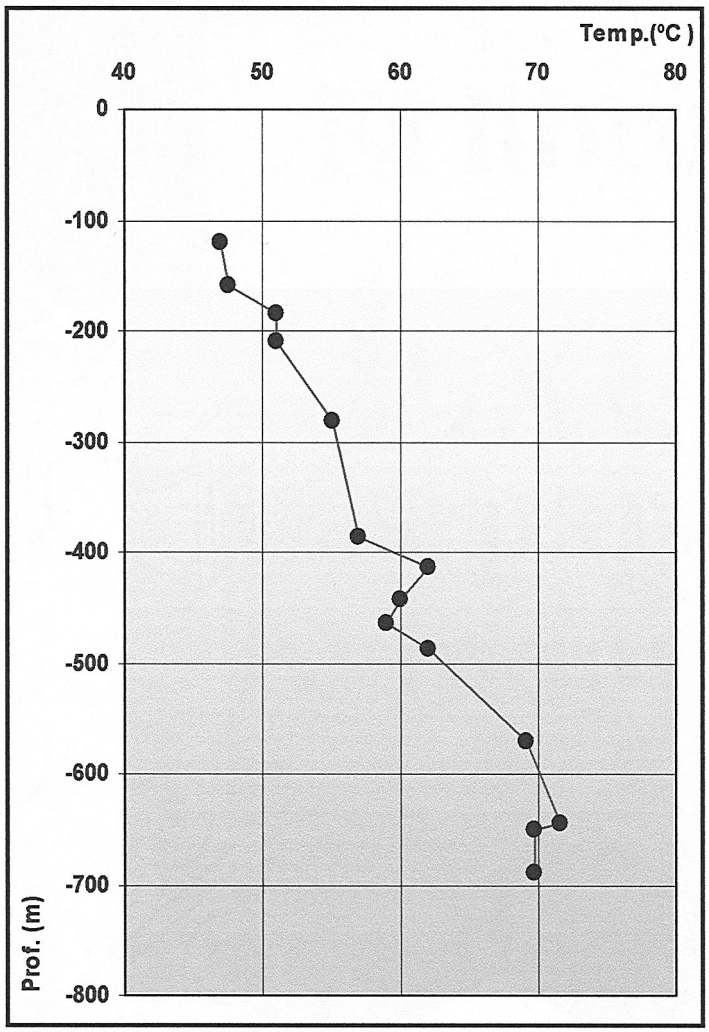


Figure 5. Deph-temperature evolution.

Switzerland

Thermal response tests: in situ determination of geothermal characteristics of soils

Gilbert Steinmann & Lyesse Laloui, Soil Mechanics Laboratory, EPFL, Lausanne

Determination of the geothermal characteristics of soils is essential, not only for geothermal analysis, but also more and more commonly for the geotechnical design of borehole heat exchangers (BHE), as well as energetic geostructures, such as foundations piles. These underground structures, later in the article called "heat exchangers", are used for the storage of dissipated heat in summer and its subsequent reuse for heating in winter. Detailed information concerning the practical aspects of such thermal response tests of soils may be found in the proceedings of the international workshop held at the Swiss Federal Institute of Technology in Lausanne (EPFL) in 2001 [1].
Testing equipment for the in situ determination of the geothermal characteristics of soils has been developed at the EPFL. It is based on a heating method that enables the determination of the following parameters:

- Mean underground temperature along a heat exchanger before and after the heating of the ground (Figs. 1 and 2);
- Thermal resistivity of the ground (Fig. 3);
- Thermal conductivity of the ground along the heat exchanger (Fig. 4).

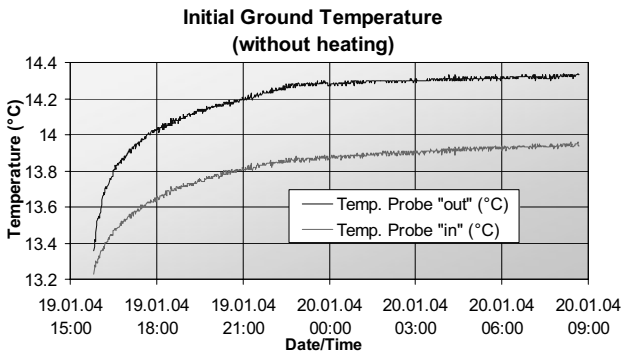


Fig. 1. Evolution of the initial underground temperature during the test (no heating).

