

**Ex-ante Evaluation****1. Name of the Project**

Country: The Republic of Indonesia  
Project: Lumut Balai Geothermal Power Plant Project  
Loan Agreement: March 30, 2011  
Loan Amount: 26,966 million yen  
Borrower: The Republic of Indonesia

**2. Background and Necessity of the Project****(1) Current State and Issues of the Electricity Sector in Indonesia**

The peak demand for power in Indonesia nationwide in 2008 was 21,866 MW, and according to the Long Term Electricity Development Plan 2009-2018 (RUPTL), which was prepared by the national electricity company, PT. Perusahaan Listrik Negara (Persero) (hereinafter referred to as “PT. PLN”), the capacity of existing power supply facilities nationwide is 29,205 MW. This means that the reserve ratio for power supply facilities is 34%, which is below PLN’s target of 35%. According to the RUPTL, peak demand in the Sumatra System, where the project is located, was 3,089 MW in 2008, and as a consequence of increasing demands for electricity associated with economic growth, this is expected to increase at an average annual rate of about 8.9%, reaching 7,354 MW by 2018. On the other hand, the current generation capacity of the system was 3,760 MW in 2008, and if anticipated shutdowns of existing power plants due to obsolete facilities in the future are taken into account, the development of new generation capacity is an urgent issue for Indonesia.

**(2) Development Policies for the Electricity Sector in Indonesia and the Priority of the Project**

In addition to dealing with increasing growth in the demand for power, the Government of Indonesia is pushing ahead with a policy for the diversification of energy sources, including the promotion of renewable energy development, as one of the key measures for climate change mitigation. Furthermore, the Presidential Decree No. 5/2006 on the national energy policy (issued January 25, 2006) sets a target of supplying 17% of Indonesia’s primary energy consumption with new and renewable energy by 2025, including 5% of geothermal. Indonesia is said to possess the largest geothermal potential in the world, estimated at 27,000MW. Of the targeted development of 10,000 MW of power generation capacity in its power development acceleration program called the Crash Program II (2010-2014), which was formulated in 2010, 3,967 MW is expected to be met by geothermal. The project is one of the key components of this Crash Program II.

**(3) Japan and JICA’s Policy and Operations in the Electricity Sector**

In Japan’s Country Assistance Program for Indonesia (2004), “sustainable growth driven by the private sector” has been set as one of the priority assistance areas, and building economic infrastructure is regarded as a development issue. In response to this policy, JICA has positioned “assistance for energy supply capacity” as one of its cooperative programs. Given that the project has a potential of qualifying as a Clean Development Mechanism (CDM)

project, and therefore, reductions in greenhouse gas emissions can be expected in a way that is measurable, reportable and verifiable, the project is also in line with the direction of the Japanese government's support for developing countries in climate change up to the end of 2012. In the Indonesian electricity sector, Japan has provided assistance in the form of about 100 loans since 1969, worth a total commitment of about 704.7 billion yen. In technical cooperation, Japan has provided assistance for geothermal development, energy-conservation policies and so on, and Japan has also provided assistance for thermal power plant rehabilitation projects in grant aid.

#### (4) Other Donors' Activities

In its Country Partnership Strategy for Indonesia (2009-2012), the World Bank states that the greater capacity of power generation facilities to meet the rapidly increasing demand in the electricity sector is needed for the purpose of strengthening competitiveness in Indonesia. In its Indonesia: Country Strategy and Program (2006-2009), the Asian Development Bank set goals in the electricity sector of improving energy efficiency and encouraging private sector participation, and is attempting to promote sector reforms and the development of renewable energy.

#### (5) Necessity of the Project

As described above, the project places a high priority on Indonesia's development policy, and it is in line with Japan's and JICA's priority assistance areas. In addition, given that it also contributes to mitigating climate change, the project is highly necessary and relevant.

### **3. Project Description**

#### (1) Project Objectives

By constructing the Lumut Balai Geothermal Power Plant (55 MW×2 (110 MW)) in the South Sumatra Province and connecting it to the Sumatra System, the project aims to improve the stability of power supply in the system, thereby contributing to the improvement of the investment climate and to the economic development of the Sumatra region. Furthermore, the project also aims to promote renewable energy development and to contribute to easing the negative impact on the global environment.

#### (2) Project Site/Target Area

South Sumatra Province, Muara Enim Regency

#### (3) Project Components

- 1) Construction of steam production facilities
- 2) Construction of geothermal power plant (55 MW×2)
- 3) Construction of power transmission and substation facilities (about 50km)
- 4) Drilling of exploration wells at other development sites
- 5) Consulting services (detailed design, assistance for bidding, construction supervision, assistance for environmental management, etc.)

#### (4) Total Project Costs

Total project costs: 44,124 million yen (Loan amount: 26,966 million yen)

(5) Schedule

The project construction is scheduled from March 2010 to October 2015 (68 months in total). The project will be deemed complete when the facilities come into service (October 2014).

(6) Project Implementation Structure

- 1) Borrower: The Republic of Indonesia
- 2) Executing Agency: PT. Pertamina
- 3) Operation and Maintenance System: PT. Pertamina will authorize its subsidiary PT. Pertamina Geothermal Energy (PGE) to conduct operation and maintenance of the power plant.

