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GEOTHERMAL FUND FOR HASTENING THE DEVELOPMENT OF INDONESIA'S GEOTHERMAL RESOURCES

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ABSTRACT

Indonesia is blessed with substantial deposit of natural riches; one of these is geothermal resources. The majority of geothermal capacity came on line during the 1990s but some of the projects have to be suspended or terminated, due to the 1997 Asian monetary crisis. The government has attempted to resuscitate the deferred programs but with little progress. To hasten the exploration and development of their geothermal resources, Indonesia needs to provide an environment that will attract investments, and one of these options is the participation of Government of Indonesia in the initial exploratory survey, in order to address the geothermal resource development risks. The decision to participate in the initial exploration by making available a Revolving Fund (later called Geothermal Fund) in the 2011 State Budget is intended to provide potential developers and investors with sufficient and credible information on green field geothermal sites that will be offered during the tendering process of new areas. The costs of conducting the survey and initial exploration would be recovered in the various forms, including data compensation to be paid by the participants in the tender process and reimbursement of the drilling costs by the winner.

It is expected that the Geothermal Fund may make the risk of geothermal venture more measurable thereby it should reduce the expected project IRR, which will translate to lower electricity price. The fund will support achievement of Indonesia's geothermal target of 12,500 MW by 2025 by discovering new sites and reducing the risk of investment in those sites, and allow the Indonesian Government to negotiate more favorable terms with prospective developers by improving public knowledge on the value of the resource. Some International Financial Institutions have indicated interest in contributing to the Geothermal Fund utilizing green fund, climate change fund and other funds available for the development of renewable energy and reduction of CO_2 emission in developing countries. This may entail development of a multi-tranche geothermal fund management that complies with Indonesian regulations as well as international best practice. This paper will discuss the program, its expected benefit and implementation including the screening process for the prospects that would receive the fund.

INTRODUCTION

Two of the issues facing Indonesia in its economic development today are an acute electricity shortage and global warming and climate change. Growing concerns about climate change and awareness about environmental problems lead to the implementation of actions favorable to the new and renewable energies (long-lasting energies) for reduction of the greenhouse effect gas in particular.

For Indonesia, one of energy resources that are well suited to climate change mitigation is the increase geothermal development. Indonesia has already harnessed some of the geothermal energy in power plants. The majority of geothermal capacity came on line during the 1990s when increasing electricity demand in 1980 and tax incentives worked together to create a wave of geothermal development that lasted until the late 1990s, when some of the projects have to be suspended or terminated, due to the 1997 Asian monetary crisis. The government has attempted to resuscitate the deferred programs but with little progress.

To hasten the exploration and development of their geothermal resources, the Government of Indonesia (GOI) has decided to allocate a Revolving Fund of IDR 1,236.5 billion (equivalent to USD 145 million) in the 2011 State Budget dedicated for geothermal development. The establishment of the Revolving Fund (now called Geothermal Fund) is intended to provide potential developers and investors with sufficient, high quality information (temperature and chemical characteristics, and potential reserves) of pre-selected green field geothermal sites. The following paper will discuss the program – the background of the program and its objective and goal.

PROGRAM BACKGROUND

Indonesia's geothermal development is governed by two separate regulatory frameworks. The first is the Presidential Decree (PD) Nr. 45 of 1991 that was based on Law Nr. 44 of 1960 on Oil and Gas. In early 2001 the Law Nr. 44/1960 was replaced by Law Nr. 22 of 2001, which was followed by Law Nr. 27 of 2003 on Geothermal. The new law on geothermal provides a basis of new geothermal development undertaking.

The new geothermal law opened geothermal development up to private participation through competitive tendering conducted by the government authority responsible to issue the geothermal mining work area (*Wilayah Kuasa Pertambangan* Panas Bumi or WKP). Under the new law, provincial and local governments are given the authority to regulate, supervise and license geothermal energy developments. Under this provision, the geothermal mining work areas are to be tendered by regional administrations. The basis for the award has been based on the lowest electricity price, although it is not specified.

