The International Geothermal Association and the Western Pacific Regional Branch; collaboration among geothermists in Asian countries

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ABSTRACT

The International Geothermal Association (IGA) is a scientific, educational and cultural organization established in 1988. The objective of the association is to encourage research, development and utilization of geothermal resources worldwide through the compilation, publication and dissemination of scientific and technical data and information not only within geothermal specialists but also to general public. As one of the main activities, the IGA holds the World Geothermal Congress (WGC) every five years. The next congress, WGC2010, will be held in Bali, Indonesia in April 2010. The Western Pacific Regional Branch (WPRB) was established under the IGA in 2006 to foster closer collaboration in geothermal research and development in south-eastern Asia and western Pacific regions and to focus on dissemination of information on areas of geothermal science and technology which are special interest of the Region. Geothermal energy is one of the most promising renewable energy resources that can and must take a major role in the energy utilization worldwide for providing benefits to human life and for solving global warming problem. It is particularly true for Asian countries where economical growth is very rapid. Thus, the IGA is requested to take the lead, by a non-political manner, in promoting geothermal energy utilization worldwide.

Keywords: International Geothermal Association, geothermal resources, World Geothermal Congress, Western Pacific Regional Branch, Aisa

1. International Geothermal Association (IGA)

1.1 General

The International Geothermal Association (IGA), established in 1988, is a scientific, educational and cultural organization that operates worldwide. It is non-political, non-profit, and non-governmental. The objectives of the association include the following.

- To promote the coordination of scientific and technical education in geothermal related matters.
- To advance and promote the establishment of criteria for the exploration and development of geothermal resources in an environmentally responsible manner.
- To encourage enactment and adoption of uniform and appropriate legislation, rules and regulations for the development and utilization of geothermal energy resources.
- To serve as a public forum to provide objective and unbiased information on the nature of geothermal energy and its development.
- To facilitate collation and dissemination of data related to geothermal resources and development.
- To cooperate and communicate with national and international governmental, institutional and private agencies in matters relating to development and utilization of geothermal resources.

IGA is now affiliated to the International Renewable Energy Alliance (IREA), which is a group of international organizations of renewable energies, such as geothermal, solar, wind and hydropower.

1.2 Organization

Categories of the IGA memberships are individual members (260), student members (17), corporate members (20), institutional members (4), and sustaining members (13), where numbers in the parentheses indicate current number of the members, according to the IGA Web. However, majority of the memberships are through affiliated associations for

various countries. As shown in Table 1, there are 29 affiliated associations for 27 countries. A few more associations are under negotiation to join the IGA. A member of an affiliated association automatically becomes an IGA member, as equivalent with an individual member. The total numbers of members through affiliated associations is 3894, as of October 2008.

Table 1: List of affiliated associations of the IGA.

Country	Affiliation	# Members
Canada	CGEA	15
China	GCES	65
Costa Rica	AGC	20
Eire (Ireland)	GAE	30
El Salvador	ESGA	46
Ethiopia	EGA	45
Georgia	GGA	50
Germany	GtV	740
Hungary	HGA	97
Hungary	HTES	40
Iceland	GAI	120
Indonesia	API/INAGA	480
Iran	IGEA	10
Italy	UGI	85
Japan	IGAJ	103

Country	Affiliation	# Members
Lithuania	LGA	30
Macedonia	MAGA	50
Mexico	MGA	70
Netherlands	SPG	38
New Zealand	NZGA	150
Philippines	NGAP	250
Poland	PGA	80
Poland	PSG	65
Romania	RGA	60
Russia	GES	60
Slovakia	SGA	40
Switzerland	SVG-SSG	70
Turkey	TGA	85
USA	GRC	900
	Total	3894

Benefits that the members enjoy include the following (according to the IGA brochure).

- IGA Membership Directory (online for members in the near future).
- IGA News: a newsletter to provide timely general information on geothermal matters.
- Discounted subscription to a professional journal (*Geothermics*).
- Reduced registration fees to participate in short geothermal courses held either by IGA or by other organizations.
- Dissemination of geothermal information by scientific and technical exchange
- A World Geothermal Congress every 5 years and other scientific and technical meetings
- Point of contact for a wide spectrum of inquiries from scientists, engineers, governmental bodies, news media and the public
- The IGA Home Page in the World Wide Web (http://www.geothermal-energy.org/)
- Discount on the Proceedings of the World Geothermal Congresses 1995, 2000 and 2005

The routine task of the IGA is executed by the Board of Directors (BoD) and the Secretariat. The Secretariat is currently located in Reykjavik, Iceland. It was located in Berkeley (California, USA), Wairakei (New Zealand) and Pisa (Italy) in the past. The term of the BoD is for three years. Current BoD is the 7th term since the establishment of the association. The number of board members is 30, and they are elected by vote of whole IGA members. The Officers of the Association are President, Vice-President, Secretary and Treasurer, who are elected from and by the BoD. Tasks of the association are responsible for eight standing committees: namely Audit, Bylaws, Education, Finance, Information, Membership, Nomination, and Programme and planning. Daily routine tasks are conducted by the Executive Director at the Secretariat.

