Quarterly No. 57 **July-September 2004**

IGA NEWS

Newsletter of the International Geothermal Association

IGA ACTIVITIES

Transfer of the Secretariat

Guido Cappetti, IGA President

The IGA Secretariat is moving from Pisa, Italy, to Iceland where it will become fully operational by the beginning of October 2004.

Therefore, this is the last issue of the IGA News that the Pisa Secretariat will edit and print. It is thus with warm and sincere gratitude that I thank Enel for hosting and operating the Secretariat for the last six years (1998-2004), for assuming the expense of delivering the newsletter and for supporting our activities with in-kind services.

I would like to thank the Enel management on behalf of the IGA Board of Directors and of the entire IGA community of members for the excellent service provided. At the same time I am totally confident that the new Secretariat will be equally generous and successful.

The MoU between the IGA and the new host organization was signed by Fridrik Sophusson, Chairman of the BoD of Samorka, and myself during the International Geothermal Conference on Multiple Integrated Uses of Geothermal Resources on 15th September 2003. The new Secretariat will run for a five year term, until 31st August 2009.

My thanks go to Dr. Ruggero Bertani for his invaluable contribution as Executive Director, and to Dr. Iris Perticone, who has worked by his side throughout the six years of Enel hospitality. I worked with them as IGA Secretary during the first term (1998-2001), and as President during the second (2001-2004); without their contribution I would have been a lost man. Working for the IGA has been a continuous challenge, one that we have had to tackle on a day-to-day basis, but it has always been interesting and personally rewarding.

Figure 1. *The IGA staff (Ruggero Bertani, Guido Cappetti and Iris Perticone) is closing the IGA Secretariat in Pisa.*

Last, but not least, I would also like to thank the entire staff of the former Enel GreenPower in Pisa for their help in many and varied practical and procedural matters.

IMPORTANT NOTICE

The new IGA Secretariat e-mail is:

iga@samorka.is

See the back cover page for all the new contact details.

Ruggero Bertani, IGA Executive Director

After six years as Executive Director of the IGA, the moment has now arrived for me to hand over the reins to a very good friend, Valgardur Stefansson. From Italy to Iceland, a long jump north, from the cradle of the geothermal industry to literally the most emerging geothermal country in the world. Iceland is in fact in continuous growth, increasing its surface area by a some hundred of square metres every year, thanks to the volcanic forces exerted beneath the mid Atlantic. Sometime in the future, it will be the biggest geothermal country in the world, but by then I suppose the IGA Secretariat will have again moved to another geothermal country.

I have greatly enjoyed my job as Executive Director: it has been the most productive and satisfactory period of my working life. I'll never forget the interaction with authors for IGA News and the satisfaction in seeing the printed issue, the organization of the BoD meetings and the relaxing moment when the minutes have finally been mailed out; many of my IGA-related tasks have been very proactive and really exciting.

Now it's time for me to move on to other challenging experiences, both at Enel and on the IGA Board. But before doing so, I'd like to thank all the people who have helped me over the years: Iris Perticone, Guido Cappetti, Ian Thain, Raffaele Cataldi, Franco Luccioli, Marnell Dickson, Adele Manzella, Enrico Barbier, Marcelo Lippmann, George Frye, John Garnish, Ladsi Rybach, all the past and present BoD members, my contact persons in the Affiliated Organizations and many other friends and colleagues, too numerous to mention here.

I wish Valgardur all the best; I am sure he will have a most fruitful and satisfactory period in the Secretariat.

I would like to bid the Secretariat a fond farewell.

Presentation of the new Executive Director

IGA Secretariat

Valgardur Stefansson received a Ph.D. (degree) in nuclear physics from the University of Stockholm, Sweden, in 1973. He joined Orkustofnun in Iceland in 1973. In the beginning he served as geophysicist in geothermal prospecting, but from 1975 he started to build up the geothermal logging and reservoir-engineering unit within Orkustofnun. He was the head of the geothermal logging unit 1975-1985 and served simultaneously as Deputy Director of the Geothermal Division of Orkustofnun 1979-1985. During 1985-1990, Stefansson served as Interregional Advisor on Geothermal Energy at the Department of Technical Co-operation for Development at the United Nations in New York. He returned to Orkustofnun in 1990 where he has been the Head of the Geothermal Reservoir Group (1990-1996), the Chief Project Manager from 1996 to 2003, and the Head of the Energy Resources Division 2003-2004. Stefansson has served as Geothermal Advisor in 21 countries outside Iceland. He has published more than 100 scientific papers in international journals.

During the time from 1st of September to 10th of October 2004, both the office in Pisa and the office in Reykjavik will be in operation.
The Pisa office will handle the 36th BoD meeting on October 9 (last meeting of the old board) and the AGM, whereas the Reykjavik office will handle the 37th BoD meeting on October 10 (the first meeting of the new board). After the AGM meeting we hope that the office in Reykjavik can take over. However, the Pisa office is responsible for the minutes of the 36th BoD and the AGM-2004.

Valgardur Stefansson - Executive Director
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Election results

IGA Election Committee

The IGA BoD election process was completed on schedule. The ballot sheets were mailed between 1 and 20 April 2004 to all members of the IGA with voting rights. A web-based election page was prepared, and individual ID/passwords were disseminated through the membership. The total number of eligible voters is 2665 IGA members.

Between 1 and 10 July the election committee, consisting of Ruggero Bertani, Iris Perticone and John Garnish, scrutinized the ballots that had been received at the IGA Secretariat by the evening of 30 June 2004, and counted the votes. A total of 18 late arrival ballots, mailed in June, were delivered to Pisa during the first week of July. As in the previous elections, we decided to accept these ballots. An independent check was then performed by Franchi & Sbrana, the IGA Business consultant.

Ballot Statistics

The main statistics are reported in table I.

We received 224 paper ballots and 78 faxed/emailed votes. The remaining 532 valid ballots were cast on the

Total ballots received	**856**
Anonymous outer envelopes	1
In arrears with payment	3
Ballot mailed/faxed after election closure	3
Double votes	15
Total invalid ballots	**22**
Total ballots counted	**834**
Ballots considered invalid because more than 30 votes were expressed	**0**
Total valid ballots	**834**
Total number of valid preferences	**12,968**

Table I. *Main election statistics.*

website (64%). The 834 counted ballots represent **32 %** of the total number of IGA voters, covering 44 countries.

Country	Total	%voters
Albania	1	100%
Algeria	1	100%
Argentina	2	100%
Australia	5	56%
Austria	2	25%
Belgium	4	80%
Brazil	1	100%
Bulgaria	1	50%
Canada	10	40%
Chile	1	33%
China	12	38%
Croatia	1	50%
El Salvador	1	14%
Ethiopia	1	33%
France	6	30%
Georgia	1	4%
Germany	18	31%
Greece	4	33%
Hungary	43	40%
Iceland	52	43%
India	1	25%
Indonesia	57	12%
Israel	1	25%
Italy	40	43%
Japan	76	55%
Kenya	2	22%
Korea Rep	1	100%
Lithuania	5	20%
Macedonia	11	34%
México	19	24%
Netherlands	2	15%
New Zealand	54	50%
Nicaragua	1	33%
Pakistan	1	100%
Philippines	135	55%
Poland	24	34%
Portugal	1	20%
Romania	23	51%
Russia	20	33%
Slovakia	4	11%
Slovenia	2	40%
Spain	1	100%
Switzerland	14	21%
Tanzania	1	50%
Turkey	58	65%
Uganda	1	100%
UK	3	33%
USA	109	19%

Table II. *Ballot distribution per country.*

Affiliation	Total	%voters
API-INAGA	57	12%
CGEA	7	47%
GAI	41	40%
GCES	12	43%
GGA	1	4%
GRC	153	21%
GtV	13	30%
HGA	31	54%
IGAJ	56	52%
LGA	5	21%
MAGA	11	35%
MGA	12	22%
NGAP	131	55%
NZGA	53	50%
PGA	24	35%
RGA	23	61%
RUGA-GES	20	34%
SGA	3	10%
SVG-SSG	17	23%
TGA	52	68%
UGI	31	48%
TOTAL	**753**	**31%**

Table III. *Ballot distribution from Affiliated Organizations.*

The geographical distribution of the counted ballots is reported in Table II, which also shows the percentage of ballots received from each country out of the total number of voters for each country/continent (called "%voters" in the table II):

In Table III the distribution of votes received from the affiliated organizations is shown, along with the percentage of the voters participating in each of them.