(7) Environmental and Social Consideration/Poverty Reduction/Social Development

- 1) Environmental and Social Consideration
  - (i) Category: A
  - (ii) Reason for Categorization  
The project is classified as Category A because it applies to the thermal power generation (geothermal) sector listed in the “Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations” (established April 2002).
  - (iii) Environmental Permit  
The environmental impact assessment (EIA) report, the environmental management plan (RKL) and the environmental monitoring plan (RPL) for this project were approved in August 2008 by the AMDAL Committee in Muara Enim, the location of the project.
  - (iv) Pollution Control Measures  
With regard to hydrogen sulfide (H<sub>2</sub>S), once the discharged vapors have been tested and the meteorological data obtained, PGE will calculate the predicted concentration of H<sub>2</sub>S at discharge and at landing, and will adopt mitigation measures so that regulation standards are met. No particular impact on the surrounding environment is expected because avoidance and mitigation measures for water quality, waste matter, noise and so forth are scheduled to be implemented in accordance with Indonesia’s domestic laws.
  - (v) Natural Environment  
Since the target area of the project falls within a nationally designated forest reserve, an application for development approval is currently underway in accordance with Indonesia’s domestic procedures. Furthermore, although it is expected that the zone which includes the project’s target area is inhabited by animals protected under Indonesia’s domestic laws, any adverse impact on the natural environment is expected to be minimal since measures will be taken in accordance with Indonesia's domestic laws and procedures.
  - (vi) Social Environment  
The project will be implemented on state land. Therefore, it will not involve any acquisition of private land (farmland, etc.) or any resident relocation.
  - (vii) Other/Monitoring

As part of the project, during construction and after operations have commenced, PGE will monitor air quality, water quality, noise and so forth in accordance with the RKL and RPL, and will report the results to JICA and to the relevant organizations (Ministry of the Environment, South Sumatra Province, Muara Enim Regency, etc.).

2) Promotion of Poverty Reduction  
None in particular

3) Promotion of Social Development (gender perspective, measures for infectious diseases including HIV/AIDS, participatory development, consideration for persons with disabilities, etc.)  
As part of the package relating to the construction of the project's power plant, HIV/AIDS countermeasures will be implemented, targeting the construction workers employed during the construction period.

(8) Coordination with Other Donors

None in particular

(9) Other Important Issues

The project has a potential of qualifying as a Clean Development Mechanism (CDM) project, and there are plans to provide support for the preparation of Project Design Documents (PDD).

#### 4. Targeted Outcomes

(1) Quantitative Impact

1) Performance Indicators (Operation and Effect Indicators)

Indicator (unit)		Baseline	Target (2016) [2 years after completion of the project]
Maximum output (MW)		N.A	110
Plant load factor (%)		N.A	90
Availability factor (%)		N.A	90
Auxiliary power ratio (%)		N.A	4.5
Net electric energy production (GWh/year)		N.A	867.2
Outage hours according to cause (hours/year)	Human error	N.A	0
	Mechanical error	N.A	240
	Planned outage	N.A	636

2) Internal Rate of Return

Based on the conditions indicated below, the economic internal rate of return (EIRR) for this project is 12.46% and the financial internal rate of return (FIRR) for this project is 9.68%.

Costs: Project costs (taxes excluded for EIRR calculation), operating and maintenance costs  
Benefits: Revenue from power sales  
Project life: 30 years

- 3) Contribution to the reduction of greenhouse gas emissions: 590,385 carbon dioxide equivalent tons/year

(2) Qualitative Impact

The improvement of the living conditions, investment climate and the economic development of the Sumatra region, and the reduction of the negative impact on the global environment through the development of a renewable power plant.

<b>5. External Factors and Risk Control</b>
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None in particular

<b>6. Lessons Learned from Findings of Similar Projects Undertaken in the Past</b>
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From past ex-post evaluations of completed ODA loan projects, it has been learned that securing a supply of steam is imperative in realizing the targeted outcomes. JICA's "Preparatory Survey for the Lumut Balai Geothermal Power Plant Project" has already shown an anticipated presence of resources sufficient to implement the project, and PGE's preliminary exploratory survey has confirmed a supply of steam for the project. In addition, development of all steam wells needed to commence the operation of the project is expected to be completed with PGE's budget prior to the construction of the power plant. Therefore, it is expected that the abovementioned problems will not occur.

<b>7. Plan for Future Evaluation</b>
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(1) Indicators for Future Evaluation

Maximum output (MW)

Plant load factor (%)

Availability factor (%)

Auxiliary power ratio (%)

Net electric energy production (Gwh/year)

Outage hours due to human error (hours/year)

Outage hours due to mechanical error (hours/year)

Outage hours due to planned outage (hours/year)

Economic internal rate of return (%)

Financial internal rate of return (%)

Contribution to the reduction of greenhouse gas emissions (carbon dioxide equivalent tons/year)

(2) Timing of Next Evaluation

Two years after the project's completion