Quarterly No. 72

April - June 2008

IGA NEWS

Newsletter of the International Geothermal Association

IGA ACTIVITIES

Message from the President

Ladsi Rybach, President

Dear IGA member, this is the third message from your President.

First some real good news: global geothermal power generation capacity is now approaching 10 GWe, and should exceed it by the end of next year, according to a compilation performed by IGA Vice President Ruggero Bertani of the electric capacity added since 2000. The full study is part of this Newsletter.

The keynote paper for IPCC, mentioned in my message in IGA News no. 71, can now be referenced: *Fridleifsson, I.B., R. Bertani, E. Huenges, J. W. Lund, A. Ragnarsson, and L. Rybach (2008). The possible role and contribution of geothermal energy to the mitigation of climate change. In: O. Hohmeyer and T. Trittin (Eds.) IPCC Scoping Meeting on Renewable Energy Sources, Proceedings, Luebeck, Germany, 20-25 January 2008, 59-80.* It can be downloaded from the IGA website.

In the last few weeks, the main activity of IGA in general and of its Board of Directors in particular - along with the IGA Steering Committee for WGC 2010 - was the preparation and implementation of the meetings in Nusa Dua (Bali, Indonesia). These events were preceded by a highly successful "Technical Seminar on Cost Reduction through Improved Geothermal Well Targeting", jointly organized by INAGA, Indonesia, and IGA's Western Pacific Regional Branch WPRB on April 28, 2008. 76 participants attended the Workshop, which also featured presentations given by industrial experts working in the area. A detailed report of WPRB Chairman Jim Lawless will appear soon in this Newsletter.

On April 29, 2008, the joint meeting of the Organizing Committee for WGC2010 (OC) of INAGA and IGA's Steering Committee (SC) took place, chaired by Herman Daniel Ibrahim. IGA was represented by Gordon Bloomquist (IGA SC Chairman), Roland Horne (WGC2010 Technical Program), Beata Kepinska (WGC2010 Short Courses), Eduardo Iglesias (WGC2010 Publications), Mahmut Parlaktuna (WGC2010 Fellowships), and IGA Past President John Lund. The meetings discussed and approved the Draft Master Plan (including budget), field trip options, technical program, short courses, and social program. The presentation of the Official Congress Organizer (Pacto Ltd.) about Conference logistics was followed by a visit to the WGC2010 venue, the Westin International Conference Center. This really outstanding facility became known to a broader public when hosting the UN Climate Change Conference in December 2007. The Conference Center is absolutely magnificent, both in terms of location in paradisiac Nusa Dua and its design and infrastructure. The safety standards are outstanding. All IGA representatives were deeply impressed and look forward to being there again.

Parallel to the OC and SC meetings, several IGA Committees met on April 29, 2008. This is a new working style, in order to discuss pending items as well as to formulate suggestions and motions to be approved by the Board of Directors. Finally, 24 BoD members and many observers met on April 30, 2008 to deal with an extensive Agenda, including the reports of the IGA Officers and Committee Chairs. The detailed outcome will soon be made available through the Minutes of the 45th IGA BoD Meeting, to be produced by our expeditious Executive Director Arni Ragnarsson. Let me just summarize the main decisions:

- Future IGA News will be produced and distributed electronically; printing will be terminated;
- The IGA website will undergo major restructuring and reshaping;
- A new IGA Membership Directory will be completed and placed –password protected– on the IGA website;
- The IGA BoD discussed and approved the 2008 budget; efforts are underway to reduce expenditure and to increase income;
- The various deliverables to comply with the IGA / World Bank GeoFund contract are under preparation, in progress, or near completion; all targets should be met by the end of 2008;
- The Geothermal Association of Costa Rica (AGC) has been affiliated to IGA;
- The IGA BoD endorses the draft document "Geothermal reporting Guidelines for resources and reserves" prepared by the Australian Geothermal Energy Group (AGEG).
- The next IGA Committee and BoD meeting will be held, along with the AGM 2008, in conjunction with the SECOND AFRICAN RIFT GEOTHERMAL CONFERENCE (ARGeo C2), in Entebbe, Uganda on November 22/23, 2008;
- The 2010 Spring meeting of BoD shall be held in conjunction with WGC2010 in Nusa Dua, Bali/Indonesia.

All the events in Nusa Dua took place at the fabulous Hotel Melia. The palm tree-rich gardens, the beach and the pools were wonderful. Unfortunately, there was too little time to enjoy them. But various evening activities like buffet or served dinners with entertainment provided by Balinese dancers, Gamelan orchestras, all at the most generous invitation by our Indonesian friends and colleagues from INAGA, were a great compensation. Finally, an impressive field trip on May 1, 2008 –bringing the participants to cultural landmarks such as imposing temples as well as to the Bedugul geothermal field under development (one discharging well)– completed the highly memorable IGA events. We would like to warmly thank our Indonesian hosts and organizers for providing us with an unforgettable experience.

The bottom line: Nusa Dua is just the perfect place for WGC2010; you should definitely plan to attend!

Future IGA News goes all-electronic!

Eduardo Iglesias, IGA News Editor

At its 45th meeting (Bali, April 29, 2008) the IGA Board of Directors approved a motion to terminate the production of printed copies of IGA News, as of issue No.73. Thereafter the newsletter will be produced only in electronic format. The new format will give us greater scope to include color prints and pictures, and to upgrade its design. This decision will also save the current printing and postage costs. It is expected these savings will contribute to financing the upcoming restructuring and reshaping of the IGA website.

Letter to the Editor – IGA News

John Garnish, former Programme Manager, European Commission

It was good to see an update on progress with the Soultz EGS project in News #71, but I must correct the statement that the project was instigated by a French and German team. It resulted when the European teams (French, German and British) that were working on their own Hot Dry Rock projects came together under the auspices of the European

Commission in 1986/7 to select a common test site for a European project. Three sites were considered – Bad Urach in Germany, Soultz in France and Cornwall in the UK – and Soultz was chosen as showing the most immediate promise. The teams from all three countries were involved from the start, and the management team on site (the 'core team') consisted of a Frenchman, a German and a Brit.

The infrastructure (especially drilling) was funded mainly by the Commission and the early research work was undertaken by national teams from the three countries, largely with funding from their own ministries. These teams were joined soon afterwards by ENEL from Italy. Although the British government withdrew after a couple of years, the British research team continued to participate. Switzerland joined somewhat later, as did teams from Japan and the US. In 1996, Electricité de Strasbourg and Pfalzwerke (Germany) formed a European Economic Interest Group (EEIG) to take the project forward to the pilot stage. The EEIG was later joined by EdF (EdS's parent company), RWE (Germany) and ENEL (Italy), with a brief involvement by Shell, but the present project is managed now by the two original partners.

It has been a long haul, with the project tracing its roots back to Fenton Hill in the early 1970s, but it has been a splendid example of international cooperation on a European (and wider) basis and it is encouraging to see it finally approaching fruition.