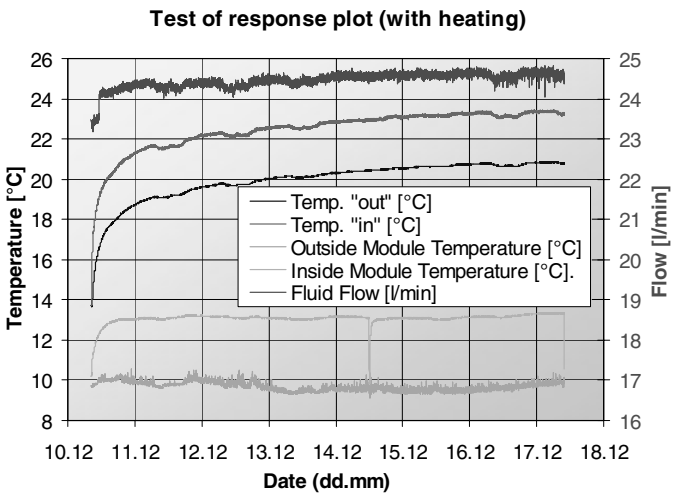


Fig. 2. Evolution of underground temperature and flow rate during the test (with heating).

This system was accredited by the SAS (Swiss Accreditation Service) in May 2004 according to the ISO/CEI 17025 Standard. Starting from the initial prototype, the heating module has been streamlined and modernised to make it more easily transportable to testing sites (Fig. 5). The latest modifications enable the remote transmission of data in quasi-real time over the Internet [2]. Currently, to the best of our knowledge, this is the only device of this type in Switzerland and the surrounding countries which offers such flexibility and applications potential for BHE and geo-structures (Fig. 6).

Advantages of in situ thermal response tests

Laboratory tests for the determination of the thermal characteristics of soils are often extremely delicate and difficult to carry out. The problems linked to such tests concern the following points:

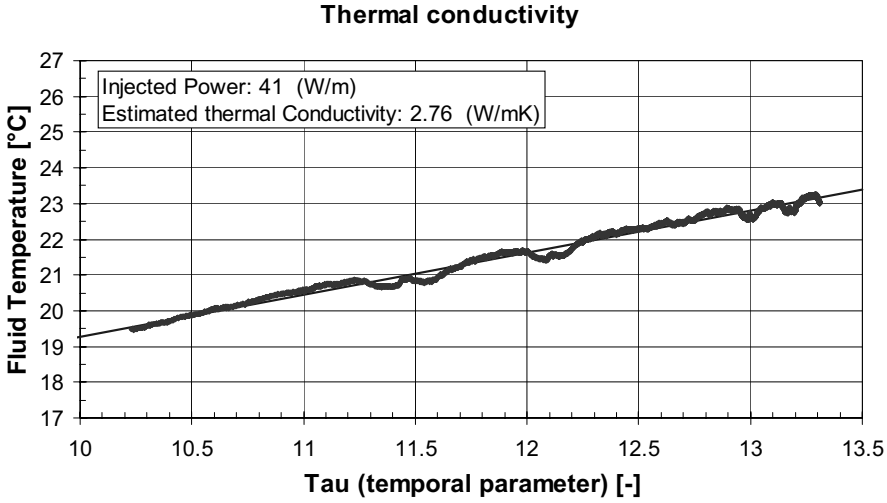


Fig. 3. Evaluation of the thermal conductivity of the underground.

- The quality of the sample, which is no longer subjected to the underground stress conditions. If these conditions are to be reproduced, the apparatus (a modified tri-axial cell) becomes highly complex and the test is difficult to carry out [3].
- In situ hydrogeological conditions, as well as the state of fissures of the ground, are not taken into consideration.
- The volume of soil taken for these tests, even if the sample was carefully chosen, is only partially representative of the natural state.
- Very precise instrumentation of the sample (gauges, flowmeters), in conjunction with sophisticated apparatus (data acquisition, insulation, thermostatic baths), is necessary to obtain credible thermal characteristics.

