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UNIVERSITY**

GEOTHERMAL TRAINING PROGRAMME
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CONTRIBUTION OF UNU-GTP TRAINING TO GEOTHERMAL DEVELOPMENT IN PERTAMINA GEOTHERMAL ENERGY, INDONESIA

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ABSTRACT

The Geothermal Training Programme of the United Nations University (UNU-GTP) plays an important role for the development of the human resource capability of PT. Pertamina Geothermal Energy (PGE). The first Indonesian UNU fellows were trained 26 years ago, in 1982. Since then 22 have completed the 6 months training of whom 20 have come from Pertamina, and 2 more are being trained in 2008. And two UNU Fellows are now undertaking Masters studies starting in late 2007. Of the Pertamina UNU Fellows 91% are still involved in PGE activities, including those that have retired but are still in the geothermal industry. The course has made an enormous contribution to dissemination of information, transfer of knowledge, and best world practice. Development of geothermal energy in Indonesia has been running rather slowly in the last twenty years, but Indonesia faces now acceleration of geothermal project for combating the energy crisis in Indonesia. Therefore, UNU-GTP will continue to be important in the near future, particularly, in providing human resource capability for this development.

1. INTRODUCTION

PT. Pertamina Geothermal Energy (PGE) was formed in 2006 and is the subsidiary of PT. PERTAMINA (PERSERO), the oil and gas company owned by the Government of Indonesia. PGE is responsible to develop, manage and sustain a portfolio of various upstream energy related businesses through organic expansion and strategic alliances planning. With over 37 years of experience in geothermal business and a proven record of accomplishment as geothermal field operator with high delivery rate (95%), PGE is striving to be “*Centre of Excellence for Indonesia Geothermal Industry*”. PGE is supported by qualified human resources and technology in the upstream geothermal industry. With a large potential reserve for development and commercialization along with area assets, PGE is geared up towards fulfilling higher energy demand. PGE owns the authority of 15 geothermal working areas (Figure 1). Totally, it yields the potential 8,400 MW equalling 4,390 MMBOE. The figure consists of geothermal reserve 6,400 MW and geothermal resource 2,000 MW. The utilization in such activities comprises of own operation and partnership, the overall installed capacity is 1,032 MW.

Currently PGE operates three plants of its own operation, Kamojang with 200 MW capacity, Lahendong with 40 MW capacity and Sibayak with 12 MW capacity. Two prospects that are still under exploration drillings phase are Ulubelu and Lumutbalai; while other prospects that are currently under scientific and environment studies consist of Kotamobagu, Hululais, and Sungai Penuh (Figure

1). Moreover, there is one prospect under the Scientific Study phase, namely Iyang Argopuro, and one plant in the Ready to Develop phase, namely Karaha. Totally, PGE operates now 252 MW or 23% of the 1,032 MW of the country's installed capacity. This is expected to increase to 1,035 MW, equivalent to 8,150 GWh/year by the end of year 2014 (PGE, 2006 and 2008)



FIGURE 1: Map of the 15 Pertamina's working areas

Under joint operation contract schemes, PGE established cooperation with Chevron in the Gunung Salak and Darajat plants, with 375 and 255 MW capacities, respectively. In the Wayang Windu plant with 110 MW capacity, PGE established cooperation with Star Energy. With Bali Energy, it has established cooperation for the Bedugul plant. While in the Sarulla plant, cooperation was established with Medco, Itochu, Ormat and Kyushu. Finally, PGE has also established a joint-venture cooperation scheme with PT Geodipa Energy, in Dieng with the capacity of 60 MW and for new plants in Patuha. Figure 2 summarizes the different operation schemes of PGE (PGE, 2006 and 2008).