1.3 Major Activities

Major activities of IGA, from the individual member's point of view, include the following.
- World Geothermal Congress
- IGA News
- Geothermal information on the IGA Web
- Educational seminars and schools in branches (Europe and Western Pacific) and other countries

1.4 IGA News

IGA News is a quarterly newsletter on which various timely information on geothermal researches, developments, events and reports in the world is published. IGA News was published both in a printed form and in an electronic form, and was limited to 16-page long. However to save printing and shipping costs, it is now published only in the electronic form since issue No. 73 in September 2008. Color figures can be freely included now and the volume of each issue can be more flexible. The layout of the newsletter will be revised from next year as well.

1.5 Web Services

The official address of the IGA Website is **www.geothermal-energy.org**. It can be accessed by any person who is interested in geothermal energy. The information published on the Web includes the following.

- Calendar of geothermal conferences in the near future and the past
- IGA News
- Textbook of geothermal resources "What is Geothermal Energy?" by Mary H. Dickson and Mario Fanelli, specially written for IGA members
- Database on development of geothermal power plants and direct use
- Database on papers presented at geothermal conferences.
- Membership directory (only for IGA members)

All members are issued their accounts and passwords for accessing the member-restricted area of the website. The layout of the website will be also renewed very soon.

1.5.1 Geothermal utilization database

Status of geothermal utilization is various countries are reported at World Geothermal Congress every five years. All updated information are summarized for worldwide in the papers on a journal, Geothermics, as well as the summary presentation at WGC (e.g., Huttrer, 2001; Lund and Freston, 2001; Bertani, 2005; Lund et al., 2005). The essence of the summary papers on Geothermics is published on the IGA Web for public reference. For example, Tables 2 and 3 were made by utilizing such information on status of geothermal power generation and direct use, respectively. These data are updated every five years, corresponding to WGC. However, they will be updated more frequently in the future.

Table 2: Trends of worldwide geothermal power development. Data from 1995 to 2000 are by Huttrer (2001)，from 2005 to 2009 from Bertani (2005, 2008). Japanese data are by TENPES (2007). Data for 2009 include power plants scheduled to be in commence by the end of 2009.

Country	1995 (MWe)	2000 (MWe)	2005 (MWe)	2007 (MWe)	2009 Estimate (MWe)	2009-2000 Increase (MWe)
Australia	0.2	0.2	0.2	0.2	0.2	0.0
Austria			1.1	1.1	1.1	1.1
China	28.8	29.2	27.8	27.8	27.8	-1.4
Costa Rica	55.0	142.5	163.0	162.5	162.5	20.0
El Salvador	105.0	161.0	151.0	204.2	204.2	43.2
Ethiopia		7.3	7.3	7.3	7.3	0.0
France	4.2	4.2	14.7	14.7	16.2	12.0
Germany			0.2	8.4	8.4	8.4
Guatemala		33.4	33.0	53.0	57.0	23.6
Iceland	50.0	170.0	202.0	421.2	569.0	399.0
Indonesia	309.8	589.5	797.0	992.0	1,172.0	583.0
Italy	631.7	785.0	791.0	810.5	810.5	25.5
Japan	378.6	533.2	534.2	535.2	535.2	2.0

Kenya	45.0	45.0	129.0	128.8	169.0	124.0
Mexico	753.0	755.0	953.0	953.0	958.0	203.0
New Zealand	286.0	437.0	435.0	471.6	635.0	198.0
Nicaragua	70.0	70.0	77.0	87.4	87.0	17.0
Papua New Guinea			6.0	56.0	56.0	50.0
Philippines	1,227.0	1,909.0	1,930.0	1,969.7	1,970.0	61.0
Portugal	5.0	16.0	16.0	23.0	25.0	9.0
Romania				0.2	0.2	0.2
Russia	11.0	23.0	79.0	79.0	80.0	57.0
Thailand	0.3	0.3	0.3	0.3	0.3	0.0
Turkey	20.4	20.4	20.0	38.0	84.0	64.0
USA	2,816.7	2,228.0	2,564.0	2,687.0	2,987.0	759.0
Total	**6,833**	**7,973**	**8,933**	**9,732**	**10,587**	**2,614**