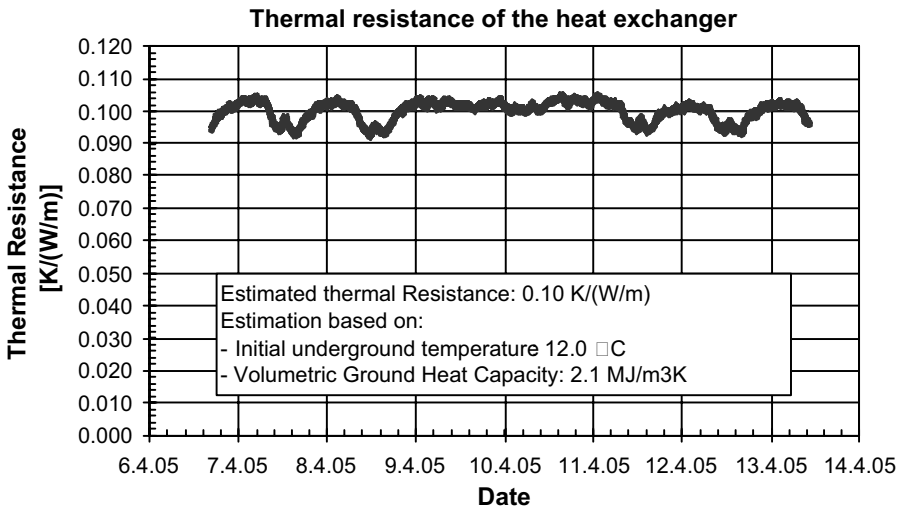


Fig. 4. Estimate of the thermal resistance (R_b) of the geothermal heat exchanger.

Moreover, in situ measurements of geothermal characteristics have the advantage of taking into account groundwater flow, porosity of the various strata and heterogeneity of the underground along the entire depth of the heat exchanger. Finally, the volume of soil used for the thermal response tests is identical to that used by the heat exchanger which monitors the energy needs.

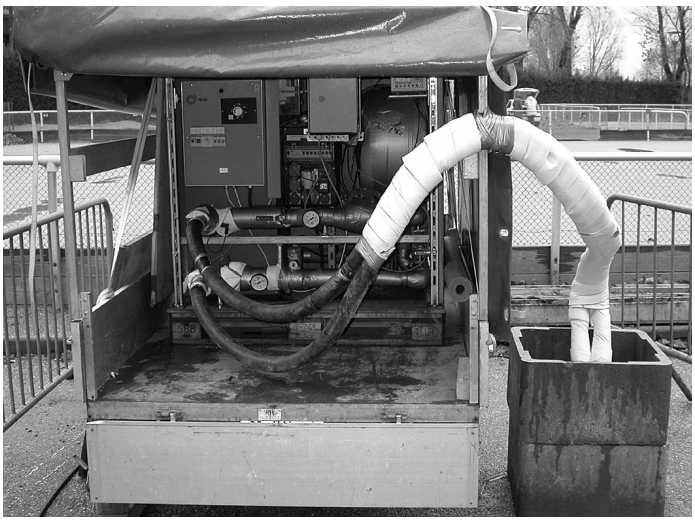


Fig. 5. Heating module, connected to a borehole heat exchanger.

Theoretical framework of the thermal response tests

Before beginning a thermal response test, the following parameters must be calculated based on several hypotheses:

- The injected power is chosen as a first approximation by the relationship:

$$P = q \cdot H \qquad (1)$$

where:

P: power of the boiler (W)
q: linear power of injected heat (W/m)
H: depth of the heat exchanger (m)

- The temperature difference between the input and the output of the heat exchanger ($\Delta T_{in\text{-}out}$) must be between 4 and 5 K. The flow rate is then determined by:

$$P = \rho_c \cdot \rho_w \cdot Q \cdot \Delta T_{in-out} \qquad (2)$$

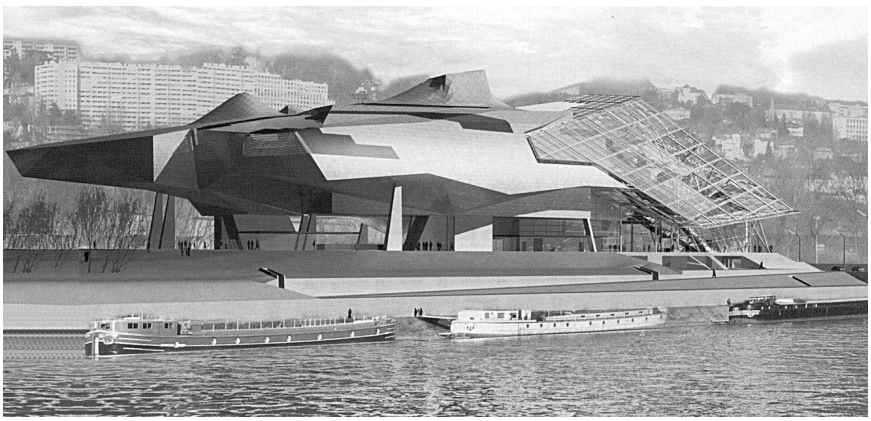


Fig. 6. Photomontage of the future "Musée des Confluences" in Lyon, France (doc. GEO).