Election results

The 12,968 preferences were independently checked by Franchi & Sbrana, and the results are reported in table IV.

All the elected BoD members have given their formal acceptance of the positions by email.

Conclusions

The election schedule approved by the BoD and published in IGA *News* #55, stated that the Election Committee should proclaim the election results before July 15. This deadline has been met. The geographical distribution of the new BoD members is reported in tables V and VI.

The new BoD elected among its members the new Officers and EuroBranch Chair.

The composition of the directive committee of the elected Officers and EuroBranch Chair is listed below. They received 29 votes in favor and two abstentions.

President:	John Lund (USA)
VicePresident:	Orhan Mertoglu (Turkey)
Secretary:	Olafur Flovenz (Iceland)
Treasurer:	Kevin Brown (New Zealand)
EuroBranch Forum Chairman:	Kiril Popovski (Macedonia)

Rank	Name	Votes	Country
1	Ruggero Bertani #	456	Italy
1	John W. Lund #	456	USA
3	Kevin Brown * #	455	New Zealand
4	Gordon R. Bloomquist #	416	USA
5	Ólafur G. Flóvenz * #	372	Iceland
6	Orhan Mertoglu * #	363	Turkey
7	Manuel Ogena #	362	Philippines
N/A ($)	Adele Manzella * °	360	Italy
8	Sakir Simsek *	349	Turkey
9	Burkhard Sanner * #	345	Germany
10	Hiroaki Niitsuma *	342	Japan
11	Marcel Rosca * #	338	Romania
12	Rosa Maria Prol-Ledesma * # °	334	Mexico
13	Beata Kepinska # °	330	Poland
14	Riki Ibrahim * #	329	Indonesia
15	Valentina Svalova * # °	325	Russia
16	Eduardo Iglesias *	319	Mexico
16	Meseret Teklemariam * °	318	Ethiopia
18	John Garnish *	315	UK
18	Antonio Yee #	315	Philippines
20	Kiril Popovski * #	292	Macedonia
21	Franciska H. Kármán * °	291	Hungary
21	Toshihiro Uchida #	291	Japan
23	Sachio Ehara *	283	Japan
24	Gestur Gislason #	283	Iceland
25	Jim Lawless #	283	New Zealand
26	Shigeto Yamada &	266	Japan
27	Joseph N. Ng'ang'a *	255	Kenya
28	François-David Vuataz #	254	Switzerland
29	Paul Brophy #	230	USA
30	Keyan Zheng #	228	China
	NON ELECTED		
31	Alimin Ginting #	210	Indonesia
32	Joel Renner #	203	USA
33	Abel H. Pesce *	202	Argentina
34	Colin Harvey @	197	New Zealand
35	Feliksas Zinevicius #	192	Lithuania
36	Ir. Suryadarma #	187	Idonesia
37	S. K. Sharma &	184	India
38	Tian Tingshan #	184	China
39	Godfrey Bahaiti &	177	Uganda
40	Mory Ghomshei #	175	Canada
41	Valiya M.Hamza &	173	Brazil
42	Yoonho Song &	164	S. Korea
43	Gábor Szita #	160	Hungary
44	Enrique Manuel Lima Lobato &	159	Japan
45	Martin N. Mwangi &	153	Kenya
46	Ryszard H Kozlowski &	93	Poland
	TOTAL	**12,968**	

Table IV. *Election results: the new BoD.*
(*) Incumbent BoD member; (#) Nominated by Affiliated Organization; (@) Candidate by Petition; (&) Nominated by Nomination Committee; (°) Woman. ($) On 21 June we received a resignation email from Adele Manzella, when the election process had already been launched and when many ballots had already been returned to the Secretariat. For this reason, it was decided not to announce her informal resignation, and to proceed with the election process. The candidate with 228 votes (Keyan Zheng) will therefore be elected.

The new Officers will start their term at the Annual General Meeting, in Antalya on October 10th.

The Secretariat congratulates the new elected Officers.

Continent	Total
Africa	2
America	5
Asia	8
Europe	13
Oceania	2

Table V. *BoD members distribution per continent.*

Country	Total
China	1
Ethiopia	1
Germany	1
Hungary	1
Iceland	2
Indonesia	1
Italy	1
Japan	4
Kenya	1
Macedonia	1
Mexico	2
New Zealand	2
Philippines	2
Poland	1
Romania	1
Russia	1
Switzerland	1
Turkey	2
UK	1
USA	3

Table VI. *BoD members distribution per country.*

Message from the new IGA President

John W. Lund, President (2004-2007)

First, I would like to congratulate all the new IGA Board members who will be serving during the following three years (2004-2007) and thank the members leaving the board for their service. The members are listed elsewhere in this IGA News. I would also like to thank the new board members for supporting my nomination and election as President - I will do my best to live up to confidence of the Board and the expectations of the IGA membership in me.

Secondly, I would like to thank ENEL and the past president, Guido Cappetti for their support of the IGA Secretariat over the past years (1998-2004), and to Ruggero Bertani as Executive Director and Iris Perticone as the Administrative Assistant for their excellent work in running the day-to-day affairs of IGA, especially in soliciting articles and publishing the IGA News. I look forward to working with our new hosts in Iceland housing the Secretariat, and with Valgardur Stefansson as the new Executive Secretary, who are willing to take on this responsibility at no cost to IGA.

Looking forward, IGA has several goals to achieve during the coming years: 1) the World Geothermal Congress 2005 in April in Antalya, Turkey; 2) placing the organiza-

IGA Membership Dues

IGA Membership dues for the year 2004 should have been paid by 31st March. In order to keep your name on our mailing list, we advise you to pay as soon as possible!

See the application form on the back cover of this issue for renewal details.

tion on a sound financial basis; 3) increasing the membership in IGA, 4) increasing the role of the IGA in promoting the use of geothermal energy worldwide, and 5) securing a location for WGC2010.

WGC2005 is the five-year milestone for the international geothermal community, where experts from all over the world come together to present their research, exchange ideas, to learn and best of all, to network. The Organizing Committee and the Turkish Geothermal Association has spent many months and hundreds of hours on planning for this exciting venue under the leadership of James Koenig. I hope all of you are planning to attend the Congress and making it a rousing success, as it will be a forum to promote geothermal development throughout the world. In addition to the usual technical sessions, there will be field trips to geothermal sites throughout Turkey and several short courses. Please visit the WGC2005 web site: www.wgc2005.org for details.

The important goal that needs to be seriously addressed, is obtaining adequate and sustainable funding for the IGA to carry out our mandate to further the development of geothermal resources. These funds will be solicited from various national and international organizations. We obviously cannot fund specific geothermal development project, but can indirectly support these efforts through: 1) supporting attendance at the International Summer School; 2) supporting attendance at other short courses oriented to project development such as mineral recovery from geothermal brines; 3) upgrade the IGA web site with technical papers and case studies; 4) prepare monographs on policy, engineering, project development, project financing, etc. for potential developers, governmental officials, and even schools; and 5) provide limited technical assistance for proposal evaluation, project development and project trouble-shooting.

A goal that has been on-going and made successful by previous IGA Boards, is to increase the membership of the organization by inviting new country affiliate organization to join. This way, we can better represent the world-wide geothermal community.

There are many ways to increase the role of IGA in promoting geothermal utilization worldwide, and one of the main ones is to see that geothermal is better recognized as a viable source of renewable and "green" energy. This can be done through education, outreach, information dissemination, etc. It can also be accomplished by encouraging and providing technical assistance to those who would development geothermal resources. This is a responsibility of the entire IGA membership and should start at the local or affiliate level. The Board of Directors will certainly assist with these programs.

Finally, we need to secure a location for WGC2010. Normally, this is announced at WGC2005 during the closing ceremony. At this date, no country and/or organization has stepped forward. Any selection needs the administrative and financial support of the government, and both private and public organizations, as the conference is a major undertaking both in time and financial commitments.

I look forward to working with the various committee chairs to help implement these goals, and encourage members at large to volunteer for the various committees – the chairs are listed in this IGA News. I would like the various Board committees to consist of at least half non-board members.

