

Indonesia's Geothermal Energy Development, Past and Challenges

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ABSTRACT

Exploration for geothermal energy in Indonesia dates in the 1920's, when the Dutch Government started a country-wide inventory of thermal features, including drilling shallow test wells at Kamojang, West Java. But not until 1972 a modern geothermal exploration started to take place. The early 1990's saw the awarding of eleven contracts for development of geothermal plants, with a total committed capacity of 3,417 MW and original completion dates between 1998 and 2002. However, as a result of the 1997 – 1998 Asian monetary crisis, the Government has to suspend several Indonesia Power Projects (IPPs), including seven geothermal projects. Attempts to resuscitate the cancelled project and to initiate new geothermal projects have progressed very slowly. Presently, of the total potential of 29,038 MW, the geothermal utilization for energy is only 4.7% (1,340 MW).

The development of Indonesia's energy resources including geothermal has not been optimum. One of the issues that inhibited the development is electricity tariff, which suffered from somewhat of a see-saw development. The other major issues impeding Indonesia's geothermal resource development are the inappropriate regulations and uncertainty over implementation of regional autonomy. Many activities have been suspended, since the areas are located in the protected forests, which often are only known after the permits are issued or the contracts are signed. Other crucial issues include overlapping of rights on mining operating areas on one side with the rights of forestry, people's land and others.

While in the long run, Indonesia still presents one of the world's most attractive geothermal regions, but the GOI must develop new approaches to maximize its potential by eliminating the hurdles to its development. Indonesia's geothermal industry needs a new legal basis. Investors require confidence that regulatory structures protect their investment. They want legal and business certainty, beginning with an immediate review of existing laws and regulations related to energy and natural resources to bring them into conformity with new requirements of regional autonomy and fiscal decentralization.

INTRODUCTION

Indonesia, located in the "Pacific Ring of Fire" volcano belt, is among only a handful of countries to develop geothermal energy; however, utilization of geothermal potential has proceeded very slowly and is still facing difficult challenges and uncertainty. Exploration for geothermal energy in Indonesia dates in the 1920's, when the Dutch Government started a country-wide inventory of thermal features, including drilling shallow test wells at Kamojang, West Java. But not until 1972 a modern geothermal exploration started to take place.

According to the Ministry of Energy and Mineral Resources (MEMR), the indicated resource base for geothermal energy totaled about 29,038 MW (13 billion barrels of oil equivalent). The largest reserves are located in the western part of the country (Sumatra, Java and Bali). However, over a span of 40 years, Indonesia developed only 1,345 MW of geothermal power, or less than 5.0 percent of the potential. Of the 1,345 MW, about 1,228 MW or 91% from the fields, that have been developed before the Asian monetary crisis in the 1990's. The following discusses various barriers to Indonesia geothermal resource development and corresponding solutions that have been or to be undertaken to accelerate the development.

REGULATORY FRAMEWORKS

Private sector development of geothermal projects that started in early 1990's is initially based on the Oil and Gas Law Nr. 44 of 1960, supplemented by the Presidential Decrees (PD), i.e. the PD Nr. 22/1981 amended by PD Nr. 45/1991. The PD Nr. 22/1981 authorizes PERTAMINA (State Owned Oil and Gas Company) or its joint operation contractors to undertake exploration and exploitation of geothermal energy resources in Indonesia and to generate and sell steam to PLN (State Owned Electricity Company) and to other bodies such as the Government or private companies (including cooperatives) for electricity generation. The PD No. 45/1991 decree improves and simplifies geothermal undertakings and introduces a total-project concept. It outlines two alternative paths for geothermal energy development in Indonesia, i.e. to generate electricity as well as develop and operate the steam field, with the electricity produced sold to either PLN or other consumers. The PD Nr. 45/1991 is also complemented by PD Nr. 49/1991, which regulates the taxes for geothermal undertaking.