where: ρ_c specific heat of water (4.18 kJ/kg . K)
ρ_w: unit mass of water (kg/l)
Q: flow rate (l/s);
and P is expressed in (kW).

- The maximum temperature at the end of the test. Perturbations along the heat exchanger caused by thermal convection are to be avoided. Thus, increase in temperature during the test should not exceed 30 to 35 °C. This estimate is obtained using relations proposed by Eskilson [4] and the following approximations:

$$\Delta T = \left(R_q + R_b\right) \cdot q \qquad (3)$$

where: ΔT : temperature in (K).
Rb : thermal resistance of the heat exchanger (K/(W/m)) ;
(taken to be 0.1 as a first approximation);
Rq : thermal resistance of the ground (K/(W/m)) :

$$R_q = \frac{1}{4 \cdot \pi \cdot \lambda} \cdot \left[\ln \left(4 \cdot a \cdot t / r_b^2\right) - \gamma \right] \qquad (4)$$

where: a thermal diffusivity (m^2/s) (order of magnitude: 10^{-6} m^2/s)
t duration of the heating phase (s)
r_b radius of the heat exchanger (m)
γ Euler's constant (γ = 0.5772)
λ thermal conductivity of the ground (W/m.K) (taken to be 2).

Procedure for an in situ thermal response test

The heating module is first linked with insulated tubes to the heat exchanger previously inserted by a specialised contractor. The test begins with the circulation of the heat-conducting fluid in the heat exchanger tubes, without heating, until the temperature is equilibrated. This operation gives the initial temperature of the underground over the depth of the heat exchanger and this first phase lasts between 12 and 16 hours.

The heating module is then turned on with the power necessary for a power injection in the heat exchanger between 40 and 50 W/m (see Equation 1).

During the tests, the following eight parameters are recorded every minute and uploaded at regular intervals to a web site:

- fluid temperature (input and output) of the heat exchanger tubes;
- internal and external temperatures of the module;
- pressure of the heat-conducting fluid (input and output) of the heat exchanger tubes;
- flow rate of the heat-conducting fluid;
- energy consumption (impulse counter).

A standard test report is prepared for each thermal response test; the graphs show the evolution of temperatures, flow rate and pressure before and after heating.

Interpretation

Calculations allow the final, precise characterisation of the geothermal heat exchanger and of the surrounding underground using the following values:

- The effective thermal resistance of the heat exchanger, R_b, determined using its geometrical and physical parameters. This value is obtained by using the software program Earth Energy Designer (EED) written by Hellström [5]. It should be noted that the quality of the heat exchanger increases as its thermal resistance decreases.
- The thermal conductivity of the ground along the heat exchanger, calculated using Equations (3) and (4), for known initial and final ground temperature values.
- An additional check of the results is carried out comparing the injected power and that really used.

Acknowledgements

Dr. D. Pahud is to be thanked for his contribution to this research study.

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[1] Eugster W. J. & Laloui L. (eds.), 2002. Tests de réponse géothermique/Geothermische response tests. Proceedings of the Workshop on Geothermal Test Responses. Lausanne – October 25 & 26 2001, 130 pages. Publisher GtV; ISBN 3-932570-43-X.

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Contacts:

Gilbert Steinmann, gilbert.steinmann@epfl.ch
Lyesse Laloui, lyesse.laloui@epfl.ch
EPFL – ENAC
Soil Mechanics Laboratory
CH-1015 Lausanne, Switzerland
Tel. +41 21 693 23 24
http://lms.epfl.ch

AFRICA

Uganda

A Close Encounter

Gestur Gíslason, Orkuveita Reykjavikur, Iceland

Geothermal exploration often places the geothermal researchers in difficult and sometimes dangerous circumstances. Recently one of our colleagues had a close encounter carrying out his geothermal fieldwork.