EUROPE

Germany

The New E.ON Energy Research Centre at RWTH Aachen University
Rolf Sweekhorst, E.ON Energy Research Centre

Within the scope of a public-private partnership, E.ON AG and RWTH Aachen University have realized a unique project — the E.ON Energy Research Centre (E.ON ERC). The aim and organizational structure of this new energy research centre, founded at RWTH Aachen University in 2006, are directed towards investigating innovative, interdisciplinary solutions for ensuring our future energy supply, whereby, in particular, larger systemic technical questions can be examined. Since the beginning of the winter semester 2007/2008, five university institutes with completely different focuses have been working together to answer questions regarding energy efficiency, the use of renewable energy resources and climate protection. The core of E.ON ERC consists of two RWTH chairs (Power Generation and Storage Systems/Prof. Rik W. De Doncker and Applied Geophysics and Geothermal Energy/Prof. Christoph Clauser) and three endowed professorships (Future Energy Consumer Needs and Behaviour/Prof. Reinhard Madlener, Energy Efficient Buildings and Indoor Climate/Prof. Dirk Müller and Automation of Complex Power Systems/n.n.). E.ON AG is financing this research centre with a total of 40 million Euros over a period of ten years. These research funds do not represent third-party funds per se but rather are donations; i.e. the results of the research at E.ON ERC are available for the benefit of the general public. Thus, important research projects can be realized for which, otherwise, third-party funds might be difficult to raise.

Fully integrated into E.ON ERC with respect to research and teaching, the five professorships are formally distributed among the faculties of electrical engineering, computer science, business and economics, mechanical engineering, and georesources and materials science. In addition, projects are initiated and coordinated within the scope of departmental and interdisciplinary scientific research in which other institutes and research centres within and beyond RWTH Aachen University are involved. Consequently, considerable additional research funds can be acquired from public endowments and from other industrial companies. Other clients – including competitors of E.ON AG – are expressly invited to become involved in research for securing our future energy supply via commissions and cooperations.

First Professorship for Geothermal Energy in Germany

The E.ON ERC is distinguished by its interdisciplinary research, already proven by the fact that the five professorships of the centre belong to four different faculties. Numerous examples of this interdisciplinary approach are found within and beyond the research centre. A case in point is the chair of Applied Geophysics and Geothermal Energy, held by Prof. Christoph Clauser, who, in May 2007, was appointed with the first professorship for geothermal energy in Germany.

Thus, Professors Clauser and De Doncker (Power Generation and Storage Systems) have together taken up the concept of micro-boreholes (microdrilling) and integrated this in a currently running feasibility study. Regarding this, both institutes are cooperating closely on a system that will make exploratory drilling for reservoirs of geothermal energy or for storage of CO2 considerably less expensive than up to now. Such exploration boreholes still use the same technology typically applied for petroleum exploration. However, these boreholes, with their comparatively large diameters, are complicated and expensive. Both scientists foresee considerable potential for improving the technique and saving costs by reducing the borehole diameter to about one to one and a half inches (2.5 cm -3.8 cm). This idea is not fundamentally new, however; such a technique using coiled tubing has been successfully practised at Los Alamos Laboratory for some time. This uses drum-wound elastic steel pipe through which water is forced to drive the drill bit hydraulically in the depths of the borehole. The unit from Los Alamos, which can fit on a car trailer, can reach exploratory depths down to about 300 metres in relatively soft sedimentary rocks. The continued development of this microdrilling should not only allow substantially greater depths to be drilled but it should also enable drilling through harder rock types. The feasibility study will also consider other drive concepts for the drill bit as well as new concepts for simultaneously drilling and recording geophysical logging data.

Currently, one of the most important projects at the E.ON ERC is the conception and realization of an efficient heating and cooling of the new building of the research centre. The building, designed by the famous architect Zaha Hadid, has already attracted public interest in its preparatory stage of construction. However, its energy supply is challenging and demands unusual solutions. Professors Müller (Energy Efficient Buildings and Indoor Climate) and Clauser are currently engaged in developing an energy supply system which includes shallow borehole heat exchangers in accordance with the mission statement of the research centre — i.e. to incorporate renewable energies, energy efficiency and energy saving — but which also completely meets the requirement of creating an absolutely comfortable living environment. Among other techniques, a heat pump is connected to a field of borehole heat exchangers which is used additionally to cool office rooms in the summer. A refrigerating machine is planned for the laboratory and seminar areas; its reverse cooling can be used to heat the building as well as to regenerate the borehole heat exchanger field.

An EU project for the geothermal generation of electricity in Turkey is also being prepared, and a close cooperation is planned with the Marmara Research Centre (MAM) in Gebze near Istanbul and the power company ZORLU. Professor Clauser will coordinate this project in its first phase, whereas the Turkish company will be responsible for carrying out this project subsequently on an industrial scale. Besides the cooperation with Turkish, French and Italian colleagues from research and industry, collaboration with the chair "Future Energy Consumer Needs and Behaviour" of the E.ON ERC will play a central role here. Professor Madlener will study how such a project can be realized, so that the partially opposing requirements of minimizing financial risk, ensuring environmental protection and fulfilling the expectations of the investors and the public are met to the greatest extent possible. Besides the planning and coordination of the entire process, Professor Clauser's institute is especially responsible for exploring the geothermal potential and its long-term behaviour with respect to safety and cost-effectiveness. Geophysical measurements in boreholes and on drill cores in the laboratory will be combined with forward modelling, because the development of numerical simulation models is one of the strengths of this institute. This cooperation — coordinated at the E.ON ERC and supported by the German Federal Ministry for Education and Research for three years — thus delivers the theoretical foundations which will be realized and tested in practice in the planned EU project. Several series of numerical simulations of geothermal reservoirs will yield increasingly more exact predictions of the critical operating parameters and their uncertainties. Because such model calculations can be continued during the subsequent operation of the geothermal power plant, well-founded operation-relevant considerations can be made for such a unit at any time yielding, for example, an optimum trade-off between the extremes of "maximum running time" and "maximum performance".

Italy

Geothermal Power Plants Commissioned in the Third Millennium
Ruggero Bertani, Enel – International Division – Renewable Energy Business

Introduction

The growth in worldwide installed capacity from geothermal power plant is given in Figure 1. An increase of about 800 MWe in the three year term 2005-2007 has been achieved, continuing the roughly linear trend of approximately 200/250 MWe per year. Installed geothermal electricity capacity is approaching the 10 GWe threshold, which could be reached before the next WGC2010 in Indonesia.

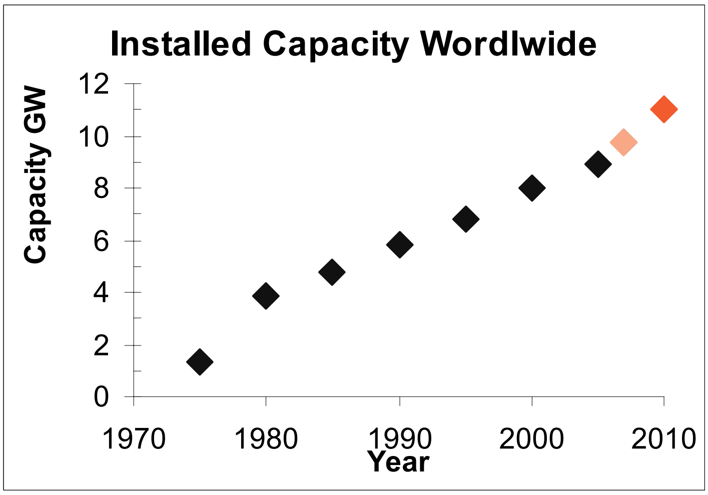


Figure 1: Installed capacity from 1975 up to end of 2007 (pink) and to 2010 (red).

The economics of electricity production are influenced by the drilling costs and resource development (typical CAPEX quota for high-enthalpy resources is 30% for reservoir and 70% plant); the productivity of electricity per well is a function of reservoir fluid thermodynamic characteristics (phase and temperature), and the higher the energy content of the reservoir fluid, the fewer is the number of wells required and as a consequence the reservoir CAPEX quota is reduced.