The contractor's relationship with PERTAMINA is governed by a Joint Operating Contract (JOC). The JOC allowed operations for 42 years, including a production period of 30 years. An Energy Sales Contract (ESC), an integral part of the JOC, is an agreement among the contractor and supplier of geothermal steam; PERTAMINA as the seller, and PLN as the purchaser of geothermal energy. Under this agreement, the production period for delivery of geothermal energy from each unit is 30 years from the date of commercial generation for each unit. The term of an ESC is 42 years.

Eleven contracts for development of geothermal power plants were signed in the early 1990 with a total committed capacity of 3,417 MW and original completion dates between 1998 and 2002. As a result of the 1997-1998 financial crisis however, the Government of Indonesia (GOI) suspended nine conventionally powered Independent Power Projects (IPPs) and seven

geothermal projects. Through a process of negotiation, several projects have restructured, some cancelled or postponed, two of which were ended in litigation.

Following the Asian monetary crisis, the very attractive incentive decrees of the mid 1990's were replaced in 2000 with PD Nr. 76/2000. Under PD 76/2000, the GOI proposes to take all or part of the exploration activities. Tax payments, however, will be in accordance with general tax law rates, i.e., 47% instead of 34% under previous PDs. No exploration activities have taken place since the enactment of PD 76/2000.

In 2001 a new oil and gas law was passed (Law Nr 22/2001), which eliminates the PERTAMINA's monopoly and changes its status as a Public Company (Persero). The new oil and gas law also eliminates the geothermal undertaking. Subsequently, in 2003 the GOI issued Law Nr. 27 of 2003 on geothermal, which sets forth the basic context for and the rules governing administration of geothermal energy. The geothermal law regulates the undertaking of geothermal resources, both as mining commodity (including accessory minerals) and as energy resources for direct and indirect use (electricity).

The law also opens up the geothermal development to private participation through competitive tendering, to be conducted by the government authority responsible to issue the geothermal mining area (*Wilayah Kuasa Pertambangan* or WKP). Under the geothermal law, the geothermal business is split into six (6) phases, namely, preliminary study, tendering of new WKP, exploration, feasibility study, exploitation and utilization of resources (for power or others). This differs with the old law, in which the geothermal business is not split into phases, and has been carried out in a single contract between PERTAMINA and Investor (Contractor). Subsequently, under the new law PERTAMINA's monopoly in geothermal resources was revoked and transferred to the MEMR, the authority to develop geothermal resources and working areas, except for those areas that have been developed and are producing.

Also, under the new law, provincial and local governments are given the authority to regulate, supervise and license geothermal energy developments. The geothermal working areas are to be tendered by regional administrations. The essence for the award of business permit over a geothermal working area (*Izin Usaha Penambangan Panasbumi* or IUP) has been based on the lowest electricity price, although it is not specified. The law is expected to open up new opportunities for the development of Indonesia's geothermal energy, but the philosophy and approach have been counterproductive to geothermal development. The development progress has been below the target due to a number of constraints. High capital costs, high exploration risk, and the associated electricity tariff required remain core problems. In addition, the potential conflict of regulation, unresolved decentralization issues, uncertainties in security and contracts, discourage investment in geothermal projects.

CONFLICTING LAWS AND REGULATIONS

In addition to energy resource related laws, the Government has also issued laws and regulations that are not directly related but may give impact to management of energy resources. For instance, following the change of the government, in 1999 Indonesia introduced Law Nr. 22/1999 on Regional Government which was later amended by the Law Nr. 32/2004. The regional autonomy law transfers central government authorities to regional governments in all government matters and administrations, except for security and defense, foreign policy, monetary and fiscal matters, justice and religious affairs. The authority was granted to two levels of regional government – provinces on the one hand, and districts and cities on the other – to make their own policies and local laws. In addition, the regional autonomy policy also regulates the practical relationship between the government and the people. The main objectives are to promote better delivery of government services and to raise accountability of local government.

The law is also supplemented by the Law Nr 25/1999 on Financial Balance between Central and Regional Government. Under the law the regional governments would be given the bulk of revenue generated from their provinces and would be independent from the central government even for local administration and governance. Following the promulgation of these regional autonomy laws, local governments have been given a larger authority, including administering tenders for projects, but they often lack the capacity to do so transparently.

