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Geothermal Development in Indonesia—Dream or Reality?

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Investment opportunities, government policies, crash program financing, Geothermal Working Areas, development barriers

15 GWe is already categorized as reserves and the rest areas are still identified as resources. In addition, near 3,000 MWe of the reserves is already proven reserves.

ABSTRACT

Indonesia has abundance potential on geothermal energy more than 29 GWe, yet, only less than 5% have been utilized. In order to speed up geothermal utilization, the Government of Indonesia (GoI) has been determines fifty Geothermal Working Areas (GWAs). To support utilization of renewable energy especially geothermal energy, the GoI have been issued crash program to accelerate 10.000 MW electricity development which 40% derived from geothermal power plant. The program need at least US \$ 11.000 million. In order to support the program, the GoI has issued some policies and regulations to overcome barriers in geothermal development.

Table 1. Geothermal Potential Per Island (Geological Survey - Ministry of Energy and Mineral Resources, 2010).

Island	Resources		Reserves			Installed Capacity
	Speculative	Hipotetic	Probable	Possible	Proven	
Sumatera	4,785	2,086	6,250	15	380	12
Java	1,935	1,836	3,848	658	1,815	1,117
Bali and Nusa Tenggara	410	359	983	-	15	
Kalimantan	115	-	-	-	-	
Sulawesi	925	67	1,299	150	78	60
Maluku	535	43	376	-	-	
Papua	75	-	-	-	-	
Total 276 Locations	8,780	4,391	12,756	823	2,288	1,189
	13,171		15,867			
	29,038					

Introduction

Geothermal energy is a green energy because it produces lower green house gasses (GHG) such as CO_x, NO_x and CFC than fossil fuel (sources). In addition, when managed properly, geothermal is also consider as a renewable energy.

Indonesia has a vast potential in geothermal energy. According to Geological Survey - Ministry of Energy and Mineral Resources (2010), 276 areas are identified as geothermal potential areas (Figure 1). Total energy from those areas reaches more than 29 GWe (Table 1). From the total potential,

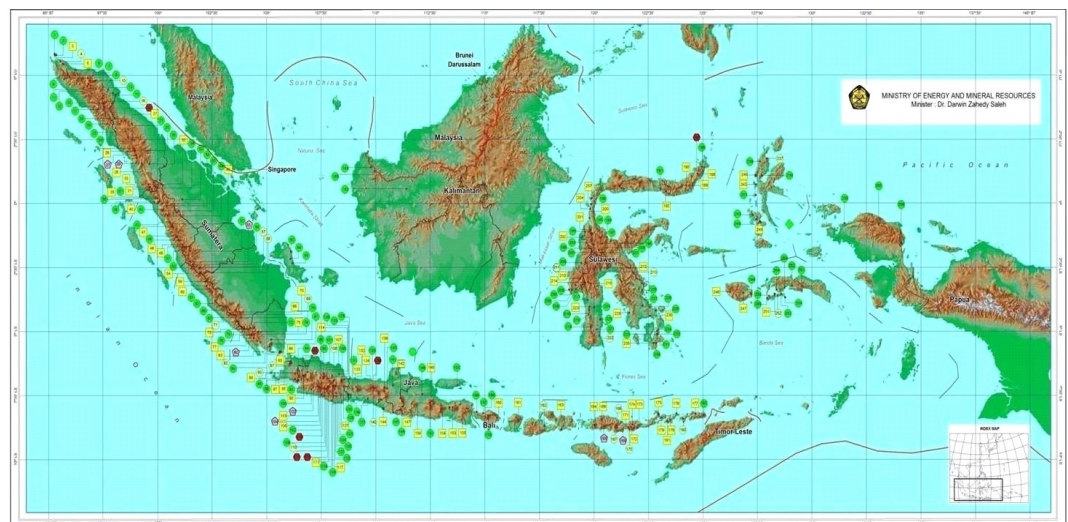


Figure 1. Geothermal Potential Distribution in Indonesia. Geological Survey - Ministry of Energy and Mineral Resources, 2010)

As a green energy, geothermal has potential in reducing GHG. Therefore, Indonesia would have contribute to mitigate the effect of global warming when the utilisation of geothermal energy is more prefer than fossil energy. Indonesia has a potential to reduce CO₂ over 400 million tons in 2025. Additionally, up to now, geothermal in Indonesia already have contributed in reducing GHG more than 33 million tons of CO₂ from 6 years production (2005-2010).