OWN OPERATIONS	JOINT OPERATION BODY	JOINT VENTURE
Kamojang 200 MW	Salak field (ChevronTexaco) 375 MW	Patuha (PT GDE)
Lahendong 40 MW	Darajat (ChevronTexaco) 255 MW	Dieng (PT GDE) 60 MW
Sibayak 12 MW	Wayang Windu (MNL) 110 MW	
Ulubelu (Exploration Drilling)	Bedugul (Bali Energy)	
Lumut Balai (Exploration Drilling)	Sarulla (Medco Energy)	
Kotamobagu (Environment Study)	Karaha-Bodas (KBC)	
Hululais (Scientific Study)		
Sungaipenuh (environment studt)		
Iyang Argopuro (Scientific Study)		

FIGURE 2: PGE working areas

2. THE UNU GEOTHERMAL TRAINING PROGRAMME

The United Nations University Geothermal Training Programme (UNU-GTP) has operated in Iceland since 1979 with six months of courses for professionals from developing countries. Specialized training is offered in geological exploration, borehole geology, geophysical exploration, borehole geophysics, reservoir engineering, chemistry of thermal fluids, environmental studies, geothermal utilization, and drilling technology. More recently, MSc degree studies have been introduced.

The trainees specialize in their fields by working side by side with professionals from Orkustofnun, ISOR – Iceland GeoSurvey, University of Iceland or other institutions, who are actively working on most aspects of geothermal research, exploration, and development. The training is tailor-made for the individual and the needs of his institution/country. The outcome of this is that the graduates can produce reasonable amounts of work as soon as they return to their home countries.

Geothermal institutions nominate their candidates, graduates in science or engineering, to participate in the UNU-GTP. Recipients of the Fellowship are selected based on the role of geothermal energy within the countries' energy plans; the institutional capabilities for geothermal research and utilization in the respective countries; and national training needs. This is complemented by approximately biennial site visits by representatives of the UNU-GTP to the countries of nominees, and personal interviews (UNU-GTP, 2008).

Among the 402 graduates of the UNU-GTP (including 2008), twenty-four of the Fellows are from Indonesia as shown in Table 1. From the table it can be seen that twenty-two have come from PGE, one from PT. PLN (state-owned electricity company) and one from the Volcanology Department. In addition, two-master's students are currently undertaking the degrees in mechanical engineering.

TABLE 1: Fellows of UNU-GTP from Indonesia

No.	Company	No. trained	Retired	Available
1.	Pertamina Geothermal Energy	22	5	17
2.	PT. PLN	1	0	1
3.	Volcanology Department	1	1	0

3. ACADEMIC BACKGROUND OF UNU-GTP FELLOWS

UNU-GTP Fellows come from a wide variety of academic backgrounds ranging from geology to engineering disciplines (petroleum, mining, electrical, chemical and mechanical engineering, Figure 2). Geologists and petroleum engineers are in the majority with 30% (or six) each of the 20 UNU-GTP Fellows (excluding those being trained), and are distributed among all PGE activities (Table 2).

TABLE 2: Distribution of active UNU Fellows

No.	Location	No. of Fellows
1.	PGE Headquarter office	3
2.	Kamojang field	4
3.	Lahendong field	3
4.	Sibayak field	2
5.	Karaha project	1
6.	Kotamobagu project	1
7.	PT. Geodipa Energy	1

Geologists have joined petroleum engineers as geothermal reservoir engineers and often work in the area of geophysics. The engineers work in diverse areas such as drilling technology, geothermal

utilization, engineering of geothermal processes and environmental studies, while the chemical engineers are working in chemical work.

The UNU-GTP, combined with practical experience in geothermal resources, has allowed the professionals to become geothermal specialists (Figure 3).