Currently a geothermal exploration project is being carried out in Uganda (Bahati, IGANews #59). The study involves a countrywide geothermal exploration, led by Mr. Godfrey Bahati, a geochemist/environmental scientist with the Geological Survey and Mines Department in Entebbe, Uganda. One of the prospects under investigation is within the Queen Elizabeth National Park, an area well known for its wildlife and beautiful scenery. On 26th September 2005 Bahati entered on foot the steep Lake Kitagata Crater with a team of 5 people, consisting of two chemists and field technician, driver and a park ranger. The purpose was to sample two hot springs in the western part of the crater. The location of the springs is constrained; the springs emerge on the shore of a crater lake that covers the whole crater floor and above it rises a vertical cliff, reaching almost 300 m above the lake. The springs can only be reached along the narrow northern shore of the lake, but to the south the route is blocked by a dense thicket. On their way to the springs the team members noticed two Cape buffaloes which they bypassed without disturbing the animals. Buffaloes are common in the park, and are frequently encountered during field work without problems, as it seemed at this time. Having reached the hot springs the team started the sampling procedure. While sampling the first spring a movement within a nearby bush was noticed but ignored, as it was thought to be a baboon which are also very common in the crater area.

Having finished sampling the first spring and preparing to move to the second spring, the team noticed that one of the buffaloes was approaching them and showed hostility. As the beast reached within 20 m the ranger fired several rounds from his AK-47 rifle in the air to drive the animal away. Instead of retreating the buffalo charged and the team tried to escape. The animal singled out Bahati, who decided to try to run to higher ground, towards the cliff. In the rough Bahati tumbled and immediately the 600 kg beast was upon him. The buffalo threw its victim in the air, but finally Bahati got hold of branches of the bush and managed to pull himself through a hole into the dense undergrowth. The buffalo charged in vain and as Bahati managed to drag himself through the bush, the ranger spotted that he had moved away from the beast and shot a burst at the mad animal, who retreated immediately.

The geothermal team reassembled and decided to leave at once. Immediately as they intended to hurry back, Bahati realized that he had been mutilated by the buffalo. On inspection he discovered that the buffalo had torn the muscle on the left leg just above the knee. The flesh was badly torn with a large portion hanging down, and the femur bone was clearly visible. Despite this horrendous damage Bahati managed, with the support by his team mates, to walk back to the vehicle which was about 1.5 km away and this included having to climb about 200 m from the crater lake to its rim in the soaring equatorial heat. Immediately Bahati was taken back to the park head-quarters where he received first aid treatment and was then taken to a hospital in Kilembe.

The Cape buffalo is considered to be one of the most dangerous animals in Africa, and along with hippopotamus and crocodile is responsible for most human deaths by wild animals in Africa. It feeds solely on grass, but when it feels it is threatened it becomes very aggressive. This is especially true for old males, who prefer solitude, whereas young cows and bulls travel in large herds.

The following day a squad of park rangers went back to the scene. They found the buffalo dead a few meters from the location of the attack, with an indication that lions were in the vicinity. Trackers from the park believed that when the geothermal team arrived at the scene the buffaloes were already being stalked by lions, and the attack on Bahati was a desperate attempt by the buffalo to escape from a close encounter. This was confirmed by the noise the team heard from the lions in the bush during the sampling of the first spring.

I met Bahati in late October this year (2005), and I am pleased to report that he is making a remarkable recovery. He is back at work in the office, busy interpreting the data already gathered, and is hoping to go back into the field as soon as his leg has recovered. He is very grateful to his team for the help given to him during this trying experience.

ASIA/PACIFIC RIM

China

20TH Anniversary of GCES and Chinese Geothermal Symposium

Keyan Zheng, Geothermal China Energy Society (GCES)

GCES celebrated satisfactorily its 20th anniversary of establishment. As the main core, the Chinese Geothermal Symposium with the theme of Sustainable Development of Geothermal Industrialization was held in Beijing during the period 14-16 September 2005. Approximately 130 persons attended the symposium. Participants include geothermal experts, geothermal enterprisers and government administrators. They come from different parts of the country, including Tibet. A few foreigners attended the symposium too.

The purpose of the symposium was to exchange experiences of the pattern of geothermal industrialized development and sustainable development mechanisms, in order to coordinate and advise geothermal exploration, exploitation and research for the future in China. Some 69 papers were submitted and 65 of them were collected in the Proceedings of the Symposium. The main topics include sustainable development, exploration and utilization, geothermal management and research and application.