Geothermal Business Stage

According to Law No. 27/2003 on Geothermal Energy and the Government Regulations (GR) No. 59/2007 on Geothermal Business Activities as amended in GR No. 70/2010, geothermal activities in Indonesia comprise preliminary survey, establishing Geothermal Working Area (GWA), tendering the GWA, exploration, feasibility studies and production / utilization as shown in Figure 2.

As can be seen in Figure 2, preliminary survey could be conducted by government, local government or business entity through the assigning by the Government of Indonesia (GoI) c.q. Ministry of Energy and Mineral Resources (MEMR). The assigning of preliminary survey is regulated by Ministerial Regulation of MEMR (MR of MEMR) No. 02/2009 on the Guidelines for Geothermal Preliminary Survey Assignment. Currently, there are seven areas to be offered in preliminary survey assignment scheme. Area where the preliminary survey assignment is conducted will be evaluated to be determined into GWA. GWA determination is the authority of MEMR.

Government and business entity could conduct the exploration. Business entity could conduct exploration on the GWA after getting geothermal business permit or so-called IUP. The IUP will be granted throughout the tender mechanism. The issuing of an IUP depends on the location of the GWA. If the GWA is located within a regency/city, IUP is issuing by regent/city government. When the GWA is located at across several regent/city areas, the IUP is granted by the provincial government. The central government (MEMR) only gives the IUP for GWA which lies across several provinces.

Geothermal Development

Up to 2011, The Government of Indonesia (GoI) has determined total of fifty GWAs. Nineteen of the GWAs were established before the issuance of Law No. 27/2003 while 31 of them were

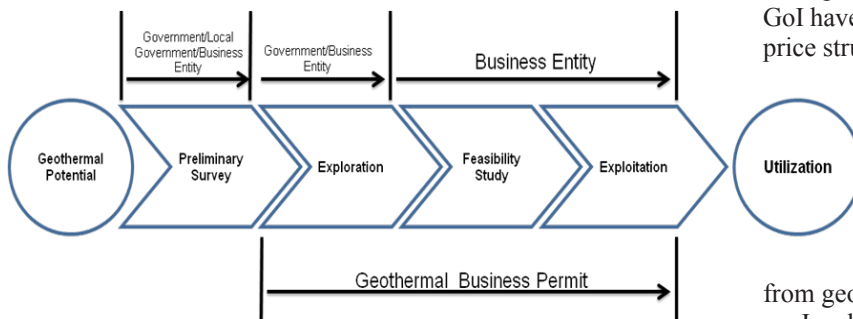


Figure 2. Geothermal Activities in Indonesia (Harsoprayitno, 2011).

established afterwards with a 4,170 MW total target capacity of geothermal power. From the existing GWAs, 38 of them already have IUP and the rests are still in tendering process (Harsoprayitno, 2011).

Table 1 shows that total installed capacity of geothermal energy is 1,189 MW. Most of the capacity lies on in Java Island. The capacity derived from seven geothermal fields; Sibayak (12 MW), Gunung Salak (375 MW), Wayang Windu (227 MW), Kamojang (200 MW), Darajat (255 MW), Dieng (60 MW) and Dieng (60 MW) (Harsoprayitno, 2011).

Barriers in Geothermal Development

Sukhyar (2010) restated the barriers of geothermal based on the results of World Geothermal Congress (WGC) 2010 discussions in Bali that the barriers consist of resources risk, high investment cost at the early of the project, pricing scheme, unbankable bidding process, small scale development, direct use of geothermal energy, human resources development, local content, overlapping areas with forestry, and bureaucracy. Nugraha (2007) also identified that government related problems as hinders to develop geothermal in Indonesia. The problems are regarding to tender process and uncertainty in price. In addition, Saptadji (2006) focused the problems on the lacks of skill and knowledge of local government staff on legal, technical and economic aspects of geothermal.

The World Bank (WB) also have identified that at least three problems to be solved in order to accelerate geothermal development in Indonesia. The problems are pricing, risk mitigation and transaction or bidding process. The problem in pricing is not only the level of the price but also the mechanism and its certainty. Transaction problems is regarding to bidding process such as bidding documentation.