Binary plant technology is playing a very important role in the modern geothermal electricity market for several reasons. It can be an efficient way to recover the energy content of the reservoir fluid after its primary utilization in standard flash plant, achieving a better energy efficiency for the overall system. Whereas in dry steam reservoirs (such as Larderello, Italy, or The Geysers, USA) the exploited energy of the fluid can be fully utilized, in all other situations worldwide the majority of the thermal energy in the fluid is lost, being reinjected at high temperature and effectively wasted. Binary plants on the reinjection stream could be a very effective way of producing cheap energy, because there will be no additional mining costs associated with this extra production. Utilization of lower temperature resources can be achieved only with binary plant, increasing the overall exploitable potential worldwide.

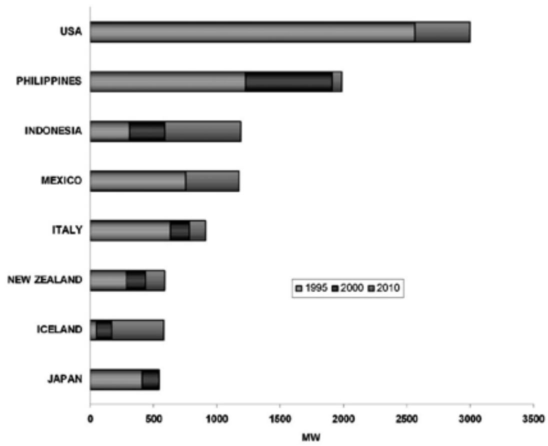


Figure 2a: 1995, 2000 and forecast to 2010 of the installed capacity.

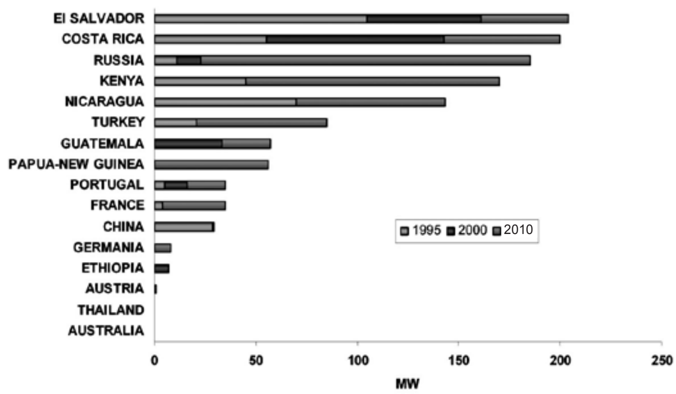


Figure 2b: 1995, 2000 and forecast to 2010 of the installed capacity.

Figure 2 presents data from all the countries currently generating geothermal electricity, with actual values for 1995 and 2000; a forecast for 2010, taking account of existing projects that are in an advanced stage of development, is also presented. Figure 3 shows a forecast of the year 2010 installed capacity as a world map (updated from EGC2007).

It is difficult to estimate the overall world-wide potential. With the present engineering solutions it is possible to foresee an increase from the extrapolated value of 11 GWe for year 2010 up to a maximum of 70 GWe. The gradual intro-

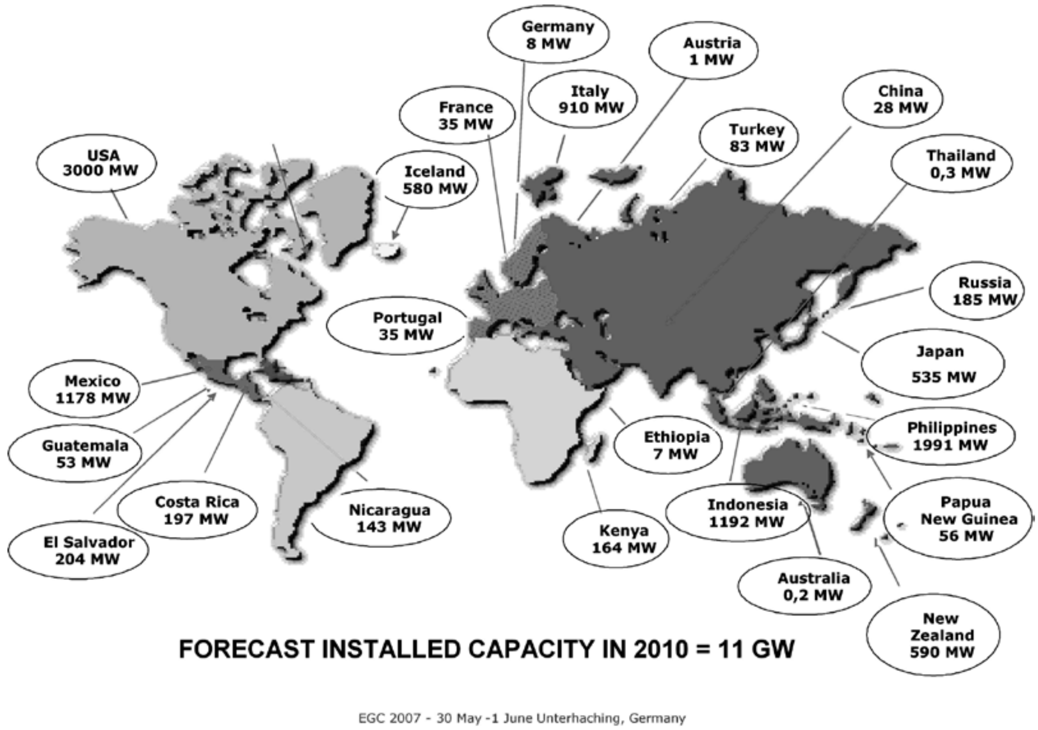


Figure 3: Installed capacity worldwide in 2010

duction of new developments (permeability enhancements, drilling improvments, enhanced geothermal systems, low temperature production, supercritical fluid) may boost the growth rate with exponential increments after 10-20 years, thus reaching the global world target of 140 GWe for the year 2050 (Figure 4).

It should be pointed out that some of these "new technologies" are already proven, like the binary plant ("low temperature electricity production"), and are currently spreading fast into the market, whereas EGS are just entering the field demonstration phase to prove their viability.

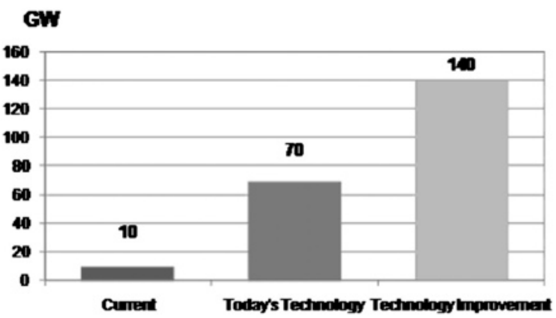


Figure 4: Forecast of the geothermal reserves exploitable by the year 2050

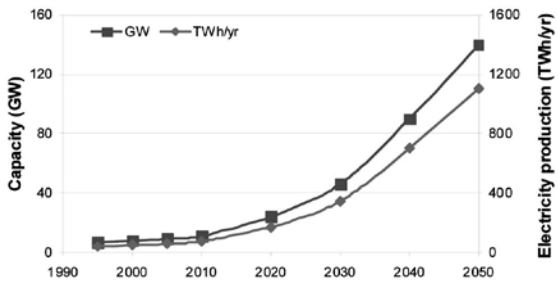


Figure 5. Installed Capacity and Electricity production 1995-2005 and forecasts for 2010-2050.