With the great special opportunity that the 39th IGA BoD Meeting was held in Beijing, all participants of IGA BoD were invited to attend our opening ceremony, and were photographed together with the Chinese geothermal leadership. Then 6 invited papers from IGA BoD members were presented at the symposium. Chinese geothermal workers listened for the first time to many world-famous geothermal experts' presentations, covering worldwide geothermal development (John Lund), sustainable utilization (Valgardur Stefansson), geothermal space heating (Gestur Gislason),

From left to right, front row: TIAN Tingshan, ZHANG Zhenguo, TAO Qingfa, BAO Yunqiao, John Lund, REN Xiang, Ruggero Bertani, Toshihiro Uchida, Kevin Brown, ZHENG Keyan, Rosalba Mottola; middle row: Valgardur Stefansson, SI Shirong, ZHU Jialing, Shigeto Yamada, Sachio Ehara, LI Wei, Valentina Svalova, Meseret Teklemariam, Paul Brophy, James Lawless, Gestur Gislason, WU Aimin, XU Junxiang, MA Encheng; back row: Burkhard Sanner, JIANG Yong, DOR Ji, Gyorgy Paczay, Mihaly Kurunczi, LIANG Guizhi, QI Jinsheng, PAN Xiaoping, RAN Weiyan; Final row: DONG Yin, PANG Zhonghe.

geothermal power generation (Ruggero Bertani) and geothermal heat pumps (Berkhard Sanner). Unfortunately, Eduardo Iglesias from Mexico had to cancel his trip at the last minute, but his paper on Geothermal Reserves of Twenty Mexican States was published in the Proceedings. All Chinese participants felt that they enjoyed these talks.

Chinese authors introduced their papers around sustainable development mainly, such as renewability, recycling and sustainable patterns of development and utilization; the relationship of geothermal resources and sustainable utilization; exploiting cyclic economy; large scale geothermal reinjection; combining development of deep geothermal and shallow heat pumps; and so on. These presentations showed recent researches and their achievements in China. In addition, a book "100 Examples of Geothermal Exploration and Development in China" was published at the same time. It introduces many more typical examples since geothermal as new energy was developed in the country.

All participants from home and abroad visited Nangong Village – the First Geothermal Village in China. Comprehensive local geothermal utilization and cascade use gave visitors a favorable impression. IGA President Dr. John Lund wrote down "You have a wonderful example of using a renewable and green energy source – geothermal" for the village.

The Beijing Declaration

By Burkhard Sanner

The Beijing Declaration, adopted on Nov. 8, 2005, is the major outcome of the Beijing International Renewable Energy Conference, "Renewables 2005". The Declaration explicitly includes Geothermal Energy as a renewable energy to be supported by the governments. The governmental delegations from around the world, in several cases headed by the relevant ministers themselves, agreed on the text, after the representatives from NGOs and stakeholder groups had voiced their opinions and wishes. The geothermal sector was represented by two persons only, making it almost vanish among all the wind, solar and biomass people. The Declaration is available for download at: http://www.birec2005.cn

Philippines

On Its Way to Privatization

by PNOC Energy Development Corporation

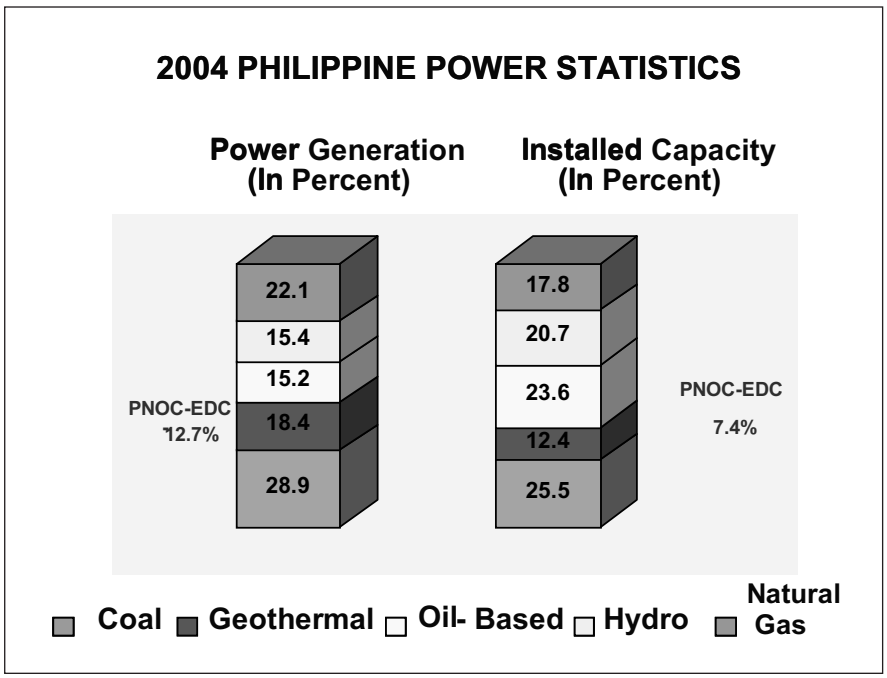
In line with the Philippine Government's thrust to restructure the power sector, PNOC Energy Development Corporation (PNOC-EDC) is slated for privatization this year. The approved Privatization Masterplan was formulated by PNOC-EDC, together with its financial advisor, CLSA Exchange Capital, a majority-owned subsidiary of CLSA based in Hong Kong.