Another hinder to be considered is an overlapping area between geothermal area and forestry areas. Geological survey has been identified that 81 geothermal areas are partially or completely lie on forestry areas, 29 areas lie on conservation forest and 52 lie on protecting areas. According to regulation, there are no mining activities that allow to be conducted on conservation forest. Geothermal potential in those areas reach more than 12,000 MW (Kasbani, 2009).

Government Initiatives

In order to overcome the problems and barriers for accelerating geothermal development in Indonesia, the GoI has been issued some policies and regulations. Regarding to pricing problems, the GoI have been issued MR of MEMR No. 02/2011 on geothermal price structure. The MR gives certainty on electricity price from geothermal power plant. The MR determines a bidding price as purchasing price by PT PLN that will be included in Power Purchase Agreement (PPA). The price is final and non-negotiable. According the law, PT PLN, state-owned electricity company, is the one and only electricity buyer in Indonesia. Furthermore, the MR also determines the ceiling price of electricity from geothermal power plant at US \$ 9.7 cents/kWh.

In addition, the GoI also provides several fiscal incentives for geothermal development through GR No. 62/2008 jo No. 1/2007,

Ministerial Regulation of Minister of Finance (MR of MoF) No. 177/PMK.011/2007 and MR of MoF No. 22/PMK.011/2011. Danar (2010) summarized the incentives as follow: 30% of corporate income tax, 10% of added-value tax paid by the GoI, custom duties exemption for geothermal developer, 25% per year depreciation for 8 years with double declining balance method, and investment tax credit 5% per year for 6 years.

The GoI c.q. MEMR have been received grant from Global Environment Facility (GEF) through the WB to review existing regulation and to develop new policy and mechanism in pricing and transaction.

Government Policies

The GoI has been setting up the policy in renewable energy including geothermal through some regulations. The regulations are Presidential Regulation (PR) No. 04/2010 jo. MR of MEMR No. 15/2010 on 2nd stage of 10.000 MW crash program to accelerate electricity development in which electricity from renewable energy as focused. In the program, 60% of capacity derived from renewable energy and 3,967.MW from geothermal power plant. Other regulations to support the utilization of renewable energy are as follow:

- PR No. 4/2010 on assigning to PT. PLN in order to accelerate Power Plant Development Using Renewable Energy, Coal and Gas;
- MR of MEMR No. 31/2009 on Electricity Purchasing Price by PT. PLN from Small – Medium Scale of Renewable Energy Power Plant; and
- MR of MEMR No. 15/2010 on projects list of Power Plant Development acceleration using Renewable Energy, Coal and Gas and its Related distribution transmission.

In the near future, the GoI will set up some policies regarding to pricing, transaction, risk mitigation, and overlapping geothermal areas with forestry areas. For

pricing, feed in tariff mechanism will be chosen for giving certainty in pricing. The mechanism is still being developed by the GoI to be in line with existing regulation. In addition, GR and MR of MEMR that regulate bidding process are being revised in order to make the tender more simple, transparent and bankable. Furthermore, in order to mitigate risk in exploration stage, the GoI will establish state-owned enterprise for conducting the ex-

Table 2. List of Geothermal Project in 2nd Crash Program.