Electricity production from geothermal sources is strongly related to the plant capacity factor. Since 1995, this has increased continuously from the initial average value of 64% to the present one of 73%. Better technical solutions for the power plants improve their performances; the most advanced approaches for the resource development (reinjection, inhibitors against scaling/corrosion, better knowledge of the field parameters using advanced geophysical surveys) will increase the average capacity factor linearly towards 90%, a factor already reached by many geothermal fields in operation. The forecasts for capacity, capacity factor and energy are presented in Figures 5 and 6.

It is expected that the next generation will see the implementation of Enhanced Geothermal Systems (EGS) and an intensive increase in low-to-medium temperature applications through binary cycles and cascade utilisations. Geothermal may not be a major energy supplier, but its base-load capability is a very important factor for its success. The utilisation of binary plants and the possibility of production from enhanced geothermal systems (to be considered as possible future developments) can expand its availability on a worldwide basis.

Construction Activity in the Third Millennium

Geothermal electricity installed capacity is approaching the 10,000 GW threshold, which could be reached before the next WGC2010 in Indonesia. We thought that the geothermal community would be interested in a compilation of all the new power plant that have been commissioned or ordered in the third millennium, i.e. since WGC2000. This snapshot is a realistic view of the new capacity that will be online within 2008/2009. Data are presented in table I. The column captions are as follows:

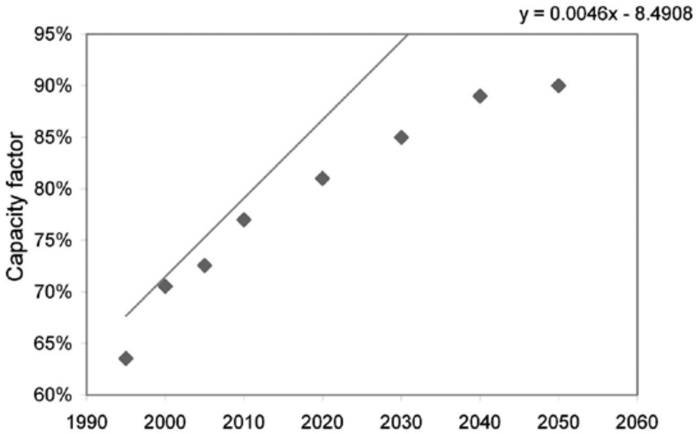


Figure 6. Capacity factor of geothermal power plants in the world 1995-2005 and forecasts for 2010-2050.

COUNTRY=country name

2008/2009: forecast of installed capacity by the end of the next two years, on the basis of plant already ordered

FIELD: the geothermal field name

NEW PLANT COMMISSIONED: the incremental installed capacity in MWe from new plant inaugurated, commissioned or ordered since WGC2000

CATEGORY: the plant type, according to the standard classification of binary, single or double flash, and so on

WGC2000: Installed capacity reported in the WGC2000 official world update report

UNITS: the number of units

MANUFACTURER: the Turbine Manufacturer, considered as the major qualifying element of the geothermal plant

DIFFERENCES: the difference in MWe between the WGC2000 data plus the new plants, and the forecast for 2008/2009; this value is related to changes in the capacity for different reasons, for instance decommissioning of old plants, increasing their capacity (re-rating) or decreasing it (de-rating), as explained in the **NOTE**.

TABLE I: New Plant Data

COUNTRY	WGC2000 MW	2008/2009 MW	FIELD	New plant commissioned MW	Manufacturer	Category	Units	Differences MW	Note
AUSTRIA	0	1	**Total**	**1.1**				0	
			Altheim	0.9	Turboden	Binary	1		
			Bad Blumau	0.3	Ormat	Binary	1		
COSTA RICA	143	163	**Total**	**18**				2	
			Miravalles V	18	Ormat	Binary	1		
El SALVADOR	161	204	**Total**	**53**				-10	Decommissioning 2x5 BP units from Berlin
			Berlin III	44	Nuovo Pignone	Single Flash	1		
			Berlin Binary	9.2	Enex	Binary	1		
FRANCE	4	16	**Total**	**12**				1	
			Soultz-sous-Forets	1.5	Turboden	Binary	1		
			Bouillante II	10	Alstom	Single Flash	1		
GERMANY	0	8	**Total**	**8.4**				0	
			Neustadt Glewe	0.2	GMK	Binary	1		
			Landau	3.8	Ormat	Binary	1		
			Bruchsal	1.0	Siemens	Binary Kalina	1		
			Unterhaching	3.4	Siemens	Binary Kalina	1		
GUATEMALA	33	57	**Total**	**24**				0	
			Amatitlan Binary	24	Ormat	Binary	1		
ICELAND	170	569	**Total**	**406**				-7	Decommissioning 3 BP units from Svartsengi
			Nesjavellir III-IV	60	Mitsubishi	Single Flash	2		
			Hellisheidi LP	33	Toshiba	Single Flash	1		
			Hellisheidi	180	Mitsubishi	Single Flash	4		
			Svartsengi VI	33	Fuji	Single Flash	1		
			Reykjanes I , II	100	Fuji	Single Flash	2		
INDONESIA	590	1172	**Total**	**320**				263	110 MW at Wayang Windu, 20 MW at Lahendong, 90 MW at Darajat already existing in 2000, but not operative; 10 MW from rerating Salak units

COUNTRY	WGC2000 MW	2008/2009 MW	FIELD	New plant commissioned MW	Manufacturer	Category	Units	Differences MW	Note
			Sibayak	10		Single Flash	2		
			Lahendong II	20	Fuji	Single Flash	1		
			Kamojang IV	63	Fuji	Single Flash	1		
			Wayang Windu	117	Fuji	Single Flash	1		
			Darajat	110	Mitsubishi	Single Flash	1		
ITALY	785	811		**214**				-189	Decommissioning of old plants: Bagnore, Bellavista, Castelnuovo, Cornia, Gabbro, La Leccia, Lago, Molinetto, Monterotondo, Radicondoli, Serrazzano
			Castelnuovo	14	Ansaldo - Existing Asset	Dry Steam	1		Not to be considered as new capacity
			Gabbro	20	Nuovo Pignone	Dry Steam	1		
			Larderello III	20	Ansaldo - Existing Asset	Dry Steam	1		Not to be considered as new capacity
			Lago	10	Nuovo Pignone	Dry Steam	1		
			Molinetto	20	Nuovo Pignone	Dry Steam	1		
			Monterotondo	10	Nuovo Pignone	Dry Steam	1		
			Serrazzano	60	Ansaldo - Existing Asset	Dry Steam	1		Not to be considered as new capacity
			San Martino I - II	40	Nuovo Pignone	Dry Steam	2		
			Radicondoli	20	Nuovo Pignone	Dry Steam	1		
JAPAN	547	535	**Total**	**3.9**				-16	Derating Onikobe plant
			Hatchobaru	2.0	Ormat	Binary	1		
			Suginoi Hotel	1.9	Fuji	Single Flash	1		
KENYA	45	169	**Total**	**124**				0	
			Olkaria II	70	Mitsubishi	Single Flash	2		
			Olkaria III	50	Ormat	Binary	3		
			Oserian	2.0	Elliot	Single Flash	1		
			Oserian Binary	2.0	Ormat	Binary	1		
MEXICO	755	958	**Total**	**215**				-12	Decommissioning 1 BP units from Los Azufres; derating units at Los Humeros
			Cerro Prieto	100	Mitsubishi	Single Flash	4		
			Los Azufres	100	Alstom	Single Flash	4		
			Las Tres Virgines	10	Alstom	Single Flash	2		
			Los Humeros	5.0	Mitsubishi	Back Pressure	1		
NEW ZEALAND	437	635	**Total**	**199**				18	
			Mokai II	39	Ormat	Ormat Combined Cycle	4		
			Mokai III	20	Ormat	Ormat Combined Cycle	1		
			Ngawha	20	Ormat	Binary	1		
			Kawerau	90	Fuji	Double Flash	1		
			GDL	10	Ormat	Binary	1		
			Wairakei Binary	20	Ormat	Binary	1		
NICARAGUA	70	87	**Total**	**18**				0	
			San Jacinto	10	Alstom - refurbishing of existing asset	Back Pressure	2		Not to be considered as new capacity
			Momotombo Binary	7.5	Ormat	Binary	1		
PAPUA-NEW GUINEA	0	56	**Total**	**56**				0	
			Lihir I - II	56	General Electric	Single Flash	2		
PHILIPPINES	1909	1970	**Total**	**68**				-7	Slight changes in rated capacity of some plants
			Northern Negros	49	Fuji	Double Flash	1		
			Tongonan Binary	19	Ormat	Binary	1		
PORTUGAL	16	25	**Total**	**12**				-3	
			Pico Vermelho	12	Ormat	Binary	1		
ROMANIA	0	0	**Total**	**0.2**				0	
			Oradea	0.2	Turboden	Binary	1		
RUSSIA	23	80	**Total**	**57.2**				0	
			Mutnovskaya (Kamchatka)	50	Kaluga Turbine Works	Single Flash	2		
			Mendeleevskaya (Kunashir, Kuril Islands)	3.6	Kaluga Turbine Works	Back Pressure	2		
			Okeanskaya (Iturup, Kuril Islands)	3.6	Kaluga Turbine Works	Back Pressure	2		

