

GEOTHERMAL TRAINING CENTERS IN THE WORLD

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ABSTRACT

The first geothermal training centers began operating in Pisa (Italy) and Kyushu (Japan) in 1970, at the request of UNESCO. From 1979 on, they were joined by another five training centers in Auckland (New Zealand), Reykjavik (Iceland), Mexicali (Mexico), Skopje (Macedonia), and Los Azufres (Mexico). The courses organized in these centers last from one - two weeks to eight - nine months, and they cover all aspects of the research and utilization of geothermal energy. At the moment, these centers seem capable of providing all the qualified and competent personnel required for geothermal projects currently in-flow; but, this situation could deteriorate in the future.

INTRODUCTION

The first "industrial-scale" non-balneological utilization of geothermal energy is a part of geothermal history. The rudimentary direct heat utilization set up in the Larderello area in 1827, on what could be considered an industrial scale for the time, was used to extract boric acid from the geothermal fluids. In 1904, the first experiment in producing geothermal electric energy, using a steam-driven piston engine and dynamo, also took place in the Larderello area. Industrial production of electric energy followed in the next decade, and has developed progressively since then.

Exploitation of geothermal energy worldwide developed at a very slow rate, despite the fact that high- and low-enthalpy geothermal fluids were known to be present in many parts of the world (the circum-Pacific areas, the African Rift, eastern Europe, etc.), and it had been demonstrated that these resources could be utilized in a number of applications. Suffice to say that, Italy was the only country producing geothermal electricity up until 1958, when New Zealand began generating electricity of geothermal origin at Wairakei (in a 6.5-MWe plant).

Fortunately, the international organizations were able to appreciate the significance of this energy source, especially for the developing countries. In August 1961, the United Nations organized a Conference on New Sources of Energy in Rome, during which the participants discussed the status and future of geothermal energy and the other renewable sources of energy (i.e., solar, wind and tidal). At the time of this conference, the geothermal electric power installed in the world was about 410 MWe, most of which was in Italy. Only 0.9% was installed in the developing countries, at Pathé in Mexico.

The Rome Conference in 1961 was reported worldwide, and played a significant part in making geothermal energy known not only to technicians, but also, and more importantly, to the policy-makers, who finally became aware of this source of energy, its many forms of application, its relatively harm-

less effect on the environment, and its competitiveness with other energy sources. The conference also emphasized the fact that it was an "indigenous" energy, which is particularly attractive aspect for poorer nations, as its utilization could reduce imports of premium-priced fuels from abroad. Nevertheless, in the decade between 1960 and 1970, little progress was made in the developing countries, despite the efforts of the international organizations to finance geothermal projects; although, a few were indeed launched during this period. The geothermal power installed in the world rose to 711 MWe in 1970; but, most of this was in the industrialized nations. The power installed in the developing countries increased from 3.5 to 4.4 MWe; but, their percentages of the total dropped from 0.9 to 0.6.

The snail-like pace of geothermal development in the non-industrialized countries can be blamed on a variety of factors. The main reason was, as it always was, and still is, aggravated by a lack of interest on the part of the policy-makers, and inadequate information. Another major reason for the delayed progress was the small number of geothermal experts available in these countries, capable of carrying out research independently right from the initial reconnaissance phase, and of working in conjunction with experts sent in by the international organizations.

UNESCO was the first international organization to tackle the problem of the lack of local geothermists. In August 1968, it convened a "Group of Experts on Training in Geothermal Energy" in Paris, with the objective of defining the number and type of geothermists who would be needed in the next few years to implement the geothermal projects of the developing countries. The experts present at this meeting are a part of geothermal history: John Banwell, Robert Fournier d'Albe, Masami Hayakawa, Elena Lubimova, James McNitt, Marco P. Marchetti, Gudmundur Palmason and Ezio Tongiorgi. The main conclusions reached by the Group were: a) the specific geothermists needed were geologists, geophysicists, geochemists, drilling engineers and production engineers; and b) about 25 new geothermists/year would be needed in the first half of the 1970s.