The two regional autonomy laws took Indonesia from being one of the world's most authoritarian and centralized states to one of its most decentralized. While they were also seen as the offspring of the democratization efforts, the laws had far-reaching implications. Despite the promises of decentralized control and the autonomy of the regencies, there was still much uneasiness on how such lofty policies would be carried out by the provincial governments since they were inadequately prepared administratively as well as having a shortage of technical knowledge in understanding complex issues of natural resource development, foreign direct investment (FDI), and joint-venture programs. Programs that had been approved by the central government would now have to be scrutinized by the regional governments as well. Companies have complained that tenders are often worded poorly and amended after the tender is announced. The GOI is now assisting the local governments to promote better tendering practices for the government's related projects.

The other law that has given impact for slow development includes the Law Nr. 41 of 1999 on forestry as amended by Law Nr. 19 of 2004 which classify the types of forests including conservation, protection and production forests. Under the law, the management of production forests is granted through forest concessions to private companies, individuals, co-operatives, communities, or State Own Enterprises (SOEs). The law also contains provisions that regulate the mining activities in the forestry land, in which it is stipulated that the mining activities may only be conducted in production and protected forest by not changing the main function of the forest land. The open mining activities are prohibited in the protected forest land.

Around 60% of Indonesia's geothermal resources lie in conservation forests, which are protected under Indonesian law. The Government has proposed to allow drilling in these conservation forests on the condition that the processing plant is located outside the conservation forest area. Still, developments within these areas require Presidential approval, as in May 2011 the Government of Indonesia (GOI) committed to a two year moratorium on forestry development as part of a US\$1 billion forestry agreement with Norway. It will thus be difficult for Indonesia to balance its voluntary emission reduction targets which rely on reducing deforestation whilst also reaching its geothermal potential that is crucial for the country to avoid an energy crisis.

Moreover, as Indonesia holds the second largest tract of tropical forests on the planet, many forest areas have long been home to indigenous groups which gained their livelihoods from forest farming, hunting, and gathering. Since the late 1960s, these forests and the lands on which they grow have played important roles in the political and economic strategies of the GOI. Under these circumstances, it is not surprising that forests have become the arena for increasing levels of social conflict between the interests of local communities on the one hand, and those of the state, company and others. As a result, many resource extraction activities such as geothermal, mining and oil and gas activities have been suspended, since the areas are located in the protected forests, which often are only known after the permits have been issued.

Another reason for delay in getting the land use permit has also been attributable to conflicting words or terminologies used in the various laws and regulations. For instance, geothermal exploitation is lawfully defined as a 'mining activity' (Law No. 27 2003) and thus it is prohibited to be conducted in protected forest and conservation areas (Law No. 41 1999) despite the fact that geothermal mining activities are not open-pit mining exercises and have a relatively small impact on the environment (compared to other mining activities). This prevented the Ministry of Forestry to issue the permit for geothermal exploration and development in the protected forest areas.

An amendment to the Article 38 of Law Nr. 41/1999 on Forestry, which prohibits an open pit mining in the protect forest areas or deletion of the word "mining" in the Law Nr. 27/2003 on Geothermal or replaces it with "infrastructure project" would be required. While the issue has partly been resolved, nonetheless the inaccurate wording has given detrimental impact to geothermal energy resource development. With approximately 60 percent of Indonesia's geothermal energy is located in such conservation areas, exploitation of the country's geothermal potential is blocked.