Under the new Law Nr. 27/2003, the geothermal business is split into six (6) phases, namely preliminary survey, 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 pursuant to the Law Nr. 44/1960 and PD Nr. 45/1991 was revoked. Following the introduction of this new policy PERTAMINA transferred to the Minister of Energy and Mineral Resources, through the Director General of Geology and Mineral Resources DGGMR), all governmental functions and returned the authority to develop geothermal resources and mining work areas, except for those areas that have been developed and are producing or specifically awarded by the Government to Pertamina to further explore and develop.

In the implementation, the geothermal activities based on the new law have been challenged by several constraints. These include a weak tendering process, lack of sufficient and reliable data, inadequate financial support and Power Purchase Agreement (PPA) process including the determination of electricity price. As a result, since the law was passed in 2003, there has been very little license of geothermal working area has been issued or in operation.

There are a number of reasons for the delay. Firstly, the State Electricity Company, PLN is the only buyer of geothermal power, and 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. The GOI provides a subsidy, but how the rate and the subsidy will directly affect the making of PPA between PLN and geothermal exploration companies is not well defined.

Secondly, PLN as a sole buyer of electricity is not represented in the tender committee for new geothermal areas, in order to prevent conflict of interest as PLN's subsidiary will also participate in the tender process. Also, the information on the resources at hand that is available at the stage of tendering for geothermal working area is quite limited. At best the available information is a guess on resources characteristics that are based on the observation of surface steam and heat manifestation. Under such condition, the commercial feasibility of the project may change as more information on the resources such as potential reserves and rock and fluid properties becomes available upon the completion of exploration works.

As a buyer PLN does not want to offer high prices before they know the characteristics of the resource. PLN considers that the price to be a starting point for negotiations and can be changed 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 assumptions and thus seek high prices. Therefore, such situation involves a risk for both the buyer (PLN) and developers.

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. Should the developer want a higher price, the regulation leaves room for negotiation with PLN subject to approval by the Minister of Energy and Mineral Resources (MEMR).

However, such electricity prices scheme of 'one size fits all' was found not appropriate to facilitate development. As shown in the Castlerock Consulting's study, the field costs may be segmented by size and exploration status, while competing technologies face high differences in cost according to the location. In another word, the price needs to be flexible, i.e. small geothermal should not be compared to large geothermal. More flexible pricing mechanisms have been applied in hydro-power project, where differentiation is made between macro, medium and large project.

Given such situation, in mid 2010, the GOI decided to propose to the Parliament to allocating a sizeable fund in the 2011 State Budget for financing the initial geothermal exploration activities. The initial exploration includes geological, geophysical and geochemistry surveys and drilling initial exploration

well(s). If properly managed, the fund could be made sustainable for future project development. The purpose of the fund is to enhance the existing geological data in a pre-selected area, to improve the definition of the WKP before being offered for tendering.

The enhanced data should make the geothermal risk more defined and manageable when the WKP is offered for tender, which could result in obtaining better and affordable electricity price. The fund will be made available to geothermal projects using the Public Private Partnership (PPP) scheme. The costs of conducting the survey and initial exploration would be recovered in the various forms, including data compensation to be paid by the participants in the tender process and reimbursement of the drilling costs by the winner.

The funds expended for the field data acquisition is expected to be incrementally offset with the proceeds from the sale of data acquired, so the fund to be at least self-sustaining. The Fund shall be made available to support the GOI's program on Public Private Partnership as stated in the Presidential Regulation Number 13 of 2010. In later development, the fund is now called Geothermal Fund, as the GOI also recognizes the possibility of having dry hole, so only part of the fund will be paid back.

EFFECT TO ELECTRICITY PRICE

The geothermal development project involves additional risks and uncertainties compared to the other power projects such as coal or gas fired. These additional risks and uncertainties are translated to the selling price of the electricity through additional risks premium. In its study for the Ministry of Finance, JICA has developed a formula showing the relationship between the project IRR and electricity tariff.

Figure 1 shows the impact of reduction in IRR to the electricity price (see also Appendix for formula used in calculation of electricity price).