Table 3: Trends of worldwide geothermal direct utilization. Data for the year 2000 are by Lund and Freeston (2001) and those in 2005 are by Lund et al. (2005)

Country	2000		2005	
	Installed capacity	Annual energy utilization	Installed capacity	Annual energy utilization
	(MWt)	(TJ/yr)	(MWt)	(TJ/yr)
Albania	n/a	n/a	9.6	8.5
Algeria	100.0	1,586.0	152.3	2,417.0
Argentina	25.7	449.0	149.9	609.1
Armenia	1.0	15.0	1.0	15.0
Australia	34.4	351.0	109.5	2,968.0
Austria	255.3	1,609.0	352.0	2,229.9
Belarus	n/a	n/a	2.0	13.3
Belgium	3.9	107.0	63.9	431.2
Brazil	n/a	n/a	360.1	6,622.4
Bulgaria	107.2	1,637.0	109.6	1,671.5
Canada	377.6	1,023.0	461.0	2,546.0
Caribbean Islands	0.1	1.0	0.1	2.8
Chile	0.4	7.0	8.7	131.1
China	2,282.0	37,908.0	3,687.0	45,373.0
Colombia	13.3	266.0	14.4	287.0
Costa Rica	n/a	n/a	1.0	21.0
Croatia	113.9	555.0	114.0	681.7
Czech Republic	12.5	128.0	204.5	1,220.0
Denmark	7.4	75.0	330.0	4,400.0
Ecuador	n/a	n/a	5.2	102.4
Egypt	1.0	15.0	1.0	15.0
Ethiopia	n/a	n/a	1.0	15.0
Finland	80.5	484.0	260.0	1,950.0
France	326.0	4,895.0	308.0	5,195.7
Georgia	250.0	6,307.0	250.0	6,307.0
Germany	397.0	1,568.0	504.6	2,909.8

Greece	57.1	385.0	74.8	567.2
Guatemala	4.2	117.0	2.1	52.5
Honduras	0.7	17.0	0.7	17.0
Hungary	472.7	4,086.0	694.2	7,939.8
Iceland	1,469.0	20,170.0	1,844.0	24,500.0
India	80.0	2,517.0	203.0	1,606.3
Indonesia	2.3	43.0	2.3	42.6
Iran	n/a	n/a	30.1	752.3
Ireland	n/a	n/a	20.0	104.1
Israel	63.3	1,713.0	82.4	2,193.0
Italy	325.8	3,774.0	606.6	7,554.0
Japan*	409.4	5,139.0	413.5	4,955.8
Jordan	153.3	1,540.0	153.3	1,540.0
Kenya	1.3	10.0	10.0	79.1
Korea	35.8	753.0	16.9	175.2
Latvia	n/a	n/a	1.6	31.8
Lithuania	21.0	599.0	21.3	458.0
Macedonia	81.2	510.0	62.3	598.6
Mexico	164.2	3,919.0	164.7	1,931.8
Mongolia	n/a	n/a	6.8	213.2
Nepal	1.1	22.0	2.1	51.4
Netherlands	10.8	57.0	253.5	685.0
New Zealand	307.9	7,081.0	308.1	7,086.0
Norway	6.0	32.0	600.0	3,085.0
Papua New Guinea	n/a	n/a	0.1	1.0
Peru	2.4	49.0	2.4	49.0
Philippines	1.0	25.0	3.3	39.5
Poland	68.5	275.0	170.9	838.3
Portugal	5.5	35.0	30.6	385.3
Romania	152.4	2,871.0	145.1	2,841.0
Russia	308.2	6,144.0	308.2	6,143.5
Serbia	80.0	2,375.0	88.8	2,375.0
Slovak Republic	132.3	2,118.0	187.7	3,034.0
Slovenia	42.0	705.0	49.6	729.6
Spain	n/a	n/a	22.3	347.2
Sweden	377.0	4,128.0	3,840.0	36,000.0
Switzerland	547.3	2,386.0	581.6	4,229.3
Thailand	0.7	15.0	2.5	79.1
Tunisia	23.1	201.0	25.4	219.1
Turkey	820.0	15,756.0	1,495.0	24,839.9
Ukraine	n/a	n/a	10.9	118.8
United Kingdom	2.9	21.0	10.2	45.6
USA	3,766.0	20,302.0	7,817.4	31,239.0
Venezuela	0.7	14.0	0.7	14.0
Vietnam	n/a	n/a	30.7	80.5
Yemen	1.0	15.0	1.0	15.0
Total	**15,145**	**190,699**	**28,268**	**273,372**

*Japanese data do not include hot spring spa utilization.