The next few years will be exciting, with geothermal taking the lead among renewables, and becoming more competitive with fossil fuel sources. Geothermal is presently being utilized in over 60 countries with power generation in 25. The installed capacity (MWe and MWt) could easily be doubled in the next 10 years. IGA should be part of the team effort to make this happen. I look forward to working with all you and achieving these ambitious goals.

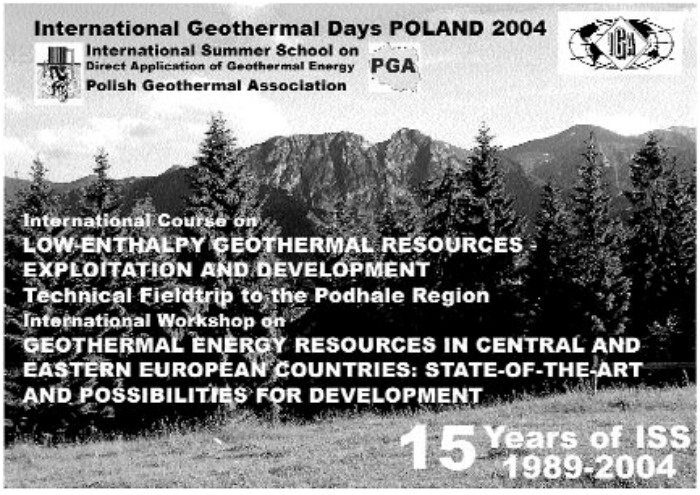
International Geothermal Days Poland 2004

K. Popovski, Chairman of IGA EBF

International Summer School on Direct Application of Geothermal Energy of IGA works this year in Zakopane (Poland), together with the Polish Geothermal Association and the Global Environmental Facility of the World Bank, where the International Geothermal Days POLAND 2004 are organized. They consists of the following events:

- International Geothermal Course on Low-Enthalpy Geothermal Resources – Exploitation and Development (Zakopane, September 13-15, 2004);
- Technical Field Trip to the Podhale Region (September 14, 2004); and
- International Workshop on Geothermal Energy Resources in Central and Eastern European Countries: State-of-the-Art and Possibilities for Development (Zakopane, September 15, 2004).

Lecturers of the course are renown experts of IGA, like Prof. J. Lund, Prof. L. Rybach, Dr. E. Gunlaugsson, Dr. P. Ungemach, Dr. B. Sanner, Prof. K. Popovski, Prof. G.



Bloomquist, etc. Invited introductory speakers are renown Polish experts like Dr. S. Ostaficzuk, Dr. B. Kepinska, Dr. W. Bujakowski, etc., plus the experts from CEE countries like P. Kralj (Slovenia), M. Rosca and M. Antics (Romania), Dr. F. Karman (Hungary), Prof. J. Takacz (Slovakia), Dr. M. Kovacic (Croatia), Prof. A. Frasheri (Albania), etc., Prof. E. Boguslavsky and V. Svalova (Russia) and Mr. O. Mertoglu from (Turkey). Field trip is planned and organized by Dr. B. Kepinska, co-chairman of the executive committee of the International Days. It's necessary to underline also the significant contribution of the WB, with the organization of a special session for possibilities for financing geothermal projects in CEE countries and identification of the best possibilities where WB can give the most useful support.

International Geothermal Days Poland 2004 shall be attended by about 40 participants from 15 mainly European countries plus about the same number of Polish participants, plus several guest of honor from the Ministry of Ecology of Poland, Ministry of Science and Education of Macedonia, the town of Zakopane, the Mineral and Energy Economy Institute of the Polish Academy of Science, IGA and IGA EBF, etc.

Participants of the International Course shall get the Certificate of Attendance and all the lecturers and invited speakers the Certificates for successfully fulfilled work.

Taking into account that this year is the 15th Anniversary of the International Summer School on Direct Application of Geothermal Energy, Certificates of Gratitude shall be supplied to 20 persons who maximally contributed to it's development with a continual support, free of charge service and even with payment of own traveling costs to all the events of ISS in different countries of Europe, Asian part of Turkey and U.S.A. It's necessary to underline some of them, like Dr. M. Fanelli, Mrs. M. Dickson, Prof. K. Dimitrov, Prof. G. Martzopoulous and Prof. C. Nikita Martzopoulou who founded the school together with Prof. K. Popovski, and Prof. J. Lund, Prof. G. Bloomquist, and Dr. P. Ungemach who continually lectured during all the years of development.

EUROPE

Within the Sixth Framework Programme

Patrick Ledru, BRGM, France

Within the Sixth Framework Programme (2002-2006) for research, technological development and demonstration (RTD), non-nuclear energy research is mainly funded under the "Sustainable Energy Systems" (SES) thematic sub-priority. Information is available at

http://www.cordis.lu/sustdev/energy/home.html.

For research activities having an impact in the medium and longer term, the focus is on research and development activities (including pre-normative and socio-economic research and the validation of technical and economic feasibility in pilot plants and prototypes), research-related networking activities, training and dissemination activities. The main risks to be addressed are scientific and technological rather than market and financial. Projects funded under this part of the programme are managed by DG Research.

A new call for proposal has been published on the 8th September 2004 at

http://fp6.cordis.lu/fp6/call_details.cfm?CALL_ID=167

The dead line for this call is 8th December 2004. One Coordination action and 2 STREP are considered to be able to be funded for geothermal energy:

Geothermal

Co-ordination and structuring of research, technology transfer and information dissemination in the field of enhanced geothermal systems and other unconventional geothermal resources. The objective is to co-ordinate ongoing research and to promote the development and uptake of innovative methods and technologies to expand the exploitation of unconventional geothermal resources, in particular enhanced geothermal systems. Proposals should address the assessment of ongoing research, the identification of best practices, gaps in knowledge and barriers to implementation, and propose strategies for implementation as well as directions for future research. Instrument : this topic is only open for CA proposals. To address the goals of the topic, it is expected that one CA could be funded. Opportunities for including research organisations from the new Member States and Candidate Countries should be fully explored.

Improved exploration methods for deep geothermal resources. The objective is to develop innovative, cost-effective and accurate exploration methods for deep geothermal resources in order to reduce the risk prior to drilling. The research should cover the development of integrated geophysical techniques for the detection of fractured and/or fluid bearing prospective geothermal zones, and include advanced processing, interpretation and modelling approaches. Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

High-temperature downhole tools and instruments. The objective is the development and testing of innovative, reliable tools and instruments for the characterisation and exploitation of high-temperature unconventional geothermal energy resources.
Instrument : this topic is only open for STREP proposals. To address the goals of the topic, it is expected that one STREP could be funded.

This call results from the analysis of 75 Expressions of Interest covering all Sustainable Energy Systems that were submitted to the EU on the 19 March 2004. The list and content of each of these EoI are found at

http://fp6.cordis.lu/eoi/sustdev/energy/eoi_srch.cfm

Nine proposals refers directly to geothermal energy.

Integrated Project

– Geothermal Hybrid Plants: increasing geothermal power conversion efficiency of low enthalpy reservoirs applying Hybrid technique (European Institute For Energy Research, co-ordinator)

STREP

– Environmental impacts of geothermal energy with Life Cycle Analysis and environmental risk assessment (Technological Institute of Iceland, IceTec, Iceland co-ordinator)
– Unconventional Geothermal Resources (ISOR, Iceland GeoSurvey co-ordinator)
– Characterization for Handling Impacts of CO2 Storage (Geosciences Azur Nice co-ordinator)
– Innovative concept of a new geothermal system in European salt domes (PBG - Geophysical Exploration Company co-ordinator)
– Integrated geophysical modelling for exploration of geothermal resources (GFZ Potsdam co-ordinator)
– Possibilities for geological sequestration of CO2 in the SW part of the Pannonian Basin System (University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering co-ordinator)

Coordination Action

– Enhanced geothermal innovative network for Europe (BRGM co-ordinator)
– Geothermal production of electricity in Associated / Potential Candidate Countries by the Technology Hot-Dry-Rock (HDR) (RKW Rationalisierungs- und Innovationszentrum der Deutschen Wirtschaft e. V. – Bundesgeschäftsstelle co-ordinator)

Comments

The comparison between the EoI and the call for proposal shows that, for geothermal energy, the priority is put on Enhanced Geothermal Systems (co-odination action). Compared to the previous call for tender (March 2003), the main difference concerns the introduction of a new concept, i.e. unconventional Geothermal Resources. Thus, improved exploration methods and integrated geophysical modelling can be proposed for the exploration of deep geothermal resources (STREP 1) in Enhanced Geothermal Systems in as well as in high enthalpy systems, where new high-temperature downhole tools and instruments are needed (STREP 2).

