PROJECT INFORMATION DOCUMENT (PID)

CONCEPT STAGE

Report No.: PIDC21537

Project Name	Indonesia: Geothermal Energy Upstream Development Project (P155047)
Region	EAST ASIA AND PACIFIC
Country	Indonesia
Sector(s)	Other Renewable Energy (100%)
Theme(s)	Infrastructure services for private sector development (40%), Climate change (30%), Other environment and natural resources management (30%)
Project ID	P155047
Borrower(s)	Republic of Indonesia
Implementing Agency	Ministry of Finance / PT SMI
Environmental Category	A-Full Assessment
Date PID Prepared/Updated	20-January-2015
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I. Introduction and Context

A. Country Context

1. Over the past decade Indonesia has seen strong growth and job creation. Following the recovery from the Asian financial crisis, annual growth averaged 5.6 percent over 2001-2012. Such growth was largely sustained by the external tailwinds of commodity prices and demand, and global financing conditions.

2. However, the commodities downturn has reduced potential Gross Domestic Product (GDP) growth and exposed structural challenges for Indonesia's economy. Sound macroeconomic management has helped to mitigate the impacts of a major trade shock and a bout of external financing pressure in mid-2013. Fiscal management has been prudent, but weak revenue performance has emerged as a major fiscal challenge.

3. Much-needed increases in development spending, notably infrastructure - though below budgeted levels - remain in prospect. The Government of Indonesia (GoI) will need to respond to lower-than-budgeted revenue growth, partly stemming from the negative impact of lower

global oil and gas prices on the Indonesian economy. Within this context, sustained capital spending will be critical to unlocking Indonesia's development potential in the years to come.

B. Sectoral and Institutional Context

4. Indonesia's rapid economic growth has been fueled by an ever-expanding power sector. Sustained increases in electricity consumption (with average annual demand growth of 7.8% during 2009-2013) are linked with economic growth, urbanization and subsidized electricity tariffs. Installed generation capacity was 50.9 GW as of end-2014, excluding captive generation. Nearly 78% of installed capacity is in Java and the remaining capacity is unconnected grids in major islands, and hundreds of isolated mini-grids in rural, remote areas on Java-Bali and outer islands. PT Perusahaan Listrik Negara (PLN), the national power company, supplies consumers through its own generation and purchases from private Independent Power Producers and Public Private Partnership generation (PPP).

5. Keeping up with high electricity demand is a key development challenge. After a period of surplus in power generation caused by the impact of the Asian financial crisis, electricity supply experienced shortages as PLN faced difficulties in mobilizing sufficient power generation investments to catch up with demand growth. Private sector investment came to a halt under the combined effect of capital flight from emerging markets, and the institutional turmoil that followed the repeal of the 2002 Electricity Law by the Constitutional Court in Indonesia. Supply barely managed to keep up with increasing demand; brownouts and load shedding impacted economic growth and affected even ordinary consumers.

6. GoI's electrification plans may add to the level of power system stress and required investment. Over the past decade, GoI has made great strides with the national electrification program. In 2008, data from the National Energy Council (NEC) show that the country's electrification rate was about two-thirds of the overall population. As of 2013, about 80% of the country's population was electrified. GoI now eyes a 90% electrification rate by 2020 as part of its overall vision and social mission for the country's energy sector. Stark differences in the provincial electrification program exist, with the Eastern provinces exhibiting some of the country's lowest electricity access rates and highest poverty rates – and highest diesel-based generation levels.

7. In an effort to reconcile the national electrification and economic development plans, GoI has put forward the Electricity Supply Business Plan or Rencana Usaha Penyediaan Tenaga Listrik (RUPTL), 2015-2024. The Plan foresees to bring on-line over 70 GW of newly installed capacity during 2015-2024, 80% (or about 57 GW) of which has already been allocated to specific generation options. Of this allocated amount, roughly 80% (or about 45 GW) is expected to be fossil fuel-based (coal at 55% and gas at 24%), while hydro- and geothermal-power are expected to receive the lion's share of investments in clean energy (at about 13% and 8%, respectively).