COUNTRY	WGC2000 MW	2008/2009 MW	FIELD	New plant commissioned MW	Manufacturer	Category	Units	Differences MW	Note
TURKEY	20	84	**Total**	**69**				-5	Updated capacity at Kizildere
			Kizildere Binary	5.0	Ormat	Binary	1		
			Canakkale	7.5	Ormat	Binary	1		
			Germencik	47	Mitsubishi	Double Flash	1		
			Aydin	9.5	Ormat	Binary	1		
USA	2546	2987	**Total**	**350.6**				90	The discrepancy is mainly due to several changes in rating of the plants.
Alaska			Chena	0.4	UTC Power	Binary	1		
California			Bottle Rock-The Geyser	18	Fuji - refurbishing of existing asset	Dry Steam	1		
California			Ormesa GEM & I & II upgrade	43	Ormat	Binary	1		
California			Heber 1	10	Ormat	Binary	1		
California			Gould	14	Ormat	Binary	1		
California			Heber South East Mesa 10 MW	10	Ormat	Binary	1		
California			North Brawley 50 MW	50	Ormat	Binary	1		
Hawai			Puna	8.0	Ormat	Binary	1		
Idaho			Raft River	29	Ormat	Binary	2		
Nevada			Steamboat Hills-Binary	6.0	Ormat	Binary	1		
Nevada			Desert Peak-Binary	22	Ormat	Binary	1		
Nevada			Stillwater	48	Mafi Trench	Binary	4		
Nevada			Saltwells	19	Mafi Trench	Binary	2		
Nevada			Burdette	27	Ormat	Binary	1		
Nevada			Brady	5.2	Ormat	Binary	1		
Nevada			Galena	30	Ormat	Binary	1		
Utah			Blundell	11	Ormat	Binary	1		
TOTAL	**8254**	**10587**	**TOTAL**	**2228**			108		

Comments

Since WGC2000 approximately 2.2 GWe of new geothermal power plant have been realized or have been ordered. The manufacturers in Table II are currently operating in the market.

We see that the market is dominated by the first three major manufacturers (Mitsubishi, Ormat and Fuji), who are responsible for approximately 75% of the installed capacity and 60% of the units. The "Other" is to account for the refurbishing and replacement of existing assets from one site to another, which cannot be considered as new plant but should be included among the new installed capacity.

TABLE II : List of Manufacturers

Manufacturer	MW	Units
Mitsubishi	572	15
Ormat	534	37
Fuji	474	9
Nuovo Pignone	164	8
Alstom	120	7
Mafi Trench	67	6
Kaluga Turbine Works	57	6
General Electric	56	2
Toshiba	33	1
Harbin	10	2
Enex	9	1
Siemens	4	2
Turboden	3	3
Elliot	2	1
UTC Power	0.4	1
GMK	0.2	1
Other	122	6
TOTAL	**2228**	**108**

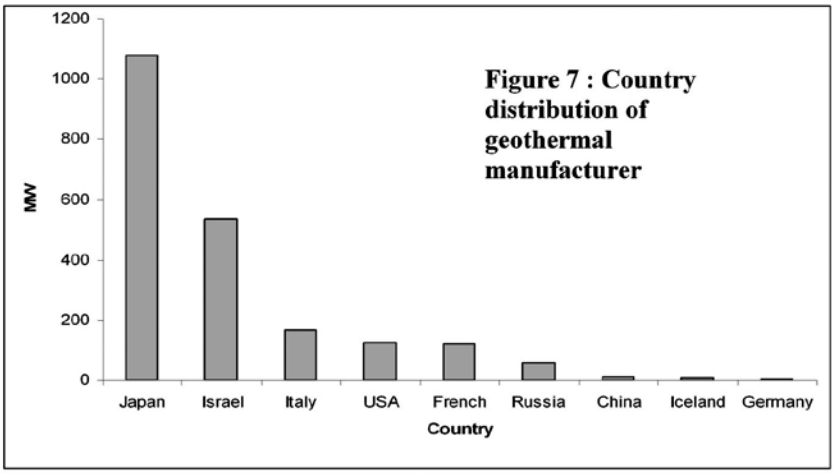


Figure 7 : Country distribution of geothermal manufacturer

The distribution of the country-contribution to geothermal development is shown in figure 7. The very strong involvement of Japanese manufacturers is noticeable, despite geothermal development in that country being stalled because of a lack of supporting measures for the new deep field investigation phases, in contrast to the recent past when NEDO or other public bodies actively supported applied research on geothermal energy, and despite the lack of incentives for renewable energy sources.

In terms of applied technology, data are presented in figures 8 and 9 for the capacity and number of units respectively. Considering Binary, Binary Kalina and Ormat Combined Cycle units in a single category, they account for 30% of the capacity and 50% of the units, whereas Single Flash, Double Flash and Back Pressure reach 60% of the capacity and 40% of the units.

It should be mentioned that this paper is not a commercial advertisement, even if we are explicitly naming manufacturers. Data have been collected through the standard IGA channels, and have been presented here only for general information. The IGA has not received any sponsorship or payment from the companies quoted here.