This number (25/year) was soon to be exceeded. A survey in the mid-1970s showed that the projects financed by the international organizations were absorbing from 35 to 40 new geothermists each year. Added to these were the experts sought for projects under bilateral agreements and others required by countries that were eager to create a geothermal staff before launching their exploration programs. Based on the number and type of requests received by the International School of Geothermics in Pisa, we estimate that at least 60 new geothermists were needed each year in the second half of the 70s.

Following on the meeting of its Group of Experts, UNESCO appealed to its member countries with geothermal experience to provide training for geothermists from the developing countries. This appeal was met by the governments of Japan and Italy, and in January 1970, the Post-Graduate Course in Geothermics began in Pisa, later to become the International School of Geothermics. In September that same year, the Group Training Course in Geothermal Energy was launched in Kyushu. At the end of the 1970s, the two centers, in Kyushu and Pisa, were able to train a total of 30 experts per year between them. During that period, the course in Japan lasted 2 1/2 months and concentrated on training within the 5 sectors indicated by the Group of Experts of UNESCO; whereas, the course in Italy lasted 9 months and was a general character.

As the training centers sponsored by UNESCO could meet only a part of the requirements of the developing countries, the UNDP contacted the government of New Zealand in 1975 with a request to set up a geothermal training center there. The agreement between the UNDP and New Zealand was formalized in 1978 and the Geothermal Diploma Course launched in Auckland in January 1979. In that same period, the United Nations University (UNU) also came to an agreement with the Icelandic government. As a consequence, the UNU Geothermal Training Programme began operation in Reykjavik in March 1979.

At the beginning of the 1980s, there were, therefore, four geothermal training centers sponsored by international organizations in Pisa, Kyushu, Auckland and Reykjavik. The four centers trained a total of 67 new geothermists in 1980 alone. Between 1980 and 1985, they were training between 60 and 70 geothermists per year.

During this period in 1983, the Geothermal Diploma Programme was set up in Mexicali. Their program of training lasts one year and has had a variable number of trainee participants, from 12 in the period 1984-85 to 2 only in 1991. It is more regional in character and the official language being Spanish.

In the meantime, the geothermal situation worldwide was gradually evolving in a more positive direction. By the late-1970s, we were beginning to see the fruits of the projects launched at the beginning of the decade and in the 1980s, we experienced a boom, especially in the developing countries. The geothermal power installed in the world in 1970 was 711 MWe, 4.4 of which was in the developing countries, corresponding to 0.6% of the total. Twenty-five years later, the total worldwide had reached 6,798 MWe with 2,580 MWe of this figure in the developing countries, corresponding to 38% of the total. By the end of 1997, these figures had risen to 7,925 MWe, 3,389 MWe and 43%, respectively.

This trend has had its effect on the request for new geothermists, which has increased gradually from year to year. The major political events have also had an influence. The collapse of the communist regimes in eastern Europe, for example, gave a renewed impetus to industry in this area, and consequently, also to the development of their geothermal resources. These nations are keen to train new experts, especially in the mid-to-low enthalpy sector.

From a combined capacity in 1985 of over 70 experts per year trained in the four classical geothermal schools, the suspension of the long-term course in the school in Pisa in 1992, as a result of the economic crisis in Italy, brought this figure down to less than 60 experts per year. In the period 1970 - 1995, however, these four schools prepared a total of 1,850 geothermists. Even assuming that about half of them are no longer in geothermal, this still leaves more than 900 experts in service. A few countries could now begin in-house training (as would appear to be the situation in the Philippines). The number of geothermal experts currently being trained each year may effectively be sufficient to meet the needs of the geothermal community worldwide; but, this could only be confirmed by a specific survey.