1.5.2 Report on CO_2 emission from geothermal power plants

A survey to compile CO_2 gas emission from geothermal power plants was conducted by IGA in 2002 (Bertani and Thain, 2002). Data on CO_2 gas concentration in geothermal steam/hot water and emission from geothermal power plants were collected from some 85% of the plants in the world. The estimate of the CO_2 emission from geothermal power plants resulted in 122 g/kWh in average in the world (**Fig. 2**). This report is on the IGA Web.

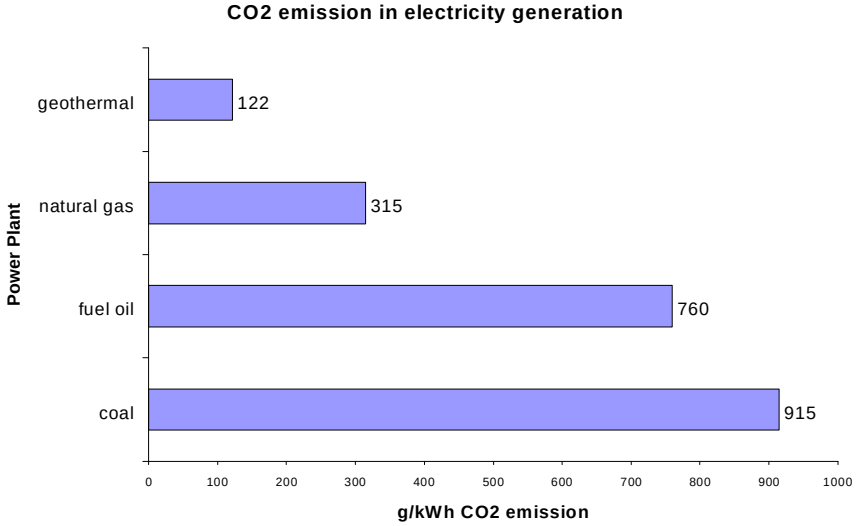

Figure 1: CO_2 emission in g/kWh for different power plants (Bertani and Thain, 2002)

1.5.3 Geothermal Conference Papers Database

The IGA website holds an archive of papers presented at geothermal conferences, with a capability of search engine. The collection includes the proceedings from World Geothermal Congress, Stanford Geothermal Workshop, New Zealand Geothermal Workshop, European Geothermal Conference, Iceland Geothermal Conference, Indonesian Geothermal Association Conference, Beijing International Geothermal Symposium, International Geothermal Workshop – Russia, and Geothermal Energy in Underground Mines - Ustron – Poland. The number of papers stored in the database exceeds 5,500 now.

1.6 GeoFund

GeoFund is a project of World Bank to promote and support geothermal developments in East Europe and former Soviet Union countries (Albania, Armenia, Azerbaijan, Belarus, Bosnia-Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kirgizstan, Macedonia, Moldova, Montenegro, Romania, Russia, Serbia, Ukraine, Tajikistan, Turkey, Turkmenistan, and Uzbekistan). IGA has a contract with World Bank, in which IGA gives technical assistance to carry out seminars and workshops, to provide a list of geothermal experts who can help in geothermal projects in the above countries, and to establish a website on geothermal activities in GeoFund countries. This project is for three years from 2006 to 2008. World Bank is considering to start a similar project to support geothermal projects in East African countries.

2. World Geothermal Congress (WGC)

2.1 General Information

World Geothermal Congress (WGC) is the biggest geothermal conference in the world, which IGA organizes. WGC is held every five years. The past congresses were held as follows:

- May 1995, Florence, Italy, hosted by ENEL

- May-June 2000, Beppu-Kazuno-Morioka, Japan, hosted by Japanese Geothermal Community
- April 2005, Antalya, Turkey, hosted by Turkish Geothermal Association

The past WGCs were attended by approximately 1,500 registrants or more and some 550-700 technical papers were presented.

2.2 WGC2010

The World Geothermal Congress 2010 (WGC2010) will be held in Nusa Dua, Bali, Indonesia, on 25-30 April 2010, hosted by Indonesian Geothermal Association (INAGA). INAGA is expecting more than 2,000 people will participate in WGC2010.