In summary, the development plan of geothermal resources in Indonesia has experienced constraints that originated from that many laws and regulations have been formulated based on the interest of each sector, thereby lacking of synchronization. As Romli Atmasasmita said, the strategy used in the development of laws and regulations between 1999 and 2004 has been solely based on the need of each sector and quantity, without any controlling mechanism for the quality. The absence of controlling mechanism has proved that many of the laws and regulations later faced several problems in the implementation. Such situation suggests that the strategy used in law formulation that is based on sector's need should be changed by emphasizing the relevancy between sectors' interest, so the authority conflict between institutions may be prevented.¹

TARIFF ISSUES

Over years, the pricing regime for Indonesia's geothermal projects has suffered from somewhat of a see-saw development. For example, when Indonesia began its geothermal development activities in the 1990's, there were two pricing schemes that commonly used in the Power Purchase Agreement (PPA) or Energy Sales Contract (ESC) between PLN and Independent Power Producer (IPP). The first scheme was that the price consists of only one component, which is based on the kWh dispatched. The price also included escalation indices and "take-or-pay" capacity provision (TOP), in which the buyer have obligation to pay for minimum capacity made available irrespective of the actual amount of dispatched, ranging from 80% to 90%. The TOP will ensure the recovery of operation and maintenance costs, debt servicing obligations in a timely manner and to provide the shareholders with a return on their investment.

The other pricing scheme consisted two or more components namely the capacity charge and energy charge, which were expressed as Dollars per kVA per month and Dollars per kWh, respectively. The capacity charge was capital recovery charge comprising return for equity capital, debt repayment, tax and depreciation, contract capacity and availability factor. The second component was usually pass-through cost components as determined by the quantity and type of fuel, specific heat rate and fuel price, and fixed and variable operating and maintenance charge. Under the scheme, only the energy charge that will be escalated, while the capacity charges will decline after the project is paid out.

As the result of renegotiation following the Asian monetary crisis in late 1997, PLN requested a change in geothermal electricity pricing from a two components to a single pricing concept with limited escalation rather than cascading prices. PLN also capped the base electricity price up to USD 0.05 per kWh between 1999 and 2003. This resulted that the utilization of geothermal potential has proceeded slowly.

In addressing the tariff issue, in 2008 the MEMR introduced a geothermal pricing regime which set a maximum geothermal tariff at different levels, depending on electricity supply production costs in the location of the project within Indonesia, which also are depending on voltage and capacity of the power plant. However, in an attempt to expedite the electricity price negotiation, in 2009 the GOI issued a regulation, setting up the maximum price for geothermal electricity to be USD 9.7 cents per kWh, regardless the geothermal reserves or power plant size. However, such electricity prices scheme of 'one

¹ Atmasasmita, R., *Strategi Pembangunan Hukum Nasional*, <http://www.portalhukum.com/displayarticle19.html>.

size fits all' was found not appropriate to facilitate development, as the Castle Rock Consulting study² showed that the price needs to be flexible, i.e. small geothermal should not be compared to large geothermal. This is due to that the field costs may be segmented by size and exploration status, while competing technologies face high differences in cost according to the location. The geothermal electricity price of USD 9.7 cents per kWh is based on calculation by the Indonesian Geothermal Association for a 110 MW plant to come up with economic threshold of ROR 16-17% with incorporation of exploration, commercial and political risks.

Due to lack responses for the development of small to medium capacity geothermal power plant, particularly in the eastern part of Indonesia, on 23 August 2012, the MEMR issued Regulation Nr. 22/2012, which again reverts back to a geographical based tariff system and the use of feed-in tariff (FIT) arrangements for Indonesian geothermal tariffs, which vary from 10 to 17 USD cents for the high voltage and 11.5 to 18.5 cents for medium voltage connection. The differentiation also includes geographic differentiation in that there are different rates for system on Sumatra, Java and other major islands in Indonesia. The differentiation is made based on the avoidance cost principle, namely the cost of oil-based fuel (diesel) for electricity generation. It is also based on the quality and size of potential resource, where the geothermal fields in Sumatra and Java have been assumed to have high enthalpy resource and larger reserves. While the geothermal resources in East Indonesia are generally low enthalpy resources, as they are associated with non-volcanic environment, thereby lower potential and higher development costs.

In the latest development, the MEMR plans to offer higher prices for geothermal-based electricity. Based on a recommendation from the World Bank, the new proposed geothermal-produced electricity price will range between 11.5 and 29 cents per kWh and will be effective until 2025. This measure is an attempt to attract investments in Indonesia's geothermal power sector, as the previous FIT.