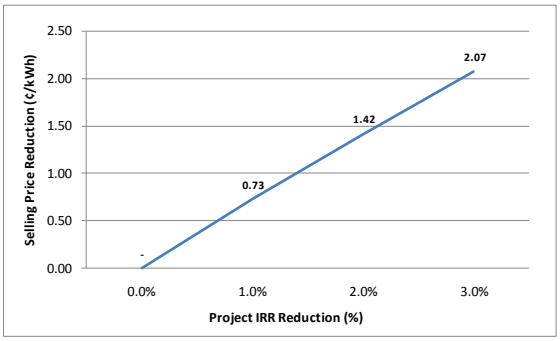

Figure 1
Impact of Project IRR Reduction to Selling Price Reduction

Based on this curve, we calculated that reduction by 2% to 3% in the expected project IRR will reduce the electricity price by about 1.42 to 2.07 ¢/kWh. Note that the curve has been developed using the formula as developed by West Japan Engineering Consultant (WJEC) adapted to Indonesia.

GEOTHERMAL FUND FRAMEWORK

The initial intent of Geothermal Fund is to fund the initial exploration work before WKP tender process. This is to complement the data produced by Indonesia's Geological Agency (IGA), thereby it would assist the potential investor in evaluation of the geothermal prospect being offered.

The preliminary surveys by IGA are funded by the State Budget and were designed to make the inventory of Indonesia's geothermal resources. The IGA's surveys were conducted based on specifications as outline in the Indonesian National Standard (SNI) Nr. 13/5012/1998 and Minister of Energy and Mineral Resources' (MEMR) Regulation Nr. 11 Year 2008. As of to date, the IGA has identified 265 geothermal prospects throughout Indonesia. These included 104 preliminary surveys to define the WKP to be tendered. A preliminary survey has usually been initiated based on the observation of surface steam and heat manifestation. IGA has also prepared a long-term plan to conduct preliminary surveys through the year 2025.

Accordingly, the Geothermal Fund should be used to:

1) Enhance data and information obtained during the preliminary surveys that have been conducted by IGA, including Magnetic Telluric (MT) survey and other geological and geophysical surveys to better locate the site of first deep well(s).

2) Drill the first deep well(s). Depending on the size of the areas, the number of wells will vary, subjects to the size and complexity of the area. The purpose is to defining better geological information, including but not limited to pressure and temperature gradient, fluid chemistry, steam quality, reservoir permeability, and exploratory proven reserves. The information and data obtained are used to improve the definition of the WKP and will be made available during the tendering process.

It is noted that during the discussion in Parliament the prime target of the Geothermal Fund is the geothermal resource in the eastern part of Indonesia, which are not associated with volcanic activity and have low temperature and low potential. Furthermore, the electricity demand is low; and in some areas it is even less than 5 MW. For this reason and because of limited data, they have failed to attract developer's interest when they were offered for WKP. By limiting the utilization of Fund to the low enthalpy resources would make the Geothermal Fund

at high risk, with respect to its sustainability. Accordingly, to ensure the Fund's sustainability consideration have been given to include some high enthalpy resources prospects in Java and Sumatra, where the electricity demand is high.

Furthermore, based on the Finance Minister Decree Number 99 of 2008, the Fund shall be managed by a special agency which adopts the financial management in the form of a Public Service Agency known as *Badan Layanan Umum* (BLU). The implementation of the Geothermal Fund will be subject to the Principles of Fiscal Risk Management of State Fund, namely to be result oriented with full accountability and transparency. For this purpose, the GOI has decided the BLU for managing Geothermal Fund for geothermal exploration will be the existing BLU within the Ministry of Finance who is responsible in the field of infrastructure development, namely *Pusat Investasi Pemerintah* (PIP) or the Indonesia Investment Agency.

Figure 2 illustrates the flow of Geothermal Fund and product.