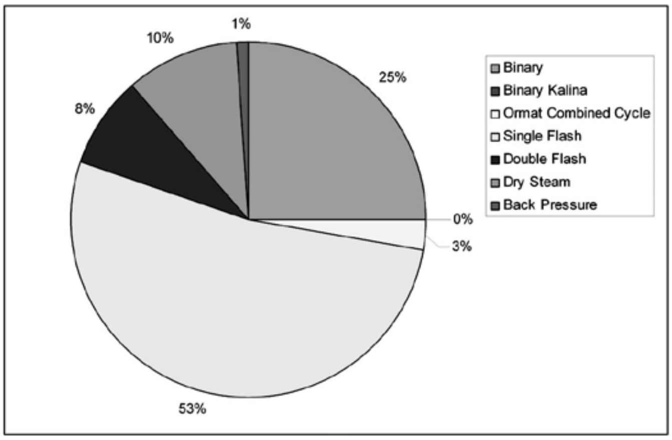


Figure 8 : Percentage of installed capacity for each category

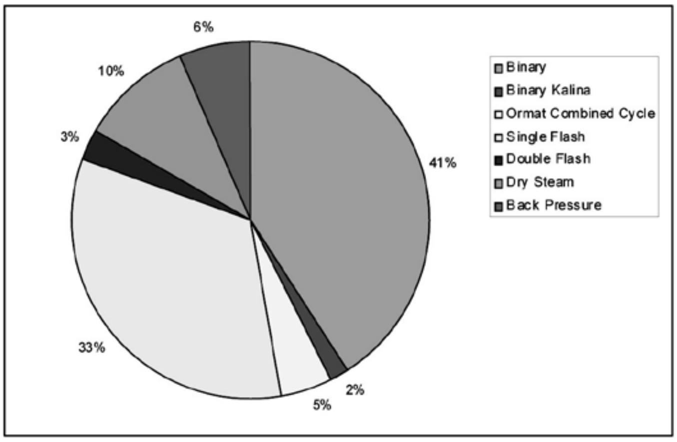


Figure 9 : Percentage of the number of units for each category

References

Bertani R., 2005a: World Geothermal Generation 2001-2005: State of the Art, Proceedings World Geothermal Congress, Antalya, Turkey, April 24-29, 2005.

Bertani R., 2005b: World Geothermal power generation in the period 2001-2005, *Geothermics* 34, 2005, 65-690.

Bertani R., 2006: World Geothermal Power Generation 2001-2005, *GRC Bulletin May-June 2006*, 89-111.

Bertani R., 2007: World Geothermal Power Generation in 2007, Proceedings European geothermal Conference 2007, Unterhaching, Germany, 30 May-1 June 2007

Romania

New Board of Directors of the Romanian Geothermal Association

Honoured by the presence of Prof. Cornel Antal (specialized in Geothermics at the United Nations University in Reykjavik in 1995, and present Rector of the University of Oradea) the Annual General Meeting 2008 of the Romanian Geothermal Association (RGA) was held at Oradea on 3 April 2008.

After summarizing the activity carried out in the period of his chairmanship (which began in 1991 with the affiliation of RGA to IGA), President Eng. Ioan Cohut thanked all members of the Board who had collaborated with him in conducting the RGA business over the past 17 years, and announced his intention to retire from his position of responsibility. He then proposed that a new Board should be elected.

On behalf of the whole RGA membership, a number of participants expressed their deep appreciation to Mr. Cohut for the notable effort made to promote geothermal development in Romania and to gain the international recognition of the RGA in Europe and worldwide.

The new Board was then elected, as follows:

- ***President***, Eng. George Calbureanu (graduated in Petroleum and Gas Engineering at the University of Ploiesti in 1983, C.E.O.of the DAFORA Group Medias);
- ***Vice President***, Prof. Marcel Rosca, Dean of the Energy Engineering Faculty, University of Oradea;
- ***Treasurer***, Ec. Alin Iacobescu, General Manager, TRANSGEX S.A.;

- ***Secretary***, Eng. Codruta Bendea, lecturer at the University of Oradea;
- ***Members at large***:
  - Dr. Serban Veliciu (Geological Institute of Romania);
  - Eng. Magdalena Stoia (A.N.R.M. Bucharest);
  - Eng. Dan Gherdan (City Hall, Oradea).

AMERICA

Mexico

Desalination using geothermal water in the Baja California Peninsula

Rosa M. Prol-Ledesma, Gerardo Hiriart, Carles Canet, UNAM

The idea of using geothermal resources in desalination has been around since the 70s (Awerbuch et al., 1976; Laird and Tleimat, 1976); however, the increasing need for fresh water and the high cost of oil have recently promoted the use of renewable sources for desalination of seawater and brackish water (Rodríguez-Gironés et al., 1996; Belessiotis and Delyannis, 2000). The lack of water is more intense in remote desert areas, which frequently do not have access to electricity from the national grids. The Baja California Peninsula is relatively disconnected from the rest of Mexico and the supply of fuel to this region is quite expensive; however, it has renewable sources of energy, including solar, wind and geothermal, that can be used for desalination purposes (Hiriart, 2006). Tourist development has led to a rise in population and consequently a great increase in energy and water demand. This necessity has resulted in the evaluation of several new geothermal areas.

The geothermal potential of Baja California is well known and there are several works reporting geothermal springs or wells in the Peninsula of California (Vidal et al., 1978; Quijano, 1985: Casarrubias-Unzueta, and Leal-Hernandez, 1993; Casarrubias-Unzueta and Romero-Rios, 1997; Portugal et. al., 2000; Barragán et. al., 2001). However, the conventional studies searching for geothermal systems overlooked many low-enthalpy geothermal areas (Torres et al., 2005) that could be considered for production of electricity to desalinate seawater (up to 5 MWe) or, in some cases, for direct use of the thermal seawater for desalination, for example Bahía Concepción (Prol-Ledesma et al., 2004) and Los Cabos (López-Sánchez et al., 2006). In addition to the previously reported areas, the Desalination IMPULSA project (Sea water desalination using renewable energies) of the Mexican Autonomous National University has provided data on new geothermal areas that may be developed to provide fresh water to rural communities as well as to larger tourist areas (Fig. 1).

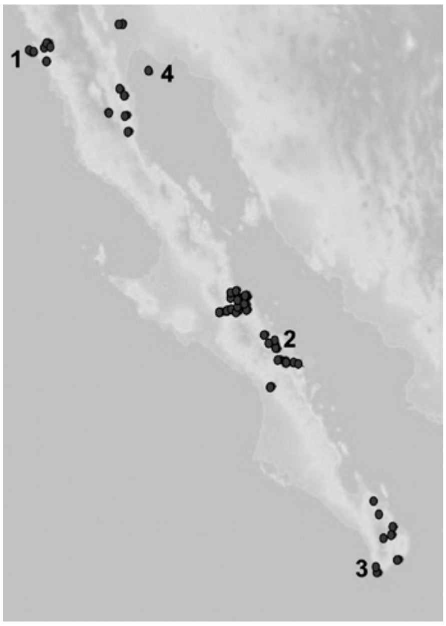


Figure 1. Geothermal areas reported in the Baja California Peninsula.

Priority for development has been assigned to the areas Ensenada (Punta Banda) in North Baja California and Bahía Concepción and Los Cabos in South Baja California (numbers 1, 2 and 3 in Fig. 1) because of a greater need for energy and water due to rapidly growing population in those areas. In addition, studies to unveil the geothermal resources in the Wagner Basin (Upper Gulf of California, number 4 in Fig. 1) promote the sustainable exploitation of submarine hydrothermal systems for energy production with the use of new environmentally friendly technology (Hiriart, 2006).

The Baja California Peninsula has a geological setting that is favourable to the presence of geothermal systems. It is a major producer of geothermal energy in Mexico with two geothermal plants producing 730 MWe: Cerro Prieto and Las Tres Vírgenes (Quijano and Gutiérrez-Negrín, 2005). The regional tectonics in Baja California are strongly related to the geodynamic development of the Gulf of California: extension with a lateral component. The result of this geodynamical context is the formation of young oceanic basins connected by transform faults. This active tectonic regime favours the occurrence of higher than average heat flow values (Fig.2) and has produced the conditions for the occurrence of numerous geothermal areas in the coastal regions of the Baja California Peninsula (Barragán et al., 2001; Prol-Ledesma et al., 2004; López-Sánchez et al., 2006). The presence of normal faulting is common on both coasts of the Peninsula. These faults permit the water to penetrate deep in the crust where it is heated by the higher than average geothermal gradient in this area (Bancora-Alsina and Prol-Ledesma, 2006).