8. Geothermal development is a pillar of the country's Low Carbon Growth Strategy and a key development priority for GoI[1]. The Ministry of Energy and Mineral Resources (MEMR)'s

[1] The relevant national policies include: (i) Indonesia's Second National Climate Change Communication (2009); (ii) the Indonesia Green Paper (2009); (iii) the GOI National Energy Policy (2005); (iv) the Energy Blueprint 2005 – 2025; (v) Indonesia's National Long-Term Development Plan 2005-2025, and National Medium-Term Development Program for 2010 – 2014 (Rencana Pembangunan Jangka Menengah, or RPJM); (vii) the National Action Plan for Climate Change (2007); (viii) the Development Planning Response to Climate Change (2008); (ix) the Climate Change Roadmap for the National Medium-Term Development

"Roadmap for Accelerated Development of New and Renewable Energy 2015-2025"[2] sees geothermal contributing 7 percentage points of GoI's renewable energy (RE) target of 23% by 2025 – today's overall RE installed capacity stands at 6%. Geothermal power is expected to contribute to the country's Greenhouse Gas (GHG) emission reduction efforts, which target a 29% cut by 2030 compared with a Business-As-Usual (BAU) emissions projection that starts in 2010[3].

9. Geothermal power is one of the best options to provide a baseload response to fast-growing energy demand and diversify the energy mix in Indonesia. It is a baseload generation technology not subject to the intermittency and variability associated with most renewable electricity sources. Indonesia's geothermal power potential is estimated at around 27 GW, roughly 40% of the world's known reserves. Many of the geothermal resources in Indonesia are also ideally located on islands with major population centers where electricity demand is high and continues to grow, though there are also resources in more remote locations such as Eastern Indonesia offering an opportunity for poverty alleviation through rural electrification, and/or displacing expensive diesel–fueled generation. Furthermore, as an indigenous and non-tradable energy source, it will also enhance the country's energy security and largely serve as a natural hedge against the volatility of fossil-fuel prices.

10. Despite the geothermal potential and the focus of GoI and development partners, only about 5% of the total resources indigenous to Indonesia are currently developed to produce power. Against a potential of approximately 27 GW, only about 1.3 GW of geothermal capacity has been developed. Most of the current installed Megawatts came on-line before the 2000s from the geothermal fields of Kamojang (1983), Darajat (1994), Gunung Salak (1994) and Wayang Windu (1999), which provide over 1 GW of aggregate capacity. Only a handful of existing geothermal operations expanded production over the past decade (so-called brownfields). In terms of new (greenfield) developments that carry greater risks only one private sector project, Sarulla (320 MW), has achieved financial closure in the last decade. Other recent greenfield developments have all relied on State Owned Enterprises (SOEs) – they include Ulubelu 1&2 (110 MW – PGE drilled steam field and PLN established power plant) as well as the following projects being progressed by PGE alone: Ulubelu 3&4 (110 MW – with power plant to be financed by loan from World Bank and CTF), Lahendong 5&6/Tompaso (40 MW – with power plant to be financed by loan from World Bank and CTF), Lumut Balai (110 MW), Hulu Lais (55 MW) and Kerinci (55 MW). Karaha (30 MW) currently being progressed by PGE is effectively a brownfield development as the field was explored by private developers initially.

11. Low levels of private sector participation have contributed to slower-than-desired geothermal development. This reflects high resource risk, a key barrier to geothermal development which remains unaddressed in Indonesia. Resource risk is exacerbated by exploration drilling costs, which can be up to US$8 million per well plus supporting infrastructure. This can be prohibitive for project developers who are not guaranteed downstream returns on their pre-production investments. Exploratory drilling also constitutes the biggest barrier to obtaining financing as its high associated risks increase investors' equity

Program for 2010 – 2014 (2009); (x) Indonesia's Technology Needs Assessment on Climate Change Mitigation (2009); and (xi) other relevant sector development policies and programs.

[2] The roadmap is dated May 2015

[3] Indonesia's Intended Nationally Determined Contribution, 2015

return requirements. Moreover, there is little appetite from the private sector to fund projects where the nature and extent of the resource are unknown.