Regional or national short courses also seem to be very effective, concentrating as they do on topics of local interest. These courses are relatively inexpensive and, in conjunction with the traditional long-term courses, can make a significant contribution to providing experts for particular fields. Two courses of this type have been launched in recent years: one in Skopje, Macedonia in 1989, initially targeted at citizens of eastern Europe and the Circum-Mediterranean countries, and now in expansion worldwide; and the other, in 1995, in Los Azufres, Mexico, and mainly directed at the Latin-American countries. The International Geothermal Association (IGA), through its Education Committee, could play an important role in coordinating this type of activity.

There are now seven geothermal training centers operating in the world. A short description follows for each beginning with the oldest.

INTERNATIONAL SCHOOL OF GEOTHERMICS - PISA, ITALY

The school in Pisa, which began its activity in January 1970, has its headquarters in the International Institute for Geothermal Research (CNR). The school is sponsored by UNESCO, and its training activity is financed by the National Research Council, the Italian Ministry of Foreign Affairs, and in part, by UNESCO.

Between 1970 and 1992, the school organized 22 annual long-term courses, each lasting an average of 8 months. The objective of the courses was to prepare experts in geothermal exploration. A total of 324 geothermists attended this course in Pisa, which has now been suspended.

At present, the school organizes short courses of 10 - 15 days each, on local or specific topics. These courses are generally held abroad, at the request of the host country. So far, seminars and workshops of this type have been held in Colombia, Italy, Thailand and Venezuela.

For more information, contact: +39 050 47066 (Fax).

GROUP TRAINING COURSE IN GEOTHERMAL ENERGY (ADVANCED) - KYUSHU, JAPAN

This course was founded in September 1970 and is sponsored by UNESCO. Financed by the Japan International Cooperation Agency (JICA), it is organized by Kyushu University in its Geothermal Research Center in Fukuoka.

The 4-month course, running from mid-August to mid-December, is held in English and covers all aspects of the development of a geothermal project. Lectures and exercises are integrated with one month field work and excursions. On completion of the course, the trainees receive a certificate. Between 1970 and 1995, a total of 320 specialists were trained at this course. Scholarships are available.

For more information, contact: +81 9 366 31350 (Fax)

GEOHERMAL DIPLOMA COURSE - AUCKLAND, NEW ZEALAND

The course in Auckland began in February 1979, and was sponsored by the United Nations Development Programme (UNDP) until the end of 1989. UNDP sponsorship will begin again in 1997. The course is financed by the New Zealand Ministry of Foreign Affairs and Trade (MFAT), and organized by the Geothermal Institute of Auckland University.

The Diploma Course generally runs from the beginning of March to the middle of November each year, providing a period of broad training in geothermal technology and lectures on specialized topics, integrated with 3 weeks of field work. Trainees can, if necessary, attend a 12-week intensive course in English prior to the Diploma Course, as well as a 1-month course on computing. On successful completion of three written examinations and a written project, the trainees receive a "Diploma in Geothermal Technology."

By 1997, a total of 519 specialists had attend this course. About 35 places are available each year (for earth scientists and engineers). Scholarships are available.

The Geothermal Institute also offers 3-month courses in Reservoir Engineering and Environmental Aspects..

For more information, contact: +64 9 373 7436 (Fax).

UNU GEOHERMAL TRAINING PROGRAMME - REYKJAVIK, ICELAND

The Reykjavik training programme was launched in March 1979, and is sponsored by the United Nations Univeristy (UNU). Financed since then by the Government of Iceland and the UNU, it operates within the Geothermal Division of Orkustofnun, the National Energy Authority of Iceland.

Lasting a total of six months, the programme consists of an initial 5-week period of introductory lectures for all trainees, followed by specialized studies tailor-made for the individual student, integrated by field work and excursions. Emphasis is laid on practical, on-the-job training. On completion of the programme, the participants receive a UNU Certificate.

By 1997, a total of 197 trainees had attended this course. Scholarships are available.