Reservoir temperatures have been estimated using chemical geothermometers; however, water from the coastal hydrothermal systems shows the effects of mixing with seawater, and most geothermometers cannot be applied under those conditions. Nevertheless, the composition of the thermal water before mixing can be estimated with a linear mixing model for the submarine vents, and the reservoir temperature can be calculated from the composition of the thermal end member (Prol-Ledesma et al., 2004). In the case of coastal and continental thermal springs, the silica geothermometer can be applied; the estimated temperature is considered as minimum reservoir temperature because of the mixing processes that take place before discharge. The average value for all 47 geothermal areas in the Peninsula, where their chemistry allows the application of the silica geothermometer, is 131°C (Bancora-Alsina and Prol-Ledesma, 2006). This value is within the range where electricity production is feasible. In some coastal and submarine manifestations (Punta Banda, Bahía Concepción and Los Cabos), the calculated reservoir temperature is higher than 200°C (Vidal et al., 1978; Prol-Ledesma, 2004; López-Sánchez et al., 2006). A conservative estimation of energy production from 1 to 5 MWe in each area would be enough for desalination of water for human and agricultural consumption.

Several models have been developed that include the use of geothermal energy or geothermally heated water in desalination plants in the Baja California Peninsula (Hiriart, 2007). Three options have been considered for the production of electricity using the low-enthalpy resources: one is a conventional binary cycle plant, and two options contemplate variations to increase the output of electricity (Hiriart et al., in preparation). The second proposal to generate electricity includes the installation of plate heat-exchangers, which enhance heat transfer and occupy a smaller volume. The fluid to be used in this plant is pure water that will go through a pressure decrease to generate vapour. The turbine will have a small diameter (10 to 20 cm) and run at high velocity (20,000 rpm). The third proposal will be designed for submarine hydrothermal vents and is based on a water-tight binary plant that will exploit the large horizontal temperature gradients near the vents as a cooling sink for the working fluid (Hiriart, 2007). Development of these plants is planned for the next three years.

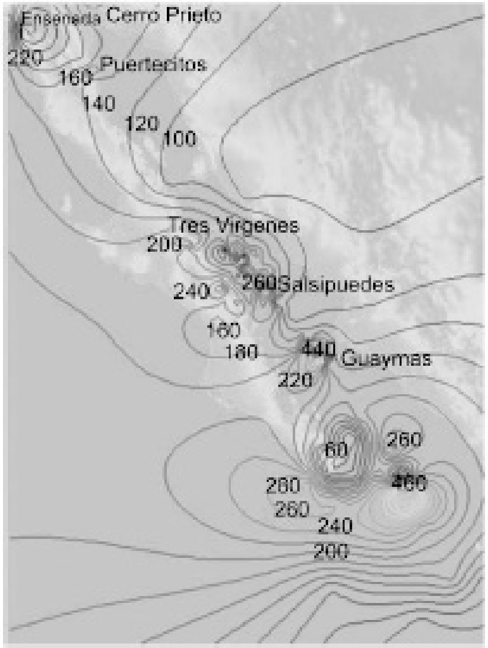


Fig. 2. Heat flow map of Baja California Peninsula and Gulf of California

References

Awerbuch, L., Lindemuth, T. E., May, S. C., Rogers, A. N., 1976. Geothermal energy recovery process. *Desalination*, 19, 325-336.

Báncora-Alsina, C., Prol-Ledesma, R.M., 2006. Mapa del flujo de calor en la Península y Golfo de California. *Reunión Anual de la Unión Geofísica Mexicana*. Puerto Vallarta, México.

Barragán R, R.M., Birkle, P., Portugal M, E., Arellano G, V.M., Alvarez R, J., 2001. Geochemical survey of medium temperature geothermal resources from the Baja California Peninsula and Sonora, Mexico: *Journal of Volcanology and Geothermal Research*, 110, 101-119.

Belessiotis, V., Delyannis, E., 2000. The history of renewable energies for water desalination. *Desalination*, 128, 147-159.

Casarrubias-Unzueta, Z., Leal-Hernandez, R., 1993. *Reporte de la interpretación geológica regional del proyecto geotérmico, Bahia Concepcion B.C.S.*, Comisión Federal de Electricidad. Gerencia de Proyectos Geotermoeléctricos. Departamento de Exploración.

Casarrubias-Unzueta, Z., Romero-Rios, F., 1997. *Propuesta para la localización de pozos de gradiente en El Centavito, Agua Caliente y Santispac, B. C. S.*, Comisión Federal de Electricidad. Gerencia de Proyectos Geotermoeléctricos. Departamento de Exploración.

Hiriart, G., 2006. Marine Energies in Mexico. *IEA-OES Newsletter.* Iss. 7, p 1

Laird, A. D. K., Tleimat, B. W., 1976. Desalinating geothermal brines. *Desalination*, 19, 309-316.

López-Sánchez, A., Báncora-Alsina, C. Prol-Ledesma, R.M., Hiriart, G., 2006. A new geothermal resource in Los Cabos, Baja California Sur, Mexico. *Proceedings 28th New Zealand Geothermal Workshop.* (S3- 6pp).

Portugal, E., Birkle, P., Barragan R, R.M., Arellano G, V.M., Tello, E., Tello, M., 2000. Hydrochemical-isotopic and hydrogeological conceptual model of the Las Tres Virgenes geothermal field, Baja California Sur, Mexico: *Journal of Volcanology and Geothermal Research*, 101, 223-244.

Prol-Ledesma, R.M., Canet C., Torres-Vera, M.A., Forrest, M.J., Armienta, M.A., 2004. Vents fluid chemistry in Bahia Concepcion coastal submarine hydrothermal system, Baja California Sur, Mexico. *Journal of Volcanology and Geothermal Research*, 137, 311-328.

Quijano, J.L., 1985. Evaluación geoquímica de las zonas termales del Estado de Baja California Sur, Comisión Federal de Electricidad. Gerencia de Proyectos Geotermoeléctricos. Departamento de Exploración.

Quijano, J.L., Gutiérrez-Negrín, L.C.A., 2005. Update of Geothermics in Mexico. Proceedings World Geothermal Congress 2005.
Rodríguez-Gironés, M., Rodríguez, M., Pérez, J., Veza, J., 1996. A systematic approach to desalination powered by solar, wind and geothermal energy sources. In: *Proceedings of the Mediterranean Conference on Renewable Energy Sources for Water Production*. European Commission, EURORED Network, CRES, EDS, Santorini, Greece, pp. 20-25.
Torres, R.J., Martínez-Estrella, J.I., Iglesias, E.R., 2005. Database of Mexican Medium- to Low-Temperature Geothermal Resources. *Proceedings World Geothermal Congress 2005*.
Vidal, V.M.V., Vidal, F.V., Isaacs, J.D., Young, D.R., 1978. Coastal Submarine Hydrothermal Activity off Northern Baja California: *J Geophys Res*, Vol. 83(B4): 1757-1774.

ASIA/PACIFIC RIM

Australia

First geothermal exploration tenement granted in Queensland

Graeme Beardsmore, Hot Dry Rocks Pty Ltd.

The first geothermal exploration permit was awarded in the State of Queensland on 2nd May 2008, more than a year after applications were first sought and submitted in that State. The successful company is Sydney-based Granite Power Ltd, while two other companies (KUTh Energy Ltd and Clean Energy Australasia Pty Ltd) are also reportedly close to having their applications approved. These constitute the first exploration permits issued under Queensland's Geothermal Exploration Act 2004.