12. GoI has designed interventions specifically to address resource risk and mobilize private capital. First and foremost, it has taken important steps to resolve institutional, regulatory and tariff constraints. In June 2014, the geothermal tariffs were revised for a second time[4], providing some relief to developers willing to take on exploration and development risks – yet leaving issues of tariff adjustment unaddressed. In August 2014, a new Geothermal Law was issued. The Law allows centralizing geothermal concession tenders while securing the interest of local government in geothermal development through a production bonus – a benefit sharing mechanism – levied on top of any applicable taxes. Another important reform is the declassification of geothermal activities as "mining activities" that allows greater latitude for geothermal development in previously off-limits areas.

13. In 2015, GoI demonstrated continued emphasis on geothermal development. To address the issues of tariff adjustment which have in the past stalled private participation, GoI started exploring options for adopting a new Feed-in-Tariff (FiT) regime. Based on a formula that factors in site-specific conditions for a given geothermal field (e.g. temperature, pressure, permeability, etc.), the new FiT system would be a two-step approach with the plant capacity and power tariff to be finally fixed following exploratory drilling thereby reducing risk for developers. GoI expects the planned FiT system to play an enabling role for geothermal developments in the advanced markets of Java and Sumatra among those developers (IPB or Ijin Panas Bumi holders) willing to take on exploration and development risks.

14. GoI is cognizant that a FiT system may not be sufficient to mobilize private investment in geothermal power development where private sector interest is low due to inherent site-specific conditions (e.g. the geothermal fields of Eastern Indonesia). Moreover, it is yet to be seen whether formula-based FiTs will be sufficient to compensate for resource risk at the speed desired by GoI. GoI has disclosed plans to transfer funds (about IDR 3.1 trillion or US$220 million) from the Geothermal Fund Facility (GFF) to PT Sarana Multi Infrastruktur (PT SMI) to for mitigation of geothermal exploratory drilling risks, particularly in areas where development prospects are not attractive for pure private sector plays. The original design of the GFF was based on collateral-backed loans and failed to adequately address the high exploration risk issues since the GFF loans were to be paid back in full even in the case of unsuccessful drilling.

15. De-risking geothermal projects by using government funds for exploration has been key to attracting risk capital and mobilizing private sector expertise towards geothermal drilling. Advanced development of the local geothermal markets in geothermal resource-rich countries such as USA, Japan, and New Zealand is largely attributable to cost-shared or dedicated government exploratory drilling programs that increase the investment appeal for investors and developers. Government-sponsored drilling is currently the focus of much of the global push for geothermal development and cost-shared drilling models are being pursued in the developing geothermal markets such as Turkey, Armenia (supported by World Bank) and Mexico (supported by Inter-American Development Bank).

16. To develop geothermal resources in Eastern Indonesia, which is distant from the big power markets and with less accessible geothermal resources, the risks involved in resource

[4] The first geothermal tariff was a ceiling tariff in 2009, which was revised to be feed-in tariff in 2012. In 2014, it was revised the second time to a ceiling tariff.

development are often not commensurable with the potential gains – despite the fact that the avoided costs are far higher in island grids with oil-fired generation than in the large grids where geothermal energy is replacing coal-fired baseload. Therefore, it is in practice impossible to attract private developers for IPB license auctions for the Eastern Islands. Based on international experience, the only way to get these important resources under development is government-sponsored drilling. However, PT SMI lacks the geothermal expertise needed to implement a pre-license drilling window and the funds in the GFF are limited. Limited capacity and limited funds are thus constraining the development of government-sponsored drilling within PT SMI with the consequence that (i) the Eastern Indonesia market risks remaining under-developed and (ii) the feasibility and effectiveness of pre-license drilling remain untested.