No.	Geothermal Power Plant Project	Status	Province	Estimation of Capacity (MW)	Istalled Capacity 2014 (MW)	Required Financing 2014 (US\$ Million)
1	Seulawah Agam	New WKP	Naggroe Aceh Darussalam	1x55	55	165
2	Jaboi	New WKP	Nagroe Aceh Darussalam	1x7	7	21
3	Sarulla 1	Existing WKP	North Sumatera	3x110	330	990
4	Sarulla 2	Existing WKP	North Sumatera	2x55	110	330
5	Sorik Merapi	New WKP	North Sumatera	1x55	55	165
6	Muaralaboh	New WKP	West Sumatera	2x110	220	660
7	Lumut Balai	Existing WKP	South Sumatera	4x55	220	660
8	Rantau Dadap	New WKP	South Sumatera	2x110	220	660
9	Sungai Penuh	Existing WKP	Jambi	2x55	110	330
10	Hululais	Existing WKP	Bengkulu	2x55	110	330
11	Rajabasa	New WKP	Lampung	2x110	220	660
12	Ulubelu 3 dan 4	Existing WKP	Lampung	2x55	110	330
13	Rawa Dano	New WKP	Banten	1x110	110	330
14	Kamojang 5 & 6	Existing WKP	West Java	1x40 & 1x60	100	300
15	Cibuni	Existing WKP	West Java	1x10	10	30
16	Cisolok-Cisukarame	New WKP	West Java	1x50	50	150
17	Darajat	Existing WKP	West Java	2x55	110	330
18	Karaha Bodas	Existing WKP	West Java	1x30 & 2x55	140	420
19	Patuha	Existing WKP	West Java	3x60	180	540
20	Salak	Existing WKP	West Java	1x40	40	120
21	Tampomas	New WKP	West Java	1x45	45	135
22	Tangkuban Perahu I	New WKP	West Java	2x55	110	330
23	Tangkuban Perahu II	New WKP	West Java	2x30	60	180
24	Wayang Windu	Existing WKP	West Java	2x120	240	720
25	Batu Raden	New WKP	Central Java	2x110	220	660
26	Dieng	Existing WKP	Central Java	1x55 & 1x60	115	345
27	Guci	New WKP	Central Java	1x55	55	165
28	Ungaran	New WKP	Central Java	1x55	55	165
29	Ijen	New WKP	East Java	2x55	110	330
30	Iyang Argopuro	Existing WKP	East Java	1x55	55	165
31	Wilis/Ngebel	New WKP	East Java	3x55	165	495
32	Lahendong 5 dan 6	Existing WKP	North Sulawesi	2x20	40	120
33	Kotamobagu 1 dan 2	Existing WKP	North Sulawesi	2x20	40	120
34	Kotamobagu 3 dan 4	Existing WKP	North Sulawesi	2x20	40	120
35	Bora	Open Area	Central Sulawesi	1x5	5	15
36	Merana/Masaingi	New WKP	Central Sulawesi	2x10	20	60
37	Huu	New WKP	West Nusa Tenggara	2x10	20	60
38	Sembalun	Open Area	West Nusa Tenggara	2x10	20	60
39	Atadei	New WKP	East Nusa Tenggara	2x2,5	5	15
40	Sukoria	New WKP	East Nusa Tenggara	2x2,5	5	15
41	Tulehu	Existing WKP	Maluku	2x10	20	60
42	Jailolo	New WKP	North Maluku	2x5	10	30
43	Songa Wyaua	New WKP	North Maluku	1x5	5	15
Total Development up to s.d 2014					3,967	11,901

Note : Cost to develop 1 MW = US\$ 3 Million

Table 3. List of support/Technical Assistance Needed for geothermal sector (Geothermal Investment and Technical Assistance in Indonesia, 2011).

Task	Objectives	Technical Assistance		
		Title of Technical Assistance	Code of TA	Indicative budget (US\$ millions)
A	Coordination efforts to provide transaction and tender agents to assist local governments with tendering, and after successful bidding, monitoring of Geothermal working areas technical, and to supports to Geothermal Task Force,	Support for Power Purchase Agreement and Public Private Partnership – Assistance to PLN and the banks/lenders in developing a common template for PPA, financial model, including the legal structure, assistance to local governments and Individual Power Producers (IPPs) in forming Joint Ventures, which are commercially viable, transparent and profitable.	A-1	12
		Support to local governments for tendering greenfields – Assistance to develop clear and precise tender documentation requirements, training for officers in local governments, develop an accreditation, endorse regulation that provides guidance on issues of moral hazard and/or conflict of interests, or potential conflicts of interest in constituting the tender evaluation committee, etc.	A-2	7
		Support to local governments for social safeguard, AMDAL, and protecting pristine forest areas	A-3	5
		Support to Geothermal Task Force Secretariat/ PMU	A-4	2
B	Capacity building both to train the required additional 1,000 geothermal engineers which are needed, and to develop national geothermal capacity Building Program (NGCBP) and research and development (R&D) program, i.e., Indonesia Geothermal Centre of Excellence (IGCE)	Studies Program – Scholarship in New Zealand, Iceland, The Netherlands, and others, and Lecturers from these countries, Scholarships for Studies in Indonesia (ITB, GM etc.), Ph.D scholarships abroad, Preparation of Study Material and IT facility improvements, Additional Classroom and Offices, Teaching Teachers at 17 Universities in Indonesia, and Special Workshops Conferences etc.	B-1	20
		Drilling Efficiency – Improve Drilling Efficiency and Improved Resource Characterization, lithosphere Tectonics and Improved Reservoir Modeling in association with Internationally wellknown Institutes	B-2	10
		Geothermal Resources – Explore Underutilized Geothermal Resources and Enhanced Geothermal Systems Research	B-3	15
		Geothermal Direct Utilization – Direct Utilization of Waste Steam, including Feasibility Studies and Business plan support, Training, and Start-up Capital Support	B-4	15
		Database of Indonesia Information Underground (DIU) – support to develop a comprehensive and accesible database of the Indonesia Underground	B-5	15
		Environmental Research – Geothermal Forestry, Social and Environmental Research and Monitoring, and Disaster Mitigation and Management	B-6	10
C	Risk sharing with resource confirmation/ exploration and debt financing for a Geothermal Financial Facility to assist local Governments to cover the cost of resource confirmation	Support to mitigate the risk of resource confirmation	C-1	5
		Support for the development of Geothermal Financial Facility (Fund) – Feed-in-tariff	C-2	2 (grant) 300 (private sector credit facility)
D	Technical assistance with financial instruments that will allow local banks to provide debt finance, as private sector will need over US\$8 billion in long term funds	Support to financial intermediation for geothermal projects, including Fees for “put” options and guarantee instruments	D-1	11