The main reason for the delay in issuing geothermal exploration permits in Queensland has been the application of Australia's federal native title legislation to the extraction of geothermal energy in Queensland. While the native title legislation is Federal, the interpretation of whether it applies to the extraction of geothermal energy (in effect a court decision on whether geothermal energy extraction constitutes "mining") has been left up to the individual states. In most cases, State courts have found that native title rights do not apply to geothermal energy, but in Queensland the decision went the other way. This decision resulted in necessary but protected negotiations between the companies and the traditional owners of the exploration permits. Granite Power is the first company to complete those negotiations and have its application approved.

The issue of native title in Queensland highlights the role that different legislative regimes have had on the distribution of geothermal exploration activity in Australia to this point. From the point of view of number of active companies and expenditure commitment, South Australia has attracted the lion's share (>90%) of attention to this point. This is partly a function of the geology of South Australia, large parts of which are underlain by hot, radioactive granite bodies. However, similar granite bodies extend beneath Queensland and Northern Territory, and maybe Western Australia, New South Wales, Victoria and even Tasmania—effectively the entire country. Another factor that distinguishes South Australia, though, is that geothermal energy exploration and production in that state is regulated under the Petroleum Act (2000), with simple procedures for "over the counter" applications and a Regulator keen to facilitate the uptake of geothermal energy. Put simply, it is relatively cheap and simple for companies to explore there.

Tasmania and New South Wales (NSW) also allow "over the counter" applications, which have resulted in a large portion of Tasmania being "pegged", but only a small portion of NSW. The main difference between Tasmania and NSW is the cost of application, which is relatively high in NSW. This, and the perception of lower prospectivity in NSW, has stifled interest in that State.

The State of Victoria took the same path as Queensland by releasing set parcels of land in a gazettal round[1†]. All of Victoria was divided into Geothermal Exploration Permits (GEPs). A competitive gazettal round late in 2006 resulted in a total of 12 GEPs being awarded to five different companies. A second gazettal round was announced in late April 2008 for the GEPs not taken up in the first round. The current gazettal round is due to close in late July 2008.

In January this year, the State of Western Australia released 495 lots of land, each about 320 km2 in area, for geothermal exploration following amendments to the Petroleum Act (1967) in December 2007. The competitive gazettal round closed in April and the successful tenderers may be announced by the time this article goes to print.

[1 †] 'Gazettal' refers to a legal notice published in the Australian *Government Gazette*.

Of the seven Australian states, only the Northern Territory remains without geothermal exploration legislation. A broad scale geothermal resource assessment of that state released in November 2007, however, is reportedly intended to pave the way for imminent legislation.

Geothermal exploration activity shows no sign of declining in Australia, and with the upcoming release of more exploration areas in Queensland, Western Australia, Victoria and Northern Territory, the total work commitments and area of land under licence looks set to expand significantly.

Philippines

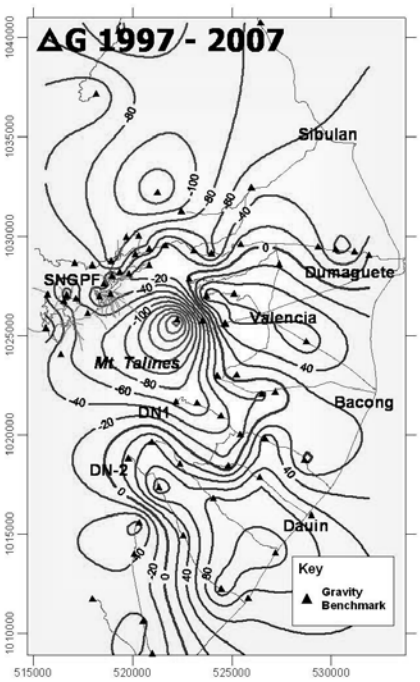
Microgravity and Precise Leveling Survey Results – Southern Negros Geothermal Production Field, Philippines

Geosciences Department, PNOC Energy Development Corp.

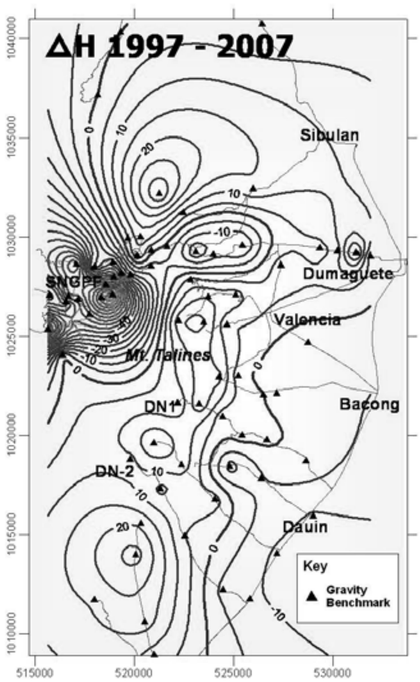
The Southern Negros Geothermal Production Field (SNGPF), located in the southeastern tip of Negros Island in the central part of the Philippines, started commercial operations in 1983 and to date generates about 200 MWe of electrical power. The current production field of Palinpinon occupies the northwestern sector of the project while Dauin, a prospect area, lies about 6 km to the south. These two areas are situated on opposite flanks of the dormant Cuernos de Negros andesitic-dacitic volcanic complex.

Repeat microgravity and precise leveling surveys were conducted in SNGPF between March and August 2007. Initial processing and analysis of the first repeat measurements in 2007 and comparison with the 1997 baseline data showed a general decrease in gravity in SNGPF. The largest magnitude of 216 microgals was recorded ~3 km east-southeast of the postulated upflow near Lagunao Dome.

The precise leveling survey performed in tandem with microgravity measurements revealed a decrease of elevations centered within the production field. A maximum of 92 mm ground subsidence was detected in the Puhagan sector. The negative changes in both gravity and elevation during the 10-year period are consistent with massive fluid extraction in SNGPF. The extension of the negative gravity contours farther to the south-southeast towards Dauin suggests a possible hydrologic connection between the geothermal systems of Dauin and Palinpinon. This interpretation will be validated by wells that will be drilled in Dauin.



Gravity change (μgals) from 1997-2007



Elevation change (mm) from 1997-2007

UPCOMING EVENTS

XVII International Conference on Computational Methods in Water Resources, Special session on Mass and Heat Transport in Geothermal Systems, San Francisco, California, 6-10 July 2008. Website: http://esd.lbl.gov/CMWR08/special sessions/index.html

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

World Renewable Energy Congress X and Exhibition 2008, 19–25 July 2008, Glasgow, Scotland, UK. Website: www.wrenuk.co.uk/wrecx.html

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

Australian Geothermal Energy Conference, 19-22 August 2008, Melbourne, Australia. Contact: ausgeothermal@impactenviro.com.au

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

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

ETH Energie Tage Hessen, 7–9 November 2008. Wetzlar, Germany. Website: http://www.energietage.com/

International Geothermal Sustainability Modelling Workshop, 10 November 2008, Taupo, New Zealand. Contact: Gudni.Axelsson@isor.is and C.Bromley@gns.cri.nz

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

2nd African Geothermal Conference (ARGeoC2), 25–29 November 2008, Entebbe, Uganda. Contact: argeoC2@minerals.go.ug

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

34th Stanford Workshop on Geothermal Reservoir Engineering, 9–11 February 2009, Stanford, CA, USA. Website: http://pangea.stanford.edu/ERE/research/geoth/conference/workshop.html

IGA News

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