17. To date, international development assistance has been focused on assisting GoI with addressing institutional and regulatory shortcomings, and providing support to downstream investment. Asian Development Bank (ADB) and several bilateral development partners such as JICA, and New Zealand Government, have been supporting GoI with institutional, regulatory and tariff reforms and WBG has assisted GoI with the development of a pricing policy and robust regulatory provisions for geothermal development through the Global Environment Facility (GEF) and the Asia Sustainable Energy Program (ASTAE). However, issues related to pricing, environmental regulation, off-take guarantees, among others, still remain to be solved. The World Bank has recently approved an Indonesia Energy Sector Reform Development Policy Loan (DPL), which includes strengthening of the regulatory environment, particularly focusing on implementation regulation for the Geothermal Law. However, to have the full effect this will need to be supplemented through well-coordinated technical assistance from multi- and bi-lateral development partners.

C. Relationship to CAS

18. The proposed Project supports the World Bank poverty alleviation and prosperity-sharing goals while supporting the GoI in its efforts to introduce indigenous energy resource alternatives to coal in order to limit GHG emissions. By focusing on the development of geothermal resources in Eastern Indonesia (where electrification rates are lowest, poverty rates are highest and electricity generation is heavily reliant on diesel), the Project is expected to contribute to the GoI's goals set forth in the national electrification, economic development and sustainable power sector expansion plans.

19. The Joint IBRD/IFC/MIGA Country Partnership Strategy (CPS) with Indonesia for FY16-20 is aligned with the country's Master Plan for "Acceleration and Expansion of Indonesia's Economic Development 2011-2025", which seeks to accelerate development through a pro-growth, pro-jobs, pro-poor and pro-green strategy.

20. The proposed Project supports two pathways identified in the 2015 Systematic Country Diagnostic (SCD) to reduce poverty and increase shared prosperity in Indonesia, namely: (i) removing infrastructure bottlenecks to economic growth and job creations, with a special focus on the role of increasing energy investments and supply to respond to expected increase in demand, enhancing sector efficiency and sustainability, and reducing regulatory uncertainties and costs of doing business in the sector; and (ii) better management of natural resources and environment, by adopting a more integrated approach to energy, agriculture and water management, including support for an expansion of renewable energy development.

II. Proposed PDO/Results

A. Proposed Development Objective(s)

21. The Project Development Objective (PDO) is to facilitate investments in geothermal energy. The focus of the Project will be on the geothermal power market in Eastern Indonesia in order to increase access to electricity in areas with high poverty rates and expensive diesel-fired power generation.

B. Key Results

22. Key result indicators to monitor progress toward achievement of the PDO are:

- Project financing for geothermal power plants secured (MW)
- Estimated GHG emission reduction compared to a business-as-usual baseline (MtCO2e /year)
- Planned increase in the number of connected households for the associated local electricity networks (Number)

23. In addition, the following intermediate result indicators will be adopted:

- Commercial capital mobilized (US$)
- Generation capacity of wells drilled, total and average (MW and MW/well)
- Villages located next to exploration sites with at least one public consultation held (%)
- Share of public consultations segregated by gender (%)

III. Project Context

A. Concept

1. Description

24. The proposed Project consists of three key components:

25. *Component 1: Risk Mitigation for Geothermal Exploratory Drilling (US$98 million)* – The component focuses on supporting government-sponsored exploration drilling. The proposed concept involves setting up a revolving mechanism through which the funds used for exploration drilling will flow back to the facility through repayment of exploration cost plus a premium from developers that have successfully secured project finance for post-delineation development. Funding for exploration drilling is expected to be made available in the measure of $49 million (CTF contribution net of management fee) from CTF with a matching contribution from MOF/PT SMI for priority sites selected by the Directorate General of New Energy, Renewable and Conservation Energy (EBTKE) under MEMR. The reflow of funds into the Facility will ensure that funding will be available for future development, thus ensuring sustainability of the risk mitigation scheme. Based on the typical size of plants observed in Eastern Indonesia, it is estimated that 65 MW are to come on-line as a result of the exploratory drilling financed under this Project.

26. *Component 2: Technical Assistance and Capacity Building (US$6.25 million)* – This component will be financed by the Global Environment Facility (GEF). Building on the previous GEF support to the Indonesian geothermal sector, GEF funding will focus on building the local capacity for geothermal development by providing the resources needed to establish an efficient and effective exploration and tendering program. Specifically, this Component will provide technical assistance to the government-sponsored drilling program, including advisory support in carrying out geology, geochemistry and geophysics surveys (3G surveys) and topographic mapping for candidate sites.