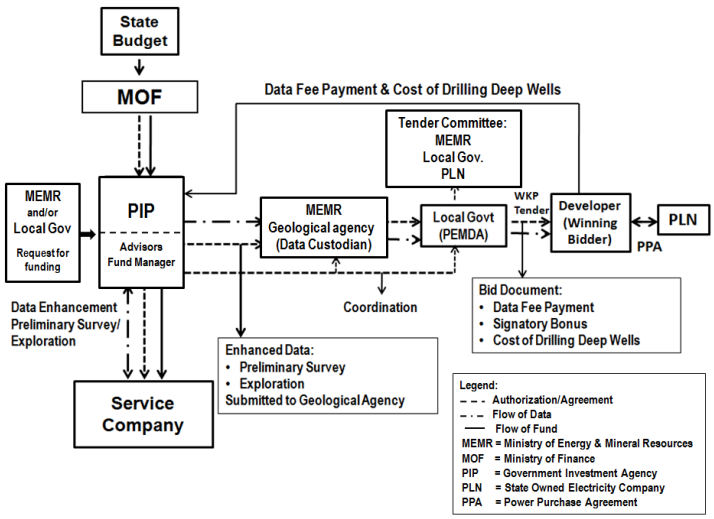

Figure 2
Diagram Showing Flow of Fund and Exploration Data

As one can see from Figure 2, the flow of the fund and product (data) are as follows:

1) The Ministry of Energy and Mineral Resources (MEMR) and/or the Regional Government will submit proposal to PIP which WKP that will be financed by Geothermal Fund (GF).
2) PIP will conduct rigorous screening of WKPs which require GF to help mitigate their respective resource development risk and attract private sector participation in WKP tender..
3) PIP will assign a Service Company to conduct initial geothermal exploration activities including drilling exploration well(s).
4) Service Company will submit the exploration data to PIP.
5) PIP will hand over the data to the MEMR (data custodian) to be used in redefining the WKP and the Local Government and Geothermal Tender Committee will also make the data available to the bidders.
6) Tender Committee will evaluate the tender results for particular WKP and determine the winner together with the agreement.
7) In exchange for the exploration data, the prospective bidder will pay data compensation to the tender committee (MEMR/Local Governments), who will pass it to the PIP. The costs of drilling deep well(s) will be passed to the winner.

GEOTHERMAL PROSPECTS SELECTION

Surveys conducted by the Indonesia's Geological Agency has identified 265 geothermal locations in Indonesia that distributed along a volcanic belt extending from Sumatera, Java, Nusa Tenggara, and Sulawesi until Maluku. Of the 265 locations, only about 30 % has been surveyed in detail, while the remaining (particularly in remote areas) the surveys have been limited to reconnaissance or preliminary. About 80 percent geothermal fields and prospects are associated with active volcano, such as in Sumatra, Java, Bali and Nusa Tenggara, Maluku and North Sulawesi. The non associated volcano geothermal resources are located in Sulawesi (43 locations), Bangka Belitung (3 locations), Kalimantan (3 locations) and Papua (2 locations).

As the Geothermal Fund is limited, the effective use of the fund becomes very important to assure that the objectives can be met. Its utilization shall meet some criteria, including that the Fund would only be used

for pre-selected sites currently facing investment constraints and other barriers for its development to alleviate the constraints and barriers. The Fund shall not be applied in prospect sites which have attracted or could attract developers to participate in the WKP tender process without preliminary survey data enhancenement, or for which the Preliminary Survey has not been conducted.

Furthermore, the goal of Geothermal Fund is to optimize the Indonesia geothermal development, by means of:

1) Targeting the fund to the geothermal prospects that can provide considerable acceleration of the prospect development and overall incremental economics benefit.
2) Screening out the prospects that can be developed with its own current merit in which the revolving fund will not have considerable impact.
3) Screening out the prospects that have minimum chance to be developed even with the assistance of the revolving fund.

Given such goal, the Geothermal Fund deployment process therefore should begin with initial prospect screening, which is aimed at identification of the prospects that meet the criteria to obtain the government fund for the first deep drilling activities. This will be followed by the geophysical and geophysical surveys and deep drilling activities. The objective of the two last stages is to enhance and obtain additional resource information in order to reduce its uncertainty and improve the chance of success of the exploratory drilling activities.