Given fiscal and non-fiscal incentives, such as tax holiday, and allocation of risks, such as government guarantee and government participation in the exploration undertakings, the geothermal electricity price could be reduced to still meet the economic threshold.

OTHER BARRIERS

In addition to tariff, other constraints included a weak tendering process, lack of sufficient and reliable data, inadequate financial support and PPA process including the determination of electricity price. Reasons for the delay included that the PLN is the only buyer of geothermal power thereby its stand for determining electricity tariff is very dominant. On the other side, the PLN's electricity selling tariffs are also regulated by the GOI, who also provided the subsidy but it is not well defined.

Also, the information on the resources at hand that is available at the stage of tendering for geothermal working area is quite limited. The complications and cost of proving the size and quality of a resource mean that accurate assessments of resource potential and hence project design and specific costs cannot be determined until drilling has taken place. As a buyer PLN considers that the price to be a starting point for negotiations and subject to change when more information on the resources is available which will be followed by the reevaluation of the commercial feasibility of the project. Likewise, the developers do not want to base their project investment cost on unwarranted assumptions and thus seek high prices.

Furthermore, one of weaknesses in renewable energy transactions is the requirement to have lowest electricity tariff during the tender. As a result, the bidders might not take a cautious approach to risk, thus tending to substantially lower the offered price of electricity below that which might in the event be actually necessary (as would eventually be established by the exploration activities). This has been a direct consequence of *not* having executed exploration works in advance of Work Area tendering.

At best the available information is a guess on resources characteristics that are based on the observation of surface steam and heat manifestation. The end result is that the party who wins the bid would have difficulties in securing the finance for the project. Of the 33 geothermal projects involving new geothermal work areas under the 2nd 10,000 MW fast-track power plant projects, 12 projects failed their commitment to raise fund of US\$ 20 – 30 million per project to carry out pre-exploration work.

As of today, a total of 58 WKP (Geothermal Mining Area) have been issued, nine of which is in production, 37 areas are in the exploration stage and the remaining 12 areas have no activity. The majority of these WKPs have been granted to the domestic companies. In one hand, this suggests an increasing interest of domestic investor to invest "risk capital", however on the other hand, many has not fulfilled their commitment in the form of work program and investment. Besides having limited fund for start-up many of the national permit holders seemed to have lack of commitment to take risks.

INVESTMENT INCENTIVES

In addition to Feed-in Tariff, the GOI has also provided fiscal incentives to help raising the capital for the geothermal development. These incentive schemes are as follows:

² Castle Rock Consulting (2010), "Geothermal Pricing and Incentive Policy Study", *Phase 1 Workshop, Minister of Energy and Mineral Resources*.

1. Ministry of Finance (MoF) Regulation Nr 21/2010, which provides fiscal incentives on import duty exemption on machinery and capital for development of power plants, exemption from Value Added Tax (VAT) on importation of taxable goods and reduction
2. MOF Regulation Nr 130/211, which provides various facilities income tax on energy development projects, including net income reductions by 5% of the investment value each year over a six-year period, accelerated depreciation and amortization (within 2 – 10 years depending on the type of asset), dividend reduced for foreign investors (allows foreign investor to pay at a rate of only 10% on dividends they receive, and compensation for losses, which is available for more than five years.
3. MoF Regulation Nr 139/2011, which provides guarantees for geothermal and hydro power plant projects as part of First Track Project II for the electricity development. This will guarantee any contractual risks in relation to government actions in order to facilitate the implementation of large infrastructure projects. This is part of public private partnership scheme as described in the Presidential Regulation Nr 78/2010 and MoF Regulation Nr. 260/2010. The scheme is not limited to renewable energy projects.