27. Support will be also made available for the preparation of drilling, well completion and resource assessment reports (based on 3G surveys) as well as for the bidding process for exploration service companies. It is envisioned that such support will be carried out by specialist service providers coordinated by an exploration management consultant (EMC). In addition, technical assistance will cover the services of a geothermal consultant to provide support for MEMR's Geothermal Directorate's capacity building efforts.

28. It is expected that the EMC and geothermal consultant activities will be financed by the GEF grant combined with grant support planned by the Government of New Zealand (GNZ). The planned grant from GNZ will be designed to be complementary to the CTF and GEF-financed support. The GNZ grant is expected to support GoI on: (i) establishment of an effective GIS-based database by collating and analyzing existing and new resources data, potentially to be housed within Badan Geologi (BG); (ii) methodology for robust resource and reserve estimation and reporting protocol to an internationally acceptable standard; (iii) methodology for prioritization of potential sites for geothermal development; and (iv) capacity building for MEMR and PT SMI for tendering and executing an exploration program.

29. Furthermore, the GEF-funded TA will produce a 'good practice' guide for preparing safeguards documentation, e.g. related to Environmental and Social Impact Assessments, Environmental Management Plans, and plans for indigenous people and resettlement that would be needed for exploration and exploitation of geothermal energy. Finally, it will cover just-in-time support for overall management, and donor coordination and ensure that adequate administrative functions are in place.

30. *Component 3: Investment Support for Geothermal Exploitation (US$300 million).* It is being considered to finance a Component 3 as a follow-up to the CTF/GEF support. Moving upstream in the geothermal development process to take full advantage of Indonesia's vast resource potential would also require post-exploration risk mitigation support. During the exploitation phase of geothermal development, such a support may be provided through debt finance instruments with enhancements, such as insurance schemes. To support new investment, WB is considering a US$300 million IBRD loan for mid-stream development (i.e. steam-field drilling). The sequencing of investments in the geothermal development process implies that Component 3 will be triggered upon successful completion of standard exploratory drillings – hence the need to commit IBRD resources in due course only.

31. **Project Cost and Financing**: Component 1 will be co-financed through PT SMI's dedicated resources for geothermal development in the amount of US$49 million and a

contingent recovery grant of US$49 million from CTF[5]. Given the revolving nature of the proposed facility, it is expected that funds will flow back in three-year cycles[6], therefore enabling 260 MW and about US$1.56 billion of new capacity and investment.

32. Component 2 will be financed by a grant of US$6.25 million from GEF. Component 3 is expected to be financed by an IBRD loan of US$300 million as a follow-up to the CTF/GEF support. Summary tables of project cost and financing (US$ million) are provided below.

CTF/GEF Support

Agency	Component 1 - Risk Mitigation for Geothermal Exploratory Drilling	Component 2 - Technical Assistance and Capacity Building	Total
MoF/PT SMI	49.00		49.00
WB/CTF	49.00		49.00
WB/GEF		6.25	6.25
Total	98.00	6.25	104.25

Subsequent Investment

Agency	Component 3 - Investment Support for Geothermal Exploitation	Total
WB	300.00	300.00
Total	300.00	300.00

33. **Rationale for Public Sector Financing:** GoI expects the private sector to bear the lion's share of investment in new geothermal capacity. To incentivize private sector participation, public interventions would need to be targeted at removing – or at least reducing – key geothermal development barriers, first and foremost: exploration drilling risk (or resource risk).

34. Such risk is inherent in geothermal energy development, as in essence, a geothermal energy project is a combination of two distinct activities: a geothermal energy mining activity (below the ground) and a geothermal heat exploitation activity (above the ground). The resource risk is highest at the initial stages of project development, before the first wells are drilled and decreases as more wells are drilled, each well providing further information about the nature of the reservoir, most importantly the temperature and permeability.