Each stage consists of several analysis steps to assess the prospects. The first analysis is identification of realistic and credible geothermal resources (the uncertainty and risk). These geothermal resources are to exclude those resources that are already in operation or under development and have been tendered or under tendering process. Geothermal resources shall be realistic and credible that provide resource capacity, data quality and area electricity demand. These geothermal resources data are to include estimated capacity, quality of data to support the estimated capacity (Reconnaissance, Preliminary Survey, Detailed Survey, Wildcat Exploration Drilling, Extended Exploration Drilling), and electricity demand forecast of the area divided into: i) Large integrated system (higher than 500 MW); ii) Small integrated system (between 50 MW and 500 MW); iii) isolated system (between 5 MW and 50 MW); and iv) small island (less than 5 MW).

The next analysis are to indentify realistic and credible barriers that would prevent the development of the proposed geothermal resource project activity from being carried out if the project activity did not obtain government assistance. Such realistic and credible barriers may include lack of available data and technological barriers, such as: (i) services, skilled and/or properly trained labor to carry out the development is not available in the relevant region, (ii) lack of infrastructure for implementation and logistics for development of the prospect, and (iii) risk of technological failure. In addition, other barriers that are specific to the region and/or prospect should also be observed. The analysis also includes a simple cost analysis or investment comparison analysis using financial indicator such as such as IRR, NPV, cost benefit ratio, or unit cost of service (e.g. levelized cost of electricity production).

The analysis will be concluded with Common Practice Analysis, which include determination as to whether the prospect is under development program of other agency and whether the government assistance to the proposed geothermal resource project activity will not relieve the barrier and/or financially or economically unattractiveness under current condition. Such realistic and credible analysis may include, among others lack of power demand, high cost of technology and criticality to the region energy development. The schematic diagram of screening analysis is shown in the Appendix.

GEOTHERMAL FUND RISK MITIGATION

Geothermal Fund could be exposed to risk, because technical risks or lost in holes risks or the winning bidder fails to execute development of WKP, attributable to failure to have financial closure for the geothermal project and error of data that the developer receives. The technical risks may be covered by conventional risks insurance, while failure to have financial closure and data errors can be mitigated by Performance Bond and securitized by Professional Indemnity Insurance. The conventional risks insurance is required to conform to industry's best practices.

The exposure of PIP (who has been appointed to manage the fund) to the Fund risk can be securitized by certain provisions that will relieve the Fund Manager from losses. Since the Fund will be applied to a risk loan or business undertaking, there should be provision for loss allowance, which could be limited to say no more than 10% per WKP or as may be agreed by the Government. This would require development of criteria for prospects selection. GOI appointment to PIP to manage Geothermal Fund should include clear direction against fund depletion and PIP accountability to justify the loss in its risky loan or business undertaking.

POTENTIAL FOR EXPANDING THE FUND

Initially, the Geothermal Fund will receive money from the State Budget for five geothermal prospects each year over a period of five years beginning 2011. Aside from the seed money from the State Budget, financing the Geothermal Fund can be expanded by co-financing from other International Financing

Institutes, multilaterals and bilateral, so the program could finance more than five potential prospects per year. Asian Development Bank has showed its interest to participate in the program. Given additional funding, the data enhancement program for each prospect may be expanded to include drilling more than three deep wells in each prospect to better define the reserves potential of some of the geothermal prospects.

The success or failure of the program will be measured by the growth of a competitive market for developing and financing geothermal projects. The Geothermal Fund facility on the other hand, should be able to operate continuously as long as geothermal projects are being prepared and implemented. An extended Geothermal Fund program becomes important to assist the GOI in achieving its target as outlined in the new and renewable energy development blueprint. Known as vision 25-25, the GOI has targeted that by the year 2025 the new and renewable energy contribution shall reach 25% of the total energy mix. This reflects that by 2025 the installed capacity of the geothermal power plant shall be increased from the current 1,189 MW to 12,400 MW.

The total geothermal prospects that need initial exploration activities to enable Indonesia meeting its target of 12,400 MW by 2025 are estimated to be 109 with the total cost of USD 2,725 million USD. The estimate also assumes the costs of USD 25 million for each site to deliver 110 MW and a success rate of 60%. The total Top Up for Geothermal Fund needed during the period is estimated at of USD 1,643 million.