Further contacts for a Co-ordination Action on enhanced geothermal systems and other unconventional geothermal resources: p.ledru@brgm.fr

ALBANIA

Country update

A. Frasheri, University of Tirana

In Albania there is a large number of low enthalpy geothermal resources. Thermal waters are located in three geothermal zones:

– *Kruja geothermal zone* represents a zone in carbonate reservoirs.
– *Ardenica geothermal zone* is located in the coastal area of Albania, in sandstone reservoirs.
– *Peshkopia geothermal zone* is located in the northeastern part of Albania. Several springs are located within the disjunctive tectonics of a gypsum diapir.

The geothermal setting of Albania offers three possibilities for the exploitation of geothermal energy:

1) The use of the thermal groundwater for space heating and cooling, by borehole heat exchangers.
2) Thermal sources of low enthalpy, both natural springs and wells, are widely distributed throughout Albania. They represent the basis for a successful application of modern technologies for:
   – SPA clinics for treatment of different diseases and hotels for eco-tourism.
   – Heating and sanitary waters of the SPA and hotels, greenhouses and aquaculture installations.
   – Extraction of minerals.
3) The use of deep abandoned oil and gas wells for terrestrial heat flow measurements.

Further data may be found in

http://www.inima.al/~nfra/geothermal/

SWITZERLAND

Continuous boom of geothermal heat pumps

Ladislaus (Ladsi) Rybach, ETH,
Institute of Geophysics, Zürich

According to IGA News no. 56, page 5 the audience in Larderello was told that *"heat pumps are installed in wells of modest depth and in roadway/railway tunnels*". This, of course, is incorrect. In fact, the heat pumps are installed inside of buildings and outside of tunnels!

This clarification provides the opportunity to give more details below about geothermal heat pumps in Switzerland and, especially, about their continuing advance.

The present status

The following main geothermal heat pump (GHP) systems are now applied to use the ubiquitous shallow geothermal resource:

– Ground-coupled heat pumps with borehole heat exchangers and, to a limited extent (a few %), buried horizontal pipes;
– Heat pumps using shallow groundwater as a heat source;
– Geostructures like "energy piles" (foundation piles equipped with heat exchanger pipes)

According to a recent statistical survey (Signorelli et al., 2004), the GHPs represented by far the largest part, 500 MWt or 90 % of 500 MW, the total installed capacity for direct use in 2003. Furthermore, the GHPs contributed 745

GWh, which is 67 % of the total geothermal heat production in 2003; the total energy produced from all geothermal sources was 1'110 GWh. The categories besides GHP are: springs and wells used for balneology, warm tunnel waters used for space heating. The total energy of 1.1 TWh is equivalent to a CO_2 emission savings of about 300'000 tons.

Rates and trends in development

Since their introduction in the late 1970ties, the number of installations of GHP systems in Switzerland increased rapidly. Figures 2, and 3 are depicting the impressive growth. The rapid spreading of GHPs called for particular quality controls. In 2002, the establishment of a special quality label for the entire GHP system (heat source like borehole heat exchanger, heat pump (HP), circulation hydraulics, heating circuit) has been initiated.

Due to climatic conditions, the average load factor amounts to approximately 20 % corresponding to a running time of 1'800 hours/year. A low capacity factor is not necessarily disadvantageous as in well-isolated buildings the heat pump running times can be kept rather short thus reducing electricity consumption.

Drilling activities

Over thousand boreholes are drilled each year to install double U-tube borehole heat exchangers (BHE) into the ground. Average BHE drilling depth is now around 150-200 m, but depths > 300 m are becoming increasingly common. Average BHE cost (drilling, U-tube installation incl. backfill) amounts now to around 40 € per meter. Figure 4 shows the growth rate. In 2003, over 550 km (!) of drillholes have been sunk for BHE's. Since 2003, the drillings of multiple BHE arrangements (i.e. installations with more than 10 BHEs, and more than 1000 m in drilled length) are separately registered.

Market Development and Stimulation

In Switzerland, there exists practically no other resource for geothermal energy utilization than the ubiquitous heat content within the uppermost part of the earth crust, directly below our feet. This can be taken as one major reason for the rapid market penetration of GHP systems in this country. However, the following technical, environmental and economic aspects can be considered equally advantageous (Rybach and Kohl, 2003):

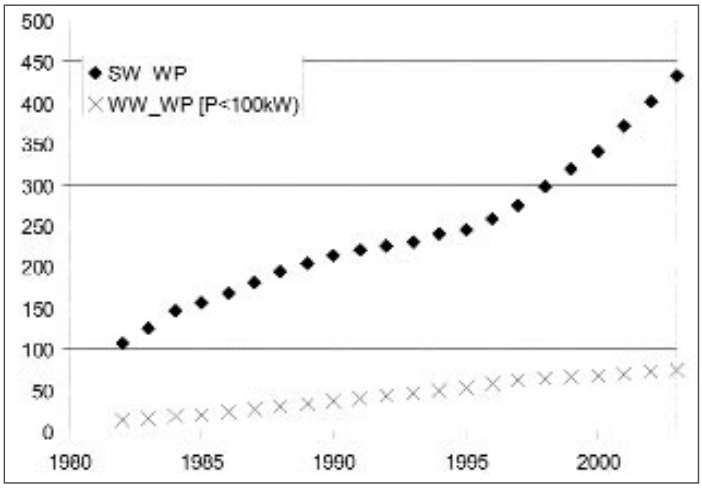


Figure 2. *Development of installed capacities (in MWt) of ground-coupled (upper curve) and groundwater-based geothermal heat pumps (lower curve) in Switzerland 1982-2003.*

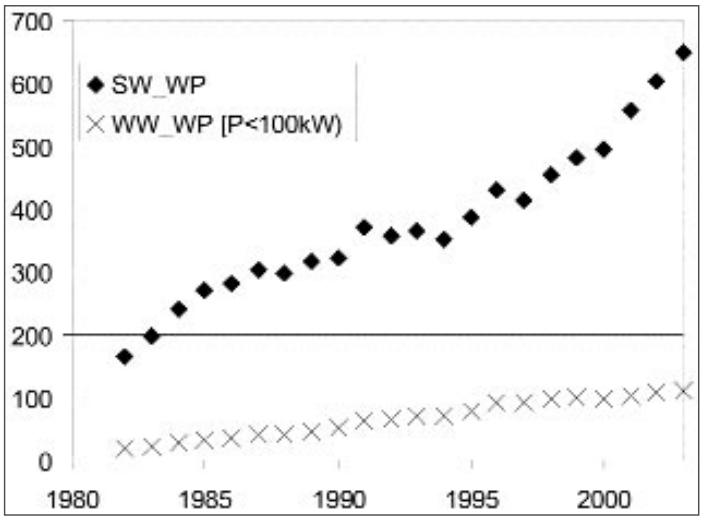


Figure 3. *Development of heat production (in GWh) by ground-coupled (upper curve) and groundwater-based (lower curve) geothermal heat pumps in Switzerland 1982-2003.*

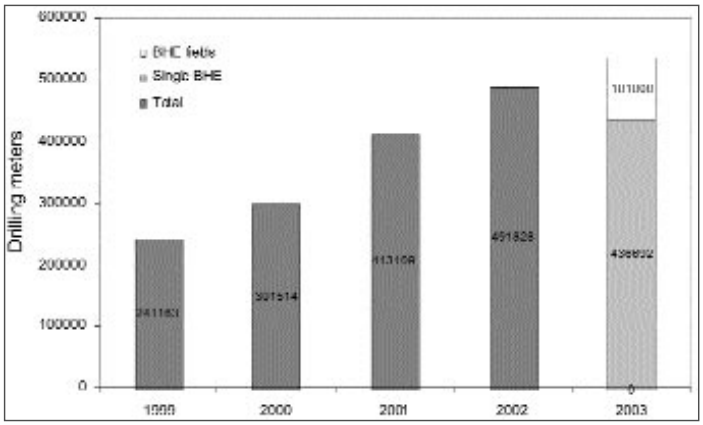


Figure 4. *Development of drillings for borehole heat exchangers in Switzerland 1993-2003.*

Technical incentives

- Appropriate climatic conditions of the Swiss Plateau, where most of the population is living. Here, long heating periods with air temperatures around 0 °C and little sunshine in the winter occur, with ground temperatures around 10-12 °C already at shallow depths;
- Subject to a correct design, constant ground temperatures will provide a favorable seasonal performance factor, and a long lifespan for a geothermal heat pump system;
- To fit individual requirements, GHP systems are installed in a decentralized manner. Therefore, costly heat distribution systems are superfluous (as compared with district heating);
- Relatively free choice of BHE positions next to or even beneath of buildings, and little spatial demand for a heat pump;

– At least for smaller units, there will be no need of a thermal recharge of the ground. Thermal regeneration of the ground during interruptions of heat extraction will be continuous and automatic.