GEOHERMAL FUND FACILITY

In 2011, the GOI has launched a new way of funding early stage geothermal projects in Indonesia to overcome a series of barriers that have traditionally constrained power sector infrastructure investment in the region. Designed by Ministry of Finance (MOF), in 2011 the GOI has decided to allocate a Revolving Fund of IDR 1,000 billion (equivalent to USD 110 million) in the State Budget dedicated for geothermal development. The establishment of the Revolving Fund (now called Geothermal Fund Facility/GFF) is intended to provide potential developers and investors with sufficient, high quality information of pre-selected green field geothermal sites that will be offered during the tendering process of new areas.³

It is expected that the GFF may make the risk of geothermal venture more measurable thereby it should reduce the expected project's rate of return, which will translate to lower electricity price. GOI would have in a better position to negotiate more favorable terms with prospective developers. The eligible recipients of the facility include local governments who will issue Mining Business License in order to enhancing the preliminary exploration data for the purpose outlining the Mining Work Area (WKP). The Indonesia Investment Agency (Pusat Investasi Pemerintah/PIP) has been appointed as manager of the GFF. The cumulative total amount of fund available in 2011, 2012 and 2013 is IDR 3 trillion, equivalent to USD 325 million. The cost of survey and exploration is only to be paid back if a site is proven to be productive.

In order to meet increasing demand, the initial scope of GFF has been expanded. The GFF will also now be made available for geothermal developers holding the IUP as a loan for exploration (including drilling wells) of geothermal resources. The GFF will provide up to USD 30 million to surface studies and exploration drilling of geothermal prospects.

NEW GEOHERMAL LAW

As part of efforts to remove the regulatory barrier, the GOI in late 2013 has submitted to the Parliament a draft of new geothermal law. The new law had been expected to pass in April 2014, which would have removed the association between geothermal and mining activities making development of geothermal resources easier. The revisions, however, maintains the authority for tendering process, issuance of IUP and other permits to the regional government and stipulates that IUP Holders should offer the Local Government for 10% Participating Interest in the geothermal undertaking. The new geothermal law will also call for state owned companies to develop geothermal sites currently unattractive to investors, and the new permit will be issued by the Central Government. The GOI expects that given a new geothermal law, the geothermal energy is projected to contribute 12 percent to Indonesia's energy mix by 2025, which will require considerable investments.

In responding to the proposed new law, the Indonesian Geothermal Association (API/INAGA) has submitted comments in the parliamentary hearing on the draft and recommended some key revisions to the draft law, in order to make the law workable and effective in meeting its objectives. Some of the revisions include the following:

- The geothermal right shall be vested at the Central Government to conform to the spirit of the Constitution. Accordingly, the geothermal Working Area or WKP tendering process and issuance of business license shall be carried out by the Central Government
- Simplification of processing permits to cut the bureaucracy
- Geothermal electricity price to be determined by the Government based on its economic value
- Regional income from geothermal business to be obtained from production bonus instead of 10% participating interest.

CONCLUSIONS

While Indonesia still presents one of the world most attractive geothermal regions and many investment incentives have been created to attract the investment, but the development has been slow. The GOI must develop new approaches to maximize its potential by eliminating the hurdles to its development. The GOI has made a breakthrough in the development of geothermal energy such as with the FIT regulation, fiscal incentives and establishment of GFF to support the initial exploration. However, inconsistencies in the law and regulation have forestalled the development of geothermal energy

³ Wahjosoedibjo, A., and Hasan, M., *Geothermal Fund for Hastening the Development of Indonesia's Geothermal Resources*, Proceedings, Thirty-Seventh Workshop on Geothermal Reservoir Engineering Stanford University, Stanford, California, 2012

infrastructure. Designing a policy structure with short-term availability and uncertainty adds to the overall risk of a project and will create a barrier entry for many developers and potential capital providers.

As natural resource extraction and production projects can cost many billions of dollars and take up to a decade to produce returns, Indonesia will remain dependent on foreign investments in order to promote growth in the related sectors and to be able to integrate into the global economy. Uncertainty created by the changing of laws may be problematic for long-term foreign investment.

Last but not least, Indonesia's geothermal industry needs a legal certainty. Investors require confidence that regulatory structures protect their investment. They want legal and business certainty, beginning with an immediate review of existing laws and regulations related to energy and natural resources to bring them into conformity with new requirements of regional autonomy and fiscal decentralization.

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