The overall strategy for implementing PNOC-EDC's privatization involves a strategic sale followed by an Initial Public Offering (IPO). Based on the current timetable, the Company hopes to conclude the strategic sale process by 4th quarter of 2005.

PNOC-EDC is the largest subsidiary of the Philippine National Oil Company. It was created to accelerate the exploration, delineation and development of indigenous energy resources, i.e. geothermal energy. The Company began its commercial operations in 1984. Over the years, PNOC-EDC has independently developed the requisite technology to locate, extract and deliver geothermal steam to power plants.

Today, PNOC-EDC is the largest geothermal company in the Philippines. It has a total installed capacity of 1,149 MW, representing approximately 63% of the country's 1,905.4 MW installed geothermal capacity. In 2004, PNOC-EDC accounts for approximately 7.4% of the country's 15,548 MW total installed power generating capacity and contributed approximately 12.7% of the country's total 55,957 GWh of power generated for the year. The Company has significantly contributed to making the Philippines the second largest geothermal producer in the world, and the highest ranked in terms of geothermal energy's contribution to total power mix.

Interested parties who wish to register their interest as a potential purchaser may contact Mr. Fermin Francisco of CLSA Exchange Capital at fermin.francisco@clsa.com; +63-2-815-4886.



PNOC EDC Installed Capacity.

Geothermal Steamfield	Installed Capacity (MW)	Power Plant Owner/ BOT Partner	Commissioning Date
Bacman			
Bacman I	110.0	NPC	1993
Bacman II	40.0	NPC	1995
Manito	1.5	PNOC EDC	1998
Leyte			
Tongonan I	112.5	NPC	1983
Upper Mahiao	125.0	CalEnergy*	1996
Malitbog	231.0	CalEnergy*	1996-1997
Mahanagdong	180.0	CalEnergy*	1997
Optimization Plants	50.9	Ormat*	1997
Palinpinon			
Palinpinon I	112.5	NPC	1983
Palinpinon II	80.0	NPC	1995
Mt. Apo (Mindanao)			
Mindanao I	52.0	Marubeni*	1997
Mindanao II	54.0	Marubeni*	1999
TOTAL	**1,149.4**		

* BOT Partner

Russia

The First International Mineral Extraction Conference

By Dr. Oksana Shamshina, Russian Association of Geothermal Energy Society

The First International Mineral Extraction Conference was held in Petropavlovsk-Kamchatski City, Kamchatka, Russia on 12-16 September 2005.

This international conference and the road-mapping workshop, designed to identify and prioritize research and development needs related to the extraction of minerals from geothermal brines, were organized by the International Geothermal Association (IGA), the Russian Association of Geothermal Energy Society (GES), the Kamchatka Scientific Center and the Far East Branch of the Russian Academy of Sciences (KSC FED RAS) and sponsored by the World Bank/Global Environmental Facility, KSC FEB RAS, and the United States Department of Energy. The Second International Mineral Extraction Conference, as proposed by the IGA (J. Lund and G. Bloomquist), will be held in the United States in the fall of 2006 at the University of Arizona.