Environmental incentives

– Contrary to oil, there exists no risk with transportation, storage, and other operations;
– No risk of groundwater contaminations (as with oil tanks);
– The geothermal systems are operating emission-free thus contributing to reduce greenhouse gas emissions like CO_2.

Economic incentives

– Installation cost of the environmentally favorable GHP solution is comparable to or only slightly higher than that of a conventional (oil based) system;
– Low operating costs (no oil or gas purchases, burner controls etc. like with fossil-fuelled heating systems);
– Local utilities are offering discounts for environmentally favorable installations with heat pumps,
– Avoidance of a possible CO_2 tax, which might come into force in 2006.

A further reason for rapid spreading of GHP systems stems from "Energy Contracting" by public utilities. The latter implies that a utility company plans, installs, operates and maintains a GHP system at own cost, and sells the heat (or cold) to the property owner at a contracted price (cents/kWh).

It can be expected that the advance of geothermal heat pumps in Switzerland will continue; with an average area-wise density of one GHP installation every 2 square kilometres (!) the country occupies and sustains a prominent rank worldwide.

Rybach, L., Kohl, T. (2003): The geothermal heat pump boom in Switzerland and its background. In: Proc. International Geothermal Congress 2003, Reykjavik/Iceland, 47-52

Signorelli, S., Andenmatten Berthoud, N., Kohl, T., Rybach, L. (2004): Projekt Statistik geothermische Nutzung der Schweiz für die Jahre 2002 und 2003. Report, Swiss Federal Office of Energy, Berne, 30 p.

HUNGARY

Hungarian Geothermal Association: After Novation

Szita, Gábor, HGA President

The latest information about Hungary for the IGA News readers was probably the report on the European Geothermal Conference approximately a year ago. By the time of EGC 2003 where some 160 participants gathered from 28 countries, the Hungarian Geothermal Association had just overcome a deep crisis period.

Disaccordance within the Board of HGA started in 2002, just after the new board had been elected in July. Things went worse and worse the next year when three attempts on holding the annual general meeting of HGA failed. The situation became even worse in April 2003 when the Hungarian geothermal community was divided into two parts because another geothermal association was formed under the leadership of HGA's former vice president. Most of the Board members of HGA also joined the new group.

At that time, late spring 2003, the Hungarian Geothermal Association had a practically inaccessible president and an uncertain membership.

Five of the members, however, decided to save HGA and called together an extraordinary meeting in May 2003. That general assembly accepted a new constitution and voted on a totally new Board for HGA. The withdrawn president appealed to the law and some of the members initiated a reviewal taken by the Prosecutor. Legal procedures lasted for almost a year when in May 2004 the General Meeting of HGA could definitively close them.

When the new Board started its activity in June 2003 it faced with the following main problems:

1. No roster of the HGA members was available.
2. Minutes of general and board meetings were missing.
3. Bank account was almost out of money.
4. Both HGA and geothermal energy (in general) had very bad reputation in Hungary.

Due to serious efforts made by the new Board, HGA had its updated roster with 55 members by the end of 2003. During this period the Board was sitting five times and adopted 14 resolutions. So the Board managed to consolidate HGA both organically and financially.

By the beginning of 2004 time had come to start the professional activity. In January 2004 HGA published the first number of its quaterly news bulletin called "Ground Heat Newsletter". This journal, which has been issued, in the meantime, three times already contains useful information for the geothermal energy users, such as reports on international/national workshops, observations of regulation, lists of upcoming geothermal events, news related to the HGA, retrospection to the past of harnessing geothermal energy, etc.

The Hungarian Geothermal Association, for the first time in its 9 year history, organised a workshop in order to discuss the present situation and possibilities for the future and main problems of geothermal in Hungary. The fact is that since the legal regulation related to geothermal waters has been changed in January 2004. The energetic use of geothermal waters gets into a disadvantageous position compared to the use of these waters in spas and thermal baths. For instance geothermal water utilised for energetic purpose has to be re-injected, while re-injection is forbidden if the water has been already used in a bath. Re-injection into argillaceous sandstone, which is the main aquifer in Hungary has been forced by the authorities for over 15 years. Unfortunately no general method for re-injection at low pressure in an economically feasible way has been found yet for any of those 10-15 pilot equipments that have been built and operated. It is even a bigger problem that a report, which was compiled by a state scientific institute in 2001 introduces 8 reference places for successful re-injection to sandstone in Hungary, while the situation in practice is completely the opposite.

HGA has recently sent remarks and reflections to the ministries and authorities in order to respond to the Mining Act, which also regulates the use of geothermal energy in Hungary. HGA hopes to eliminate existing contradictions within the act and the executive order.

The Hungarian Geothermal Association intends to go ahead with the analysis of legal environment for geothermal energy utilisation and would like to be a reputable member of the international geothermal community.

THE AMERICAS

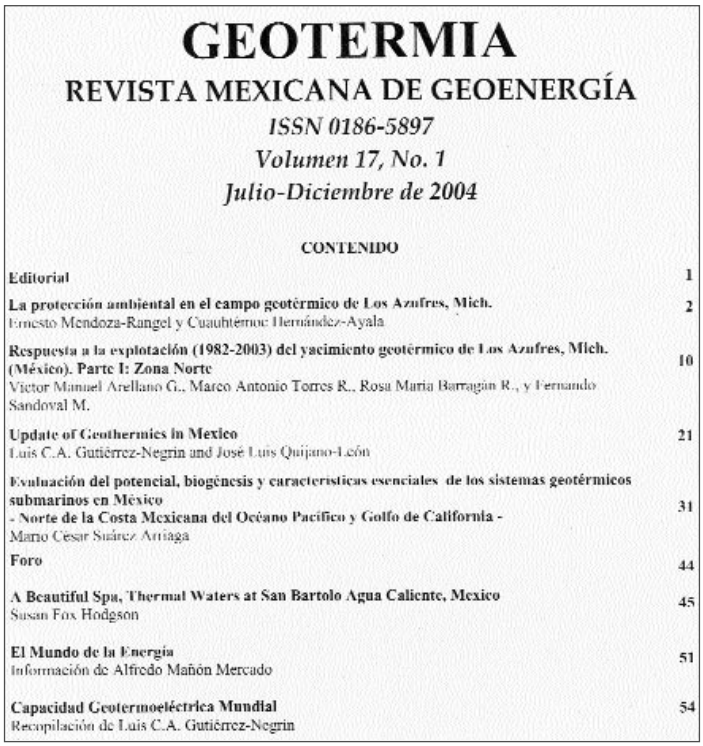
MEXICO

New Mexican Geothermal Magazine

Luis C.A. Gutiérrez-Negrín, CFE, Gerencia de Proyectos Geotermoeléctricos

The publication of the Mexican geothermal magazine Geotermia has been resumed in digital format (*.pdf file). The magazine has been issued since 1985 by the geothermal division of CFE (the Comision Federal de Electricidad). The July-December 2004 issue includes papers listed in the box.

Geotermia publishes papers in Spanish with abstracts in English and viceversa. All IGA members are kindly invited to read Geotermia by visiting the GRC website (http://www.geothermal.org), which kindly is hosting the magazine, and also to submit technical collaborations for future issues.