35. Exploration drilling risk is exacerbated by costs of up to US$8 million per well[7] plus supporting infrastructure. This can be prohibitive for project developers who are not guaranteed downstream returns on their pre-production investments. Exploratory drilling also constitutes the biggest barrier to obtaining financing as it increases investors' equity return requirements. Moreover, there is little appetite from the private sector to fund projects where the nature and extent of the resource are unknown.

[5] If the CTF resources have not been exhausted by the sixteenth year following the project start date, the remaining balance will be returned to CTF, unless agreed differently.

[6] Indicative time from start of civil works to securing a financing package for a given geothermal project

[7] Exploration well drilling prices are expected to be in the US$5-8 million range, depending on site-specific characteristics (e.g. remoteness, depth, etc.).

36. Cost-shared drilling programs have proven to mitigate resource risk, thus enabling risk capital and private expertise to be mobilized towards exploration drilling in the developed geothermal markets of the USA, Japan and New-Zealand. This is currently the focus of much of the global push for geothermal development and, with support from MDBs such as, WB and IADB, cost-shared drilling models are being pursued in the developing geothermal markets of Turkey, Armenia and Mexico. Turkey, the most advanced in this type of geothermal development program, has currently the fastest-growing geothermal capacity in the world.

37. **Value-added of Bank's Support:** This stems from the complementarity of services offered by the WBG and its global presence and knowledge applicable to the Indonesian energy sector.

38. Complementarity of Services Offered: It is envisaged that the Project will bring together grant-funded technical assistance from the Global Environmental Facility (GEF) and funding for risk mitigation models from the Clean Technology Fund (CTF). This could at a later stage be followed up by mid- and down-stream investments in the form of IBRD and/or IFC commitments. Given the structure of the power market in Indonesia, there is also an opportunity to include MIGA through its Non-Honoring of Sovereign Financial Obligations product.

39. Global Presence and Knowledge: The Bank's support would build on the existing body of work and previous engagements in the global and Indonesia geothermal space. Globally, experiences such as, the World Bank's Turkey Geothermal Development Project, Armenia Geothermal Exploratory Drilling Project, Geothermal Energy Development Program (GeoFund), and African Rift Geothermal Development Program (ARGeo), and KfW's Geothermal Risk Mitigation Facility for East Africa all provide relevant input to the project design[8].

40. In the Indonesian context, past World Bank activities which inform this operation are: (i) the PPIAF-funded Assessment of Geothermal Resource Risks, which took stock of the international experience with geothermal development and distilled mitigations options applicable to Indonesia; and (ii) the GEF-funded Geothermal Power Generation Development Project, which inter-alia supported the development of a pricing and compensation policy for geothermal power.

In addition to the Bank's past experience, ongoing activities which inform this operation are: (i) the CTF/IBRD, ADB Private Section Operations Department (PSOD) and IFC downstream investment projects and related technical assistance programs, which target to bring on-line 1560MW of new geothermal installed capacity; and (ii) the Climate Change Development Policy Loans, which, provided collectively by the World Bank, JICA and AFD, further support the development of a pricing and compensation policy that is necessary to address the higher financial cost of geothermal electricity compared with coal-based power.

IV. Safeguard Policies that Might Apply

Safeguard Policies Triggered by the Project	Yes	No	TBD
Environmental Assessment OP/BP 4.01	X		

[8] This is also informed by relevant literature review, which inter-alia includes IFC-led efforts such as, "*Success of Geothermal Wells: A Global Study*" and "*Lessons from International Experience in Geothermal Development*".

Natural Habitats OP/BP 4.04	X		
Forests OP/BP 4.36	X		
Pest Management OP 4.09		X	
Physical Cultural Resources OP/BP 4.11	X		
Indigenous Peoples OP/BP 4.10	X		
Involuntary Resettlement OP/BP 4.12	X		
Safety of Dams OP/BP 4.37	X		
Projects on International Waterways OP/BP 7.50		X	
Projects in Disputed Areas OP/BP 7.60		X	

V. Financing (in USD Million)

Total Project Cost:	104.25	Total Bank Financing:	55.25
Financing Gap:	0.00		

Financing Source	**Amount**
Borrower	49.00
Global Environment Facility	6.25
Clean Technology Fund	49.00
Total	104.25

VI. Contact point

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