The Conference was organized to discuss the following issues: (i) physical and chemical characteristics of geothermal brines; (ii) case histories from the geothermal industry; (iii) brine processing experiences from other industries (e.g. oil and gas, brine disposal and water reuse communities); (iv) physical and chemical parameters influencing extraction of chemical components; (v) methods of mineral extraction and separation from geothermal brines (chemical precipitation and co-precipitation, sorption, extraction, coagulation and electrocoagulation, hyperfiltration (reversed osmosis), extraction methods of chemical components from gas phase, bacterial-chemical methods, downhole mineral seeding, methods of partial condensation).

Dr. Alexander I. Nikolski, Vice-President of the Russian Association of Geothermal Energy Society, during his speech on results of the business-plan on creation and construction of Pauzhetsky binary GeoPP; to the right: Dr. Alexander S. Kovalev (Investment Policy Department, RAO UESR), Dr. G. Bloomquist (IGA), Dr. Yury P. Trukhin (Kamchatka Scientific Center, Far East Division of the Russian Academy of Sciences).

The Conference proceedings can be found on the web-site of the Russian Association of Geothermal Energy Society – www.gesa.ru.

The Workshop on new geothermal projects in Russia held after the Conference covered two major projects: (i) prospects for energy supply of the Center of Kamchatka from petrothermal (HDR) energy of Avachinsky Volcano; and (ii) construction of 4 MW binary Pauzhetsky GeoPP (Kamchatka), based on the business-plan prepared by Nauka SC, and a boron and lithium manufacturing plant. Here research works and achievements of Ukraine scientists (from the Ukraine Academy of Sciences) were of great interest. For a long time they have been carrying out studies on rare earth metal and iodine extraction, and recently in Gomel City Ukraine experts jointly with Belorussian specialists successfully constructed an iodine manufacturing industrial unit.

UPCOMING EVENTS

Clean Energy Power. Berlin, Germany. Jan. 18-19, 2006. Contact: Elisabetta Alberti alberti@energie-server.de, www.energiemessen.de/engl/index.htm

Stanford Geothermal Workshop. Stanford, California, USA, Jan. 30 – Feb. 01, 2006. Contact: Laura Garner lgarner@pangea.stanford.edu, http://ekofisk.stanford.edu/geoth/workshop2006.htm

World Sustainable Energy Days. Wels, Austria. Mar. 1-3, 2006. Contact: www.wsed.at

27th Annual PNOC-EDC Geothermal Conference. Manila, Philippines, Mar. 8-9, 2006. Contact: Jem Austria, austria.jjc@energy.com.ph, www.energy.com.ph/Geoscientific/geocon2006.htm

Meeting on Geothermal Energy Generation in Oil and Gas Settings. Southern Methodist University, Dallas, Texas, USA, Mar. 13-14, 2006. Contact: David Blackwell, blackwel@smu.edu, www.smu.edu/geothermal/Oil&Gas_SMUmeeting.htm

3rd Annual POWER-GEN Renewable Energy. Las Vegas, Nevada, USA, Apr. 10-12, 2006. http://pgre06.events.pnnnet.com/

ASME ATI Conference. Milan, Italy, May 147-17, 2006. www..asmeati2006.it

TOUGH Symposium 2006. Berkeley, California, USA, May 15-17, 2006. www-esd.lbl.gov/TOUGHsymposium

International Summer School on Geothermal Energy. Izmir, Turkey, May 28 – June 11, 2006. Contact: jenarum@deu.edu.tr, www.deu.edu.tr/DEUWeb/English/Icerik/Icerik.php?KOD=8425

International Heat Transfer Conference IHTC-13. Sydney, Australia. August 13-18, 2006. Contact: Graham de Vahl Davis, ihtc-13@unsw.edu.au, http://ihtc-13.mech.unsw.edu.au/

World Renewable Energy Congress IX & Exhibition. Florence, Italy, August 19-25, 2006. Contact: Ali Sayigh, asayigh@netcomuk.co.uk, www.wrenuk.co.uk/wrecix.html

International Summer School Workshop/Conference "International Geothermal Days Ukraine 2006". Odesa, Ukraine, Sep. 17-22, 2006. Contact: Kiril Popovski, isskiril@sonet.com.mk

GRC Annual Meeting. San Diego, California, USA. Oct. 1-4, 2006. Contact: Geothermal Resources Council grc@geothermal.org, www.geothermal.org

International Conference and Exhibition "Renewable Energy 2006". Makuhari Mese, Chiba, Japan, October 9-13, 2006. www.re2006.org.

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:

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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.

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e-mail: iga@samorka.is

Contributions to the next issue of IGA News must be received by 10 February 2006.

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