GEOTERMIA

REVISTA MEXICANA DE GEOENERGÍA

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Julio-Diciembre de 2004

CONTENIDO

ASIA/PACIFIC RIM

CHINA

Geothermal Industry data-base

Xiuhua Zhang, Ph.D, CREIA project leader

The UNDP/GEF Project and the World Wide Fund for Nature (WWF) China are providing financing support to the Chinese Renewable Energy Industry Association (CREIA) to establish a database (the IOF - Investment Opportunity Facility), which aims to build up a platform for international collaboration with China in the renewable energy industry.

We are planning to provide information on enterprises, consultants, industry associations and research institutes in the renewable energy industry as well as the technologies they have developed and products, projects, technical experts and industrial services they can offer.

CREIA was established under the support from the project of SETC and UNDP/GEF "Capacity Building for the Rapid Commercialization of Renewable Energy in China" and serves as a window of international communication and cooperation with China, as a bridge between government and industry, and as a network among its members. CREIA works closely with domestic and international organizations, on the research, commercial and financial concerns of renewable energy development, to create opportunities to promote technology transfer and further development of the rich new and renewable energy resources in China.

Norwegian Computing Center (Norsk Regnesentral, NR) is participating in the IOF project in cooperation with CREIA.

You can already register your organization on CREIA's website although it's final construction is not completed: http://creia.net/cms_eng/_code/english/Member/register.php

You are welcome to contact Dr. Zhang for any questions or further information you require. You will be informed about the project progress and website to look at the information you provide. We appreciate your assistance if you could spread this information to the organizations that you know.

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JAPAN

New targets for "Geothermal Development Promotion Surveys" in Japan

Kasumi Yasukawa, GSJ/AIST and Kenji Haruguchi, NEDO

The New Energy and Industrial Technology Development Organization (NEDO) started "Geothermal Development Promotion Surveys" for three new target areas in FY2004. Surveys were initiated in July 2004, at Minase, Akita prefecture, Ten-ei, Fukushima prefecture and Obama, Nagasaki prefecture, respectively (see Figure 5). These areas were carefully selected based on feasibility of power plant development from economical and social aspects, in addition to suggested potentials of the resources. A new concept of "local energy for local area" is introduced to the project.

NEDO has been conducting "Geothermal Development Promotion Surveys" program since 1980 for geothermal prospects where investigation by private section is hampered by survey risks. The program consists of surveys A,

B and C varying the content of the survey plans according to present knowledge about the field. Through the program, temperatures higher than 100 ºC have been identified at forty-nine areas out of fifty-four prospects and existence of a geothermal reservoir was identified at twenty-four areas by FY2003, resulting in the development of five power stations with total capacity of 157 MW (Uenotai, Yamagawa, Yanaizu-Nishiyama, Ohgiri and Hachijojima). In addition, four areas have proved to be capable of sustaining power plants with capacity of 110 MW in total.

Currently NEDO is intensively carrying out survey C, which is closely connected to the exploitation, aiming at a further reduction of risks and lead-time to construct power plants. Geothermal reservoir evaluation by long-term production tests from large boreholes is included in this program. Recent surveys for Appi is concluded in March 2004 and for Kirishimaeboshi-dake will be done by March 2005.

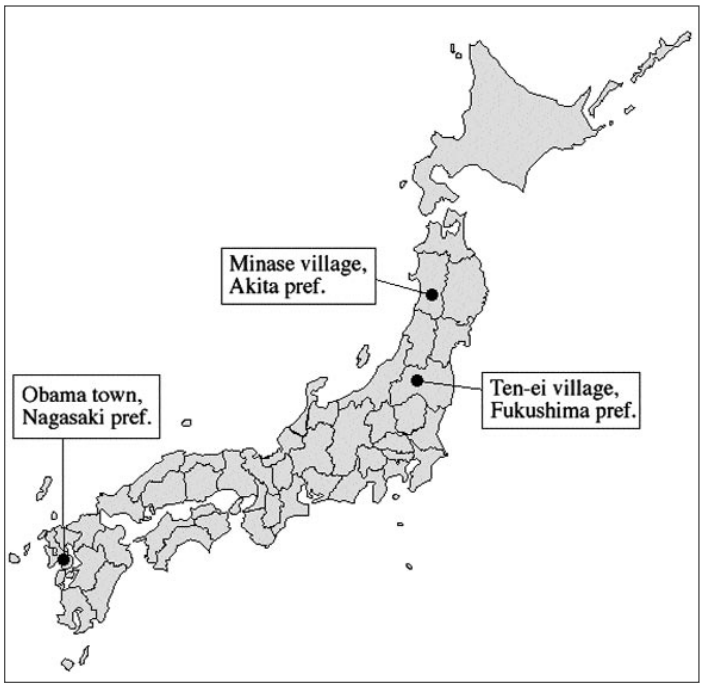

Figure 5. *Locations of the new prospects for "Geothermal Development Promotion Surveys".*

Figure 6. *"Daifunto", the steam manifestation valley at Minase*

Figure 7. *Wind Valley, Ten-ei.*

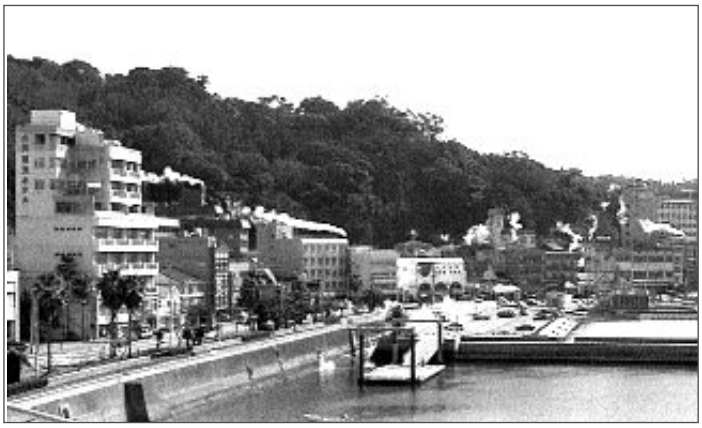

Figure 8. *Spa resort area in Obama.*

The three areas selected for survey C this year are considered to have potentials suitable for binary power plants smaller than 10 MW. Although the capacity is rather small, each area has particular characteristics that may promote further utilization of geothermal energy in the area; In Minase (see Figure 6), rich in data about geothermal potential including borehole survey data, existence of hot geothermal fluid has been already veryfied. In Ten-ei (see Figure 7), known as a wind valley with a wind power plant owned by the town, they are planning to develop a live museum of renewable energy utilization, combining geothermal energy, wind and small hydro. In Obama (see Figure 8), located at the foot of Unzen volcano, hot fluid in temperature range 140 to 240 ºC has been already identified and further investigation is longed for. At all these three areas, the municipalities are actively supporting the project. After the surveys, the results will be evaluated by the end of FY2005 (March 2006).

RUSSIA

Kamchatka geothermal plants

ITAR-TASS

Harnessing alternative sources of energy, in the first place geothermal sources, is a high priority in developing and expanding Russian energy complex. For the Kamchatka Peninsula, whose power industry is entirely dependent on costly fuel supplies from the mainland, geothermal power is of special importance, the top manager of the national power utility UES of Russia, Anatoly Chubais told journalists upon arrival. He will be participating in an international seminar devoted to various uses of geothermal power.

Russia has three geothermal power plants – all in Kamchatka: the Pauzhetskaya power plant, built in 1967, Verkhne-Mutnovskaya power plant, and Mutnovskaya power plant, rated as one of the world's best in terms of automation of production processes.

Their overall capacity exceeds 70 megawatts. The power plants produce a quarter of Kamchatka's electrical needs.

The UES of Russia is considering the possibility of creating a whole family of Mutnovsky geothermal power plants to eventually build up the capacity of this complex to 300 megawatts.

Analysts estimate Kamchatka's geothermal resources at 5,000 megawatts – an amount capable of settling the region's energy supply problem for 100 years to come.

Russian geothermal resources exceed 10-12 times those contained in fossil fuels. In the long term 70-80 percent of the country's territory can be effectively using the energy of the earth's interior to bring thermal power both to individual facilities and large communities.