Source : The National Development Planning Agency (2011)

ploration activities such as exploration drilling. The Government will also provide revolving funds (for exploration and feasibility study), particularly for the Eastern parts of Indonesia.

Regarding to overlapping areas with forestry areas, especially when overlapping with conservation forest, there will be a policy to exempt geothermal activities as prohibit activities in the areas.

The mechanism of monitoring by The Government which carried out by the Presidential Working Unit for Supervision and Management of Development (UKP4) helps to facilitate between related parties, in case bottle necking occurs, this can be addressed promptly.

The government has also issued a Presidential Decree that guarantees support for investment in Geothermal Infrastructure Project (PR No. 13/2010 jo PR No.67/2005 and PR 78/2010).

Investment Opportunities

Base on current and near future policies and program that supporting geothermal development, Indonesia is the place where there are many investment opportunities in geothermal sector. Investment opportunities to support crash program of 10.000 MW electricity developments are widely open. The program will be needed at least US\$ 11,901 million for developing 43 geothermal areas as can be seen in table 2. Besides the financial, capacity building is also one necessity to support the program. The program will require at least 800.000 worker with particular skill and knowledge about geothermal.

Up to now some multi-national investors have been participated geothermal industry in Indonesia. Chevron is one of

multinational company which becoming a geothermal developer company. In tendering the GWA, companies such as Tata Power, Star Energy, Ormat, Itochu, Kyushu and also Chevron have been participated. Therefore, after new policies and regulations, which more supporting the geothermal development, are issued, hopefully new investors will take more parts in the development.

Over 70% of the investment needed in geothermal development is expected to come from the private sector. To realize this effort, the Government will make significant investments for which multi and bilateral resources are required. Stakeholder participation and support from Partners from within and outside the country are needed. Support may include funding and Technical Assistance. The National Development Planning Agency (Bappenas) has listed support / technical assistance needed for geothermal sector. Development partners are welcomed to co-finance a number of these activities (Table 3 shows an illustration of the type of support and technical assistance needed):

- (i) TASK A – coordination efforts, i.e., technical support to the Geothermal Task Force consisting of officials from various ministries, and transaction and tender agents to assist local governments with tendering, and after successful bidding, monitoring of Geothermal working areas;
- (ii) TASK B – Capacity building both to train the required additional 1000 geothermal engineers which are needed, as well as to develop The National Geothermal Capacity Development Program (NGCDP), and Geothermal Research Programs carried out in a number of centres of excellences;

- (iii) TASK C – risk sharing with resource confirmation/ exploration and debt financing for a Geothermal Financial Facility to assist local Governments to cover the cost of resource confirmation; and
- (iv) TASK D – technical assistance with financial instruments that will allow local banks to provide debt finance, as private sector will need over US\$8 billion in long term funds.

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