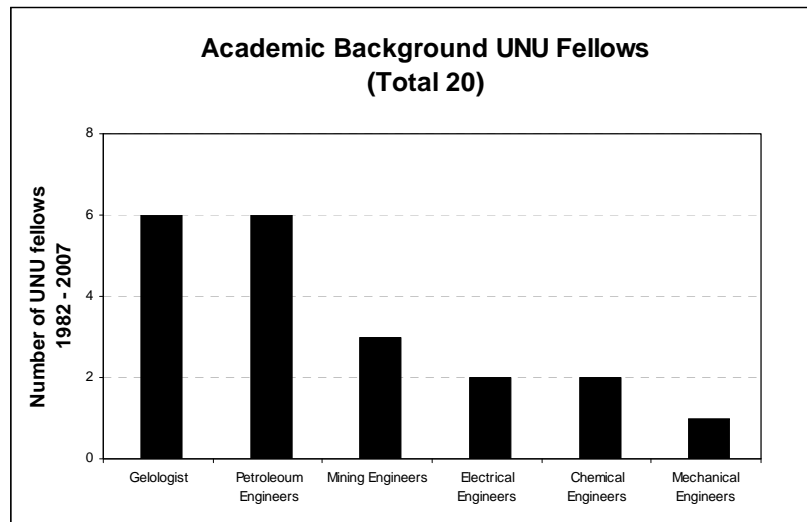


FIGURE 3: Academic background of the UNU Fellows

As seen in Figure 4, most professionals have moved to the Reservoir Engineering stream, reflecting the advanced status of the geothermal industry with fields already operating; or are in the late development phase where there is a need for conceptual and numerical models. In addition, production chemistry plays an important role reflected in the attractiveness of the specialization in Chemistry of Thermal Fluids. Exploration continues to play an important role, and hence disciplines such as geophysical and geological exploration, drilling technology, and environmental studies continue to attract professionals.

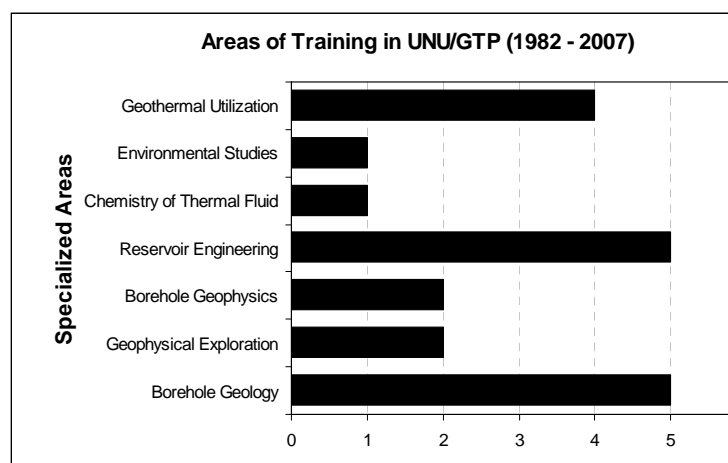


FIGURE 4: Areas of training in UNU-GTP

4. PERSONAL ACHIEVEMENTS OF UNU FELLOWS

Professional knowledge and skills obtained by UNU Fellows during the UNU-GTP courses bring important benefits for their countries, institutions and individual professional development. In Table 3 is a summary of the current roles of the UNU Fellows. Most of the UNU Fellows have been able to develop their careers in PGE. This has also been possible due to the continuous knowledge exchange and participation in congresses, seminars, and workshops.

TABLE 3: Status of currently active UNU Fellows at Pertamina, including present UNU Fellows