Major geothermal resources are available in the Chukchi Peninsula, the Kuril Islands, Primorye and West Siberia.

Geothermal resources have been explored in 80 countries and 58 of them already use these resources on the commercial basis.

Russian share in the amount of electric power generated at geothermal power plants is ten percent.

PHILIPPINES

PGI Corporate News

Sylvia Ramos, PNOC

Makeup well drilling resumes in Mak-Ban

Drilling activities in Mak-Ban field resumed last March 11 with the spudding of production make-up well Bulalo-110. This continues the Make-up Well Drilling Program that started in 2002. Five new make-up wells and a re-drill are planned for this year. Also, casing repairs of Bulalo-108 and 109 have been added to the 2004 Work Program. As before, Desco/Century Resource's Rig 26 is being utilized in this drilling campaign. Manpower is sourced mostly from the local community at Mak-Ban by Desco.

This drilling campaign was designed to meet the steam requirements of the power plants of the National Power Corporation (NPC) after rehabilitation. Currently, NPC's Units 1-4 (Plants A and B) in Mak-Ban are undergoing repairs. Upon completion of the rehabilitation, Units 1-4 will be rated at 63 MWe thus bringing the total baseload capacity of the Mak-Ban Power Plant to 402 MWe. This total includes Units 5 and 6 (Plant C) with 55 MWe each; Units 9-10 (Plant E) with 20 MWe each; and Units 7 and 8 (Plant D) with 20 MWe each on standby.

To date, Bulalo-110 was completed to 9,514' (~2,900 m) and is scheduled for testing later in July. Bulalo-111 was completed to 10,200' (~3,100 m) and was tested to produce 250,000 lbs/hr (113 tph) of steam at commercial flowing pressure. Rig 26 is currently drilling Bul-112 and is now at about 4,300' (1,311 m) as of this writing.

Update on the Tiwi and Mak-Ban Power Plant Rehabilitation Project

Tiwi. Phase 1 of the Tiwi Power Plant Rehabilitation Project was completed in middle February this year. This includes replacement of the turbine rotors and auxiliary equipment, and reliability testing at Plants A and C (or Units 1, 2, 5 and 6).

Phase 2 of the Tiwi Power Plant Rehabilitation is scheduled next year and will involve the repair of Units 1 and 2's MGES, Unit 2's switchgear and Units 5 and 6's cooling tower. Overall, the Power Plant Rehabilitation Project is expected to be completed at the end of 2005. This will bring the total rated capacity of Tiwi to 232 MW distributed as follows: Units 1 and 2 with 59 MWe each, Units 5 and 6 with 57 MWe each, while Unit 3 will have a standby capacity of 55 MW.

Mak-Ban. Similar to Tiwi, Phase 1 of the Power Plant Rehabilitation Project at Mak-Ban was recently completed last June. Phase 1 at Mak-Ban consisted of repairing power plant auxiliary equipment and replacement of the water discharge lines at Units 1-4 (Plants A and B). The rated capacity of Units 1-4 was restored back to 55 MWe after Phase 1.

New rotors for Units 1, 2 and 4 are being manufactured in Japan; Unit 3's rotor is being repaired. Phase 2 of the Project shall comprise mainly the installation of the new and repaired rotors and is scheduled to commence in February 2005. The target completion of the Power Plant Rehabilitation Project at Mak-Ban is September 2005.

After completion of the power plant repairs, Units 1-4 will have an improved capacity of 63 MWe each. Together with the 110 MWe from Units 5 and 6 (Plant C) and 40 MWe from Units 9 and 10 (Plant E), Mak-Ban will have a baseload capacity of 402 MWe from the conventional power plants. Units 7 and 8 (Plant D) will supply a standby capacity of 40 MWe. Additionally, the three binary power plants constitute another 15.73 MWe of capacity.

OCEANIA

AUSTRALIA

Habanero 2 Well is in progress

Geodynamics Press Release

In the Cooper Basin, Australia, Geodynamics has begun its second geothermal production well, Habanero 2. The Habanero wells are located inside a demonstration project to extract heat from the hot granite buried over 4.4 km underground at the company's Cooper Basin Hot Fractured Rock geothermal project (see Figure 9). The two drillings are spaced 500 meters apart, and the Habanero 1 is dedicated to injection. This location was optimised through extensive analysis of seismic and hydraulic data, and also consulting international experts. Century Drilling is responsible of Habanero 2 drilling operations.

According to the Managing Director of Geodynamics, Bertus de Graaf, the 985 km^2 geothermal exploration licenses hold heat equivalent to 50 billion barrels of oil, which is almost 20 times Australia's remaining oil reserves. Geodynamics aims at affecting the balance of power generation in Australia, in the belief that this geothermal resource will be cost competitive against coal and gas. The electricity to be produced at the Cooper Basin would be at lower cost than hydro, wind, biomass or solar alternatives, and on a continuous basis, thus leaving further off other intermittent renewable resources. Hot Fractured Rock geothermal electricity is qualified for the Renewable Energy Certificates, which are the Federal Government incentives for renewable energy. This is likely to double the electricity venues for Geodynamics in comparison with fossil fuel power stations.

Habanero 2 is designed to a depth of 15,000 ft (4,572 m), to be drilled in 95 days. The company expects to reach the depth in mid October. Woodside and Origin Energy provided well design software and planning expertise. The budget foresees AUD$ 8.7 million (US$ 6.3 million), and additional costs of $500,000 for specialized under-balanced drilling equipment. Shareholders' support was granted during two recent share placements, and these available funds will cover the expenses up to the end of drilling operations.

Habanero 2 is expected to face the high temperatures and pressures that were found in the granites during drilling of Habanero 1.

Geodynamics is pioneering Hot Fractured Rock program, and is going to prepare a circulation test, which is scheduled for a three to four month trial at the end of 2004. Water will be pumped through the first well to the underground heat exchanger, with the superheated water then returned to the surface under pressure through the second well.

The buried granites proved to be at 250°C at 4,400 m, and the horizontal nature of the underground heat exchanger, according to de Graaf, will allow heat mining on a regional scale. The stimulated area is more than nine times larger than expected. The overpressures met during the drilling of Habanero 1 will reduce the risk of water losses.

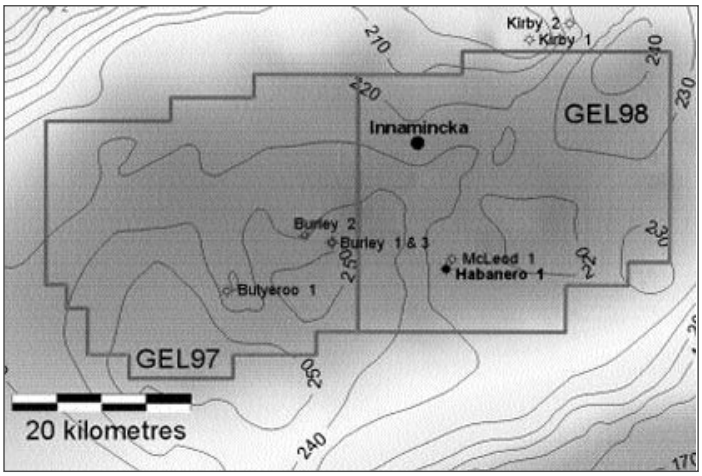

Figure 9. *Low gravity region and Habanero 1 well location, the temperature contours in °C are derived from borehole data.*

NEW ZEALAND

Promotion of Kalina Cycle in New Zealand

Geodynamics Press Release

Geodynamics has signed a Heads of Agreement with Siemens NZ Ltd. for a joint promotion of Kalina Cycle technology in New Zealand in conventional geothermal applications.

New Zealand has been one of the pioneering countries for geothermal electricity generation since the end of 50's. Total conventional geothermal capacity there now is approximately 370 MW which represents about 7% of New Zealand's electricity.

The growth rate of New Zealand's power demand is around 2% per year, and the decline of natural gas reserves draws generation utilities interest to the development of additional thermal and geothermal generation capacity.

The Kalina cycle is suitable for low enthalpy geothermal fields.

The agreement foresees:

- Joint promotion of Kalina cycle for geothermal generation in New Zealand.
- Provision of turbines and power plant equipment by Siemens along with warranties and performance guarantees for equipment and process.
- Provision of Kalina process design and licences by GPS.