Note that in order to meet its target of 12,400 MW geothermal power plant capacities by 2025, the GOI has to expand the program beyond five prospects annually, either through own fund or inviting participation of International Financial Institution. The latter would require regulatory changes to allow and enable management and operation of the Geothermal Fund to conform to internationally acceptable best practices.

CONCLUDING REMARKS

GOI's participation in the preliminary exploration for geothermal by making available the Geothermal Fund would assist in reducing the expected risk and eliminating the financial barrier to geothermal exploration venture. Reducing the expected risk by 2 - 3% would result in reduction of electricity price of 1.42 - 2.07 ¢$/kWh, thereby the improving the GOI's negotiating leverage for the electricity tariff. The fund would support achievement of Indonesia's geothermal target of 12,400 MW by 2025 by reducing the risk of investment in those sites. This will later allow the GOI to get a more competitive tariff on better terms with prospective developers, thus improving expected electricity price negotiation outcomes.

Good management of fund will be the key driver to its sustainability and ability to deliver the benefits. This will require utmost disciplines, supported by a Standard Operating Procedure (SOP) and implementation of the Principles of Fiscal Risk Management of fund in the prospect's selection. The SOP includes among others criteria in selecting the prospects to be financed and close monitoring and supervision with full accountability and transparency.

The success of the program will be dependent on the screening process to be applied in selecting the prospects that would receive Geothermal Fund. The process consists of three stages of activities, namely initial prospect screening, pre-drilling exploration activities, and exploratory drilling activities. Each stage consists of assessments of the prospects in relation to their risk and uncertainty, investment constraints and other barriers.

Geothermal Fund could be exposed to risk, because technical risks or lost-in-hole risks or the winning bidder fails to execute development of WKP due to failure to have financial closure for the geothermal project and error of data that the developer receives. The technical risks may be covered by conventional risks insurance, while failure to have financial closure and data errors can be mitigated by Performance Bond and securitized by Professional Indemnity Insurance. The conventional risks insurance is required to conform to industry's best practices.

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APPENDIX

Computation of Electricity Tariff

1. Increase the Capital Costs for Equity.

   The Capital Costs for Equity is calculated using the CAPM (Capital Asset Price Model) theory, as follows:

$$r_e = r_f + \beta \times (r_m + r_f)$$

   Where: r_f : Risk-free business IRR
   r_m : Average IRR in the market
   β : Coefficient β of investor

   Using r_f = 5% (the 10-year maturity US Treasury Bond), r_m = 10% (Average Rate of Return in the market assumption) and $\beta = 2$ and also additional country risk of 2%, the Capital Costs for Equity of geothermal project is 17%. This Capital Costs for Equity is higher than coal fired IPP project, which is calculated using $\beta = 1$ resulted in r_e = 12%.

2. Additional Resource Development Risk Margin.

   This is the technical risks of a geothermal IPP project, involving the risks and uncertainties of well depth, steam production, steam/water ratio and construction cost. Using Monte Carlo simulation, the study calculated the Resource Development Risk Margin (RM_r) for geothermal development project is equal to 3% as compared to none in other IPP project (coal fired and gas fired).

   The additional risks premium resulted in the required Project IRR for IPP's geothermal and coal project is as follows:

   Pr IRR (Geo)= WACC + RM_c + RM_r = 11.10% + 3% + 3% = 17.10%

   Pr IRR (Coal)= WACC + RM_c + RM_f = 8.15% + 3% + 0% = 11.15%

   Where:
   Pr IRR : Project IRR
   WACC : Weighted Ave. Capital Cost
   RM_c : Commercial Risk Margin
   RM_r : Resource Development Risk Margin

$$WACC = r_d \times \left(\frac{D}{E+D}\right) + r_e \times \left(\frac{E}{E+D}\right)$$

   Where:
   r_d : Capital Cost for Loan (interest = 6.5%)
   r_e : Capital Cost for Equity (Geo = 17%; Coal = 12%)
   D : Loan amount (70%)
   E : Equity amount (30%)

Screening Process