For more information, contact: +354 568 88 96 (Fax).

GEOHERMAL DIPLOMA PROGRAM - MEXICALI, MEXICO

The Mexicali training program began in January 1983, and is offered by the Universidad Autonoma de Baja California (UABC), in collaboration with the Instituto de Investigaciones Electricas (IIE), the Consejo Nacional de

Ciencia y Tecnologia, and the Comision Federal de Electricidad (CFE). It is held in the Engineering Institute of UABC.

The program lasts one year, January - December, and covers the earth science and engineering disciplines involved in the exploration and exploitation of geothermal resources. Spanish is the official language. Lectures are integrated with a number of field trips to geothermal fields in Mexico and the USA. On successful completion of the program, and after passing an oral examination or written project, the trainees receive the degree "Especialista en Geotermia."

By 1994, a total of 63 specialists had completed their training at UABC. Scholarships are available.

For more information, contact: +65 66 41 50 (Fax).

INTERNATIONAL SUMMER SCHOOL ON DIRECT APPLICATION OF GEOHERMAL ENERGY - SKOPJE, MACEDONIA

The Summer School (ISS) was founded in 1989 by the Cyril & Methodius University of Skopje, the International School of Geothermics of Pisa, and the Aristotelian University of Thessaloniki. The ISS has its headquarters in Skopje. The main sponsors of its training activity are UNESCO, FAO and the International Geothermal Association (IGA).

The courses generally last 1 - 2 weeks and are attended by 20 - 30 participants. Financial support is available. Held in English, the courses are directed at providing an update on the state-of-the-art in direct uses of geothermal energy. So far, courses have been held in Yugoslavia-Greece, Macedonia, Bulgaria, Romania, Turkey and the Azores, attended by a total of 200 participants. Each participant receives a certificate of attendance.

The courses are generally preceded or followed by a workshop.

For more information, contact: +389 91 119 686 (Fax).

GEOHERMAL TRAINING CENTRE - LOS AZUFRES, MEXICO

Training activity began in 1995 and is organized by the Comision Federal de Electricidad (CFE) in its Geothermal Training Centre in Los Azufres geothermal field. The courses are directed at Mexican and foreign technicians and engineers involved in R&D in the geothermal sector. Practical, hands-on training is emphasized in these courses, which last 1 - 2 weeks. They are generally held in Spanish, but English is available on request. The center can accomodate up to 30 participants per course.

The first course, on geothermal petrography, was held in October 1995.

For more information, contact: +43 14 39 70 (Fax).

Of the seven training centers described above, three are in Europe, two in Latin-Americas, one in Asia and one in Oceania. Together, they cover practically all sectors of geothermal research and utilization and, in theory, should now be capable of meeting the worldwide demand for geothermal experts. However, what seems a satisfactory situation could

dramatically take a turn for the worst in the near future, because of the relentless paring down of funds set aside for training. The first signal of an imminent crisis occurred in 1993, when the Italian government cut back on the funds allotted to international courses, which led the International School of Geothermics in Pisa to suspend its long-term course. Between 1993 and 1998, the UNESCO contribution was also gradually reduced by more than a third, which suggests that the international organizations are also beginning to feel the pinch. It would appear that some of our colleagues in the other training centers are also facing similar difficulties with funds. The economic problems of many European countries, in the aftermath of the European Union single currency, the recession in Japan and the economic crisis in southeast Asia in general,

with the inevitable consequences in many industrialized countries, are all factors that will tend to complicate the future for geothermal development as a whole, and training in particular. Clearly every effort must be made to combat this negative trend of affairs, and the main actions that should be taken are, in our opinion:

- optimization of the structure of the courses to reduce cost as much as possible without jeopardizing their efficiency, and
- coordination of the existing courses, again to reduce costs. Apart from avoiding any overlapping of the courses, this could, for example, eventually mean adopting the same textbooks and other teaching material.

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