Under the agreement Geodynamics will work only with Siemens for geothermal applications in New Zealand and the theoretical property of Kalina remains with GPS. Siemens NZ will provide additional resources to promote Kalina. Geodynamics and Siemens NZ are already participating in one 16MW Kalina Cycle bid in New Zealand.

BOOK REVIEW

Geothermal Energy: Utilization and Technology
Edited by Mary H. (Marnell) Dickson and Mario Fanelli
CNR- Institute of Geosciences and Earth Resources, Pisa
2003, 205 pp., 27 x 21 cm, tables and figures
ISBN 92-3-103915-6

UNESCO has actively promoted geothermal energy for over 30 years now, since the first UNESCO-sponsored geothermal training course in 1970, and the first UNESCO geothermal book in 1973. The progress achieved since then in the scientific and technological sectors and in terms of environmental awareness is immense, especially in the last ten years. For example, we are now able to construct more detailed and accurate models of geothermal systems; developments in exploration methodology and data interpretation have allowed us to cut back on the time and funds needed to investigate geothermal prospects; we are on the brink of creating artificial geothermal systems; we have increased the efficiency of geothermal power plants and direct-use plants, and have found innovative solutions to old problems; we have adopted heat pumps, which exploit the heat content of low-temperature resources, on a far greater scale and at a far faster rate than we could ever have imagined possible. In June 1992 in Rio, in December 1997 in Kyoto, and again in August 2002 in Johannesburg, at the World Summit on Sustainable Development, great emphasis was paid to greenhouse gas emissions, and there were strong recommendations to reduce our consumption of fossil fuels, and to make better use of the renewable sources of energy, one of which is, of course, geothermal energy.

It is within this context that UNESCO is publishing *Geothermal Energy- Utilisation and Technology,* as part of its new Renewable Energy Science and Engineering Series.

The book describes the various methods and technologies used to exploit the earth's heat, *after* the latter has been extracted from the earth's crust. It does *not* deal with the study of geothermal systems, the methods applied in geothermal research or the technologies used to extract geothermal resources, which would require an entire volume for these topics to be dealt with in any detail.

The reader of *Geothermal Energy- Utilisation and Technology* will, ideally, have a scientific-technological background and the technical reader will hopefully use it as a handbook. Other readers may find it a helpful guide to how geothermal resources can be utilised to our advantage and to the benefit of our environment. Finally, it should also prove an informative textbook for geothermal training courses.

The book is developed over nine chapters, the first of which provides an exhaustive overview of geothermal energy and the scientific and technological state-of-the-art, as well as acting as a framework and reference point for the chapters that follow. Chapter 2 covers the generation of electricity, while Chapters 3 to 7 deal with the various non-electric uses of geothermal energy (district heating, space cooling, greenhouse heating, aquaculture, and industrial applications). Chapter 8 discusses the environmental impact of geothermal energy, and, finally, Chapter 9 provides a complete review of the economic, financial and legal aspects of geothermal projects. The reader will find many stimulating case histories and practical examples throughout these chapters.

Geothermal Energy- Utilisation and Technology will, we hope, serve in both the geothermal workplace and study room; the more it is used, the more we feel we will have contributed to sustainable development worldwide.

Authors:

Chapter 1: Geothermal Background - Mary H. Dickson and Mario Fanelli (Institute of Geosciences and Earth Resources, Pisa).

Chapter 2: Electricity Generation - Roger B. Hudson (PB Power, Auckland).

Chapter 3: Space and District Heating – Einar Tjörvi Eliasson (Reykjavik), Halldór Ármannsson and Sverrir Thórhallsson (ÍSOR, Reykjavik), Maria J. Gunnarsdóttir (Icelandic Association of District Heating Companies, Reykjavik), Oddur B. Björnsson (Fjarhitun Consulting Engineering Company, Reykjavik), and Thorbjörn Karlsson (University of Iceland, Reykjavik).

Chapter 4: Space Cooling – Kevin D. Rafferty (Geo-Heat Center, Klamath Falls).

Chapter 5: Greenhouse Heating – Kiril Popovski (St. Kliment Ohridski University, Bitola).

Chapter 6: Aquaculture – John W. Lund and Kevin D. Raffferty (Geo-Heat Center, Klamath Falls).

Chapter 7: Industrial Applications – Paul J. Lienau (Klamath Falls, Oregon).

Chapter 8: Environmental Impacts and Mitigation- Kevin Brown (Geothermal Institute, University of Auckland) and Jenny Webster-Brown (Environmental Science, University of Auckland).

Chapter 9: Economics and Financing – R. Gordon Bloomquist (Washington State University Energy Program, Olympia) and George Knapp (Squire, Sanders & Dempsey L.L.P., Washington D.C.).

Where to buy the book:
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UPCOMING EVENTS

International Workshop on New and Classical Applications of Heat Flow Studies, 4-7 October 2004, Aachen, Germany.
website: www.rwth-aachen.de/geop/Tagung_AC/invitation.htm

1st International Conference on Renewable Energy, 6-8 October 2004, New Delhi, India. Contact: G.N. Mathur, Secretary, Central Board of Irrigation and Power, Malcha Marg, Chanakyapuri, New Delhi 110 021, India. Tel/fax: 91-11-2611 6347
e-mail: cbip@vsnl.com

Industrial Applications of Renewable Resources, 11-14 October 2004, The Fairmont Hotel, Chicago, Illinois, USA. AOCS. Tel: +1 217 359 2344, fax: +1 217 351 8091
e-mail: meeting@aocs.org
website: www.aocs.org/meetings/ia

6th Asian Geothermal Symposium - Mutual Challenges in High- and Low-Temperature Geothermal Resource Fields, 26-27 October 2004, Daejeon, Korea. Contact: Dr. Takeshi Uemoto, Clean Energy Division, MRC, 1-297 Kitabukuro-cho, Omiya-ku, Saitama-shi, Saitama 330-0835, Japan.
e-mail: tuemoto@mmc.co.jp
website: staff.aist.go.jp/hiro-muraoka/AsianSympo6E.html

Unconventional & Renewable Energy Sources Trade Fair, 3-6 November 2004, Moscow, Russia. Contact: Jefferson Reszetylo (USA). Tel.: 203 357 1400.
e-mail: jreszetylo@iegexpo.com
website: www.iegexpo.com/rus_unconventionsl.html

30th Stanford Workshop on Geothermal Reservoir Engineering, 31 January-2 February 2005, Stanford University campus, Stanford, USA. Contact: Laura Garner, Dept. of Petroleum Engineering, Stanford University, CA, USA. Tel: +1 650 725 2716; fax: +1 650 725 2099
e-mail: lgarner@pangea.stanford.edu
website: ekofisk.stanford.edu/geoth/workshop2005.htm

Power-Gen Renewable Energy, 1-3 March 2005, Las Vegas Hilton, Las Vegas, NV.
website: www.power-gengreen.com

26th Annual PNOC-EDC Geothermal Conference, 9-10 March 2005, Manila, Philippines. Contact: Arnel Mejorada, Geoscientific dept, PNOC-EDC, Merritt Road, Fort Bonifacio, Taguig, Philippines. Tel: +63 2 893 6001; fax: +63 2 840 1580 or 840 1575
e-mail: geothermalcon@energy.com.ph

The Cairo 9th International Conference on Energy & Environment (EE9): Technological Advances for a Sustainable Clean Environment, 13-19 March 2005, Cairo and Sharm El-Sheikh, Sinai Peninsula. Contact persons: Abdel Latif El-Sharkawy, National Research Center, Dokki, Cairo, Egypt, Tel: +20 7617590 – 7614150, Fax: +20 3370597 and Ralph H. Kummler, Interim Dean, College of Engineering, Wayne State University, Detroit, MI 48202, Tel: +1 313 577 3775, fax: +1 313 577 5300
e-mail: President@sat-eng.com and rkummler@eng.wayne.edu

World Geothermal Congress WGC2005, Antalya, Turkey, 24-29 April 2005. Accepted draft papers are due by May 2004.
website: www.wgc2005.org

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

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Send IGA *News* contributions to:

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e-mail: iga@samorka.is

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