The official website is **www.wgc2010.org**. The 2nd Circular, describing a detailed plan of technical sessions, poster sessions, field trips, fellowship program, and accommodation, was distributed in July 2008. The important deadlines are as follows:

- **31 January 2009**: abstract submission,
- **31 May 2009**: draft full paper submission,
- **30 October 2009**: final full paper submission

3. Western Pacific Regional Branch

3.1 General

The Western Pacific Regional Branch (WPRB) was established in 2006 to foster closer collaboration in geothermal research and development in the south-east Asia and western Pacific regions and to focus on dissemination of information on areas of geothermal science and technology which are special interest of the region. The Region geographically covers the zone outlined by Indonesia, Thailand, China, Mongolia, Japan, West Samoa, New Zealand, and Australia (Figure 2). The founding countries of the WPRB are China, the Philippines, Indonesia, New Zealand and Japan. There is another regional branch under IGA; European Regional Branch (ERB), consisting of countries in the European Continent, where direct use is dominant in geothermal utilization.

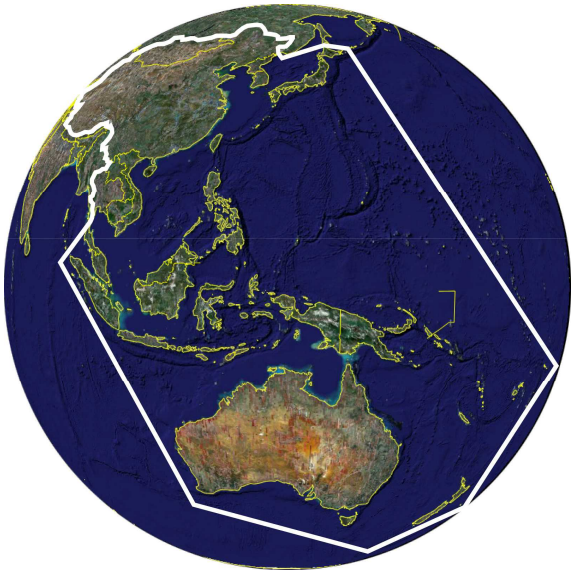

Figure 2: The geographical zone of the Western Pacific Regional Branch (white line).

3.2 Organization

The governing body of the WPRB is called Forum, and the Chairman represents the Branch. The Forum members are currently as follows:

- Jim Lawless (New Zeland) - Chairman

- Tian Tingshan (China) - Vice Chairman
- Larry Bayrante (Philippines) - Secretary
- Kevin Brown (New Zealand) - Treasurer
- Toshi Uchida (Japan)
- Graeme Beardsmore (Australia)

The membership fee was set as US$5.00 for a member who lives in New Zealand and Japan, and US$2.00 for the Philippines, Indonesia, and China. Fee for an individual member who lives in other countries is US$5.00. Student fee is 50% of them. The number of current members is approximately 500, consisting of 64 from China, 70 from New Zealand, 242 from the Philippines, 66 from Japan, 100-300 from Indonesia, and 3 individual members. Any geothermist in the Region, who is an IGA member, is welcome to join the WPRB.

3.3 Activities

Major activity of the WPRB is to hold a regional conference and technical seminars. Since the establishment, WPRB has held annual conference in Auckland, New Zealand (November 2006), Manila, Philippines (March 2007), and Bali, Indonesia (April 2008).

At the Bali meeting, a 3-day technical seminar entitled "Cost reduction through improved geothermal well targeting" was held on 26-28 April 2008. Two principal lectures were given by Jim Lawless (New Zealand) and Hiroyuki Tokita (Japan), and several lectures on geophysical technology and case studies in Indonesia were given as well. There attended 76 registrants from five countries: Indonesia, Australia, the Philippines, Papua New Guinea and New Zealand. A CD containing the lecture notes and presentation files can be purchased from the WPRB.

A one-day short course on reservoir management by Cedric Malate (PNOC-EDC, the Philippines) was held in Australia and New Zealand in August 2008.

The 2009 WPRB conference and technical seminar are scheduled to be held in Chengdu, China in September 2009. The theme of the seminar will be "Non-Conventional Geothermal Power Generation." Power generation technologies from low-temperature geothermal fluid as well as enhanced geothermal systems, which will be suitable for Chinese geothermal development, are focused in the three-day lectures.

4. Summary

IGA serves as a focal point of the information exchange on geothermal energy utilization worldwide through its congress, news, website and seminars. Geothermal energy is one of the most promising renewable energy resources that can take a major role in the energy utilization in this century, particularly in Asian countries where geothermal resources are abundant and economical growth is very rapid. However, the way of geothermal utilization differs among Asian and Pacific countries. For example, power generation is dominant in Indonesia and the Philippines, while direct use of low temperature resources is dominant in China, Korea and Indochina countries. Japan and New Zealand are characterized with both. EGS (HDR) utilization is being started in Australia. The newly formed Western Pacific Regional Branch will serve as a forum for accelerating closer cooperation among geothermists in the region. WGC2010 in Bali will be one of such opportunities for us.

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