Name/ background	Year trained at UNU-GTP	Area of work before Iceland	Line of training	Area of work/ Current position
Soeroso Engineer	1986	Engineer	Reservoir Engineering	Operation Director PT. Geodipa Energy
Tafif Azimudin Geologist	1995	Geologist	Borehole Geophysics	Project Manager Kotamobagu prospect
Doddy Sasradipoera Engineer	1995	Reservoir Engineer	Reservoir Engineering	Project Manager Karahha prospect
M. Irhas Engineer	1996	Engineer	Reservoir Engineering	General Manager Lahendong Area
M. Yustin Kamah Geologist	1996	Geophysics	Borehole Geology	Resource Development Manager - Jakarta
Hendrick Siregar Engineer	2004	Production Engineer	Geothermal Utilization	Engineering Manager Sibayak Area
Agus A. Zuhro Engineer	2004	Reservoir Engineer	Reservoir Engineering	Engineering Manager Kamojang Area
Moeljanto Engineer	2004	Environmental	Environmental Study	Reservoir Engineer Lahendong Area
M. Achyar Karim Engineer	2005	Head of Chemistry Laboratory	Chemistry of Thermal Fluids	Quality Managem. Superint. Jakarta
Dradjat B. Hartanto Geologist	2005	Geologist	Borehole Geology	Geologist Jakarta
Roy Bandoro Engineer	2006	Engineer	Geothermal Utilization, MSc studies 2007-8	Utilization Manager Sibayak Area
Ahmad Yani Engineer	2006	Drilling Engineer	Reservoir Engineering	Reservoir Engineer Kamojang Area
Tesha Engineer	2006	Drilling Engineer	Geothermal Utilization, MSc studies 2007-8	Engineer Kamojang Area
Andi Joko Nugroho Engineer	2007	Drilling Engineer	Geothermal Utilization	Mechanical Engineer Kamojang Area
Hary Koestono Geologist	2007	Geologist	Borehole Geology	Geologist Lahendong Area
I Made Budi Kesuma Engineer	2008	Drilling Engineer	Drilling Technology	
Fahmi H. Dereinda Engineer	2008	Environmental	Environmental studies	

5. THE ROLE OF THE UNU-GTP IN GEOTHERMAL DEVELOPMENT IN PGE

The UNU Geothermal Training Programme provides significant and exceptional assistance and support for PGE in educating team of professionals capable of conducting versatile activities aimed at geothermal use and development. The UNU-GTP has made an enormous contribution in the dissemination of knowledge; promotion of geothermal resource utilization; and the transfer of knowledge, know-how, experience and best practice at the global level.

The UNU Fellows have also been fortunate to have a special occasion to study and cooperate with high-level, scientific and intellectual people. They have gathered very broad knowledge in a number of key branches of geothermal utilization, to be employed in their home countries. The UNU Fellows have had a chance to observe and follow methods employed by professionals in world-renowned centres, e.g. ISOR - Iceland GeoSurvey / Orkustofnun, and the University of Iceland and had access to the Orkustofnun Library, abounding in the world's geothermal literature.

The UNU-GTP can be perceived as a builder of inter-personal, and international relationships with people trying to achieve universal targets, and who feel responsible for rational management of the Earth, its resources and preservation for future generations.

6. CONCLUSIONS

The UNU-GTP training has been very useful and will continue to be useful as more countries diversify their power generation mix to include geothermal as an indigenous and environmentally friendly source of energy. The UNU-GTP can assist PGE in improving the utilization of their trained human resources in geothermal technology to achieve the target of up to 1,035 MW by the end of year 2,014, and to become a “*Centre of Excellence for Indonesia Geothermal Industry*”.

Geothermal energy will play an increasingly important role in Indonesia in the future sustainable development of its energy sources to deal with the increasing energy crisis in Indonesia. UNU Fellows with their detailed knowledge of the resource base will continue to contribute to the development of geothermal resources not only in technical terms but also in the setting and implementation of electrification policies and plans. On a wider scale, UNU Fellows have proven to have the skills and competencies that enable them to develop into new areas and directions.

Lastly, the UNU-GTP is contributing towards enhancing human resource development in the participating countries, and is helping them to be eventually self-reliant in terms of technical expertise in the different phases of geothermal development.

ACKNOWLEDGEMENTS

I would like to give my sincere congratulations to all the UNU-GTP Fellows who have continuously contributed in the development of geothermal resources in each of their countries. I would like to greatly express many thanks to all colleagues, especially to Mr. Suroto in helping me and sharing the information required for this paper. Also to the Director, Dr. Ingvar B. Fridleifsson, the Deputy Director Mr. Ludvik S. Georgsson, all technical assistants, members of the Studies Board, lecturers, supervisors, and all persons involved with the UNU-GTP.

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