Ex-Ante Evaluation (for Japanese ODA Loan)

Southeast Asia Division 1, Southeast Asia and Pacific Department, JICA

1. Name of the Program

Country: The Republic of Indonesia (Indonesia)

Program Site/Target Area: Upper reach of Peusangan River in Takengon, Aceh Tengah District, Aceh Province

Program: Peusangan Hydroelectric Power Plant Construction Project (II)

Loan Agreement: March 31, 2023

2. Background and Necessity of the Program

(1) Current State and Issues of the Development of the Electric Power Sector and Priority of the Program in Indonesia

The Republic of Indonesia (Indonesia) has seen a stable annual economic growth rate of around 5% in recent years, which has led to an increase in power demand. According to the Rencana Umum Ketenagalistrikan Nasional (RUPTL) (General National Power Plan) (2021-2030) developed by the Indonesian government, the nationwide peak power demand is 38,799 MW as of 2020, and is estimated to reach 62,600 MW in 2030 (annual growth rate of 4.9%). To ensure sufficient electric power of approx. 84,510 MW to cover the peak power demand plus a reserve rate of 35%, the power supply capacity needs to be increased by at least 40,575 MW.

When it comes to the power source composition ratios, coal covers 66%, natural gas 17.2%, hydroelectric power 6.9%, geothermal power 5.6%, petroleum/diesel 3.1%, and others 1.2%, and the ratio of renewable energy is approx. 13% as of 2022. When developing new power sources, it is necessary to shift from fossil fuels, such as coal and diesel, to hydroelectric power, geothermal power, and other kinds of renewable energy with great potential, in light of the importance of energy security and the growing trend of decarbonization.

The electric power supply in Indonesia is covered mainly by the two interconnected systems of the Java-Bali system and the Aceh-North Sumatra system, and the islands and isolated areas that are not connected to these systems are supplied with electric power through dispersed power systems. This Peusangan Hydroelectric Power Plant Construction Project ("the Program") is a project for constructing power plants as part of the Aceh-North Sumatra system. The peak power demand in Aceh Province, the main area covered by the system, is 542 MW (as of 2020; refer to the Rencana Umum Ketenagalistrikan Nasional (RUPTL) (General National Power Plan) (2021-2030)). While the peak

power demand in this province is estimated to reach 1,007 MW by 2028, the supply capacity of the existing power-generating facilities is 211 MW (as of 2020), so expanding the power generation capacity is an urgent issue. In addition, the province relies on diesel electric power generation, which has high fuel costs and emits large amounts of greenhouse gas, so it is necessary to build a sustainable power supply system by developing new power sources that use renewable energy.

(2) Japan and JICA's Cooperation Policy and Operations in Relation to the Electric Power Sector

The Country Development Cooperation Policy for Indonesia (September 2017) identifies the following as priority areas of assistance: improving the international competitiveness of the country, and developing power sources that utilize environment-friendly hydroelectric power and other kinds of renewable energy and help to stabilize the electric power supply. In addition, the JICA Country Analysis Paper for Indonesia (June 2018) positions the elimination of bottlenecks for achieving growth, including the development of electric power infrastructures, as a priority development issue, and the Program is consistent with these policies or analyses.

In addition, the Program helps to stabilize the economy and market in Aceh and thus, contributes to the rule of law, freedom of travel, the spread and establishment of free trade, etc., in the Free and Open Indo-Pacific. The Program also helps to reduce burdens on the global environment through the use of renewable energy, and will likely contribute to achieving two SDGs: Goal 7 and Goal 13.

When it comes to the previous ODA loan projects, a loan of 34 million yen was provided to the Peusangan Hydroelectric Power Plant and Related Transmission Lines Construction Project (E/S) in 1994, and another loan of 10.625 billion yen to the Peusangan Hydroelectric Power Plant and Related Transmission Lines Construction Project in 1995. However, due to security concerns, the main construction was not started, and the terms of the loans ended in December 2003, when assistance associated with the projects was stopped. After that, the Program (a loan agreement concluded in March 2007 for a loan amount of 26.016 billion yen) was accepted and implemented as additional loan.

(3) Other Donors' Activity

In April 2016, the World Bank provided a loan of 500 million dollars to the electric power distribution development program. Through this loan, they have helped the country to develop power transmission and substation facilities for improving access to electric power, as well as the efficiency and reliability of

power transmission, and strengthen relevant organizations to improve their management abilities. In May 2017, the World Bank also provided a loan of 32.53 million dollars for a project to expand the maximum capacity for hydroelectric power generation in the Java-Bali system.

3. Program Description

(1) Program Description

1) Program Objective(s)

The objective of the Program is to construct hydroelectric power plants and related power transmission and distribution facilities, etc., in Aceh Province in order to ease the short power supply in the Aceh-North Sumatra system and secure a stable supply of electric power. This will help to promote regional economic development in the northern part of Sumatra Island by improving investment environments, to rehabilitate and reconstruct the province, and to reduce burdens on the global environment through the use of renewable energy.

2) Program Component(s)

i) Two hydroelectric power plants (45 MW and 43 MW)
ii) Construction of power transmission and substation facilities
iii) Development of related electric distribution networks
iv) Consulting service (detailed design review, assistance for bidding, construction supervision, assistance for operation and maintenance, assistance for environment management, etc.)

All of these components are covered by this loan. All of the necessary materials and equipment have already been procured.

3) Beneficiaries of the Program (Target Group)

All users of the electric power supplied by the Aceh-North Sumatra system

(2) Estimated Program Cost (Loan Amount)

Estimated program cost: 52.789 billion yen (Loan amount in this phase of the Program: 13.629 billion yen)

(3) Schedule (Cooperation Period)

Scheduled period of cooperation: 209 months in total from March 2007 to July 2024. The Program will end when the second power plant is launched in July 2024.

(4) Program Implementation Structure

1) Borrower: The Government of the Republic of Indonesia

2) Guarantor: None

3) Executing Agency: PT. Perusahaan Listrik Negara (PLN) (Persero), a government-owned electric power company

4) Operation and Maintenance Management Agency: PLN

(5) Cooperation and Sharing of Roles with Other Donors

None in particular.

(6) Environmental and Social Consideration

1) Category: A

2) Reason for Categorization: The Program falls under the hydroelectric power generation sector set forth in the JBIC Guidelines for Confirmation of Environmental and Social Considerations (established in April 2002), and thus is classified as Category A.

3) Approval regarding the Environment

An assessment report called "Analisis Dampak Lingkungan (ANDAL)," an environmental management plan called "Rencana Pengelolaan Lingkungan (RKL)," and an environmental monitoring plan called "Rencana Pemantauan Lingkungan (RPL)," which are all related to the Program, were approved by the governor of Aceh Province in October 2006. (It has been confirmed that the approval is valid as of January 2021.)

4) Pollution Control Measures

Considering that water will not be stored for long in the water reservoir, that the land where the water reservoir is to be constructed is a paddy field, and that awareness campaigns for preventing waste dumping will be conducted in the water reduction section, the Program is unlikely to have any particular negative impacts on the quality of river water.

5) Impacts on the Natural Environment

The target area of the Program is not a national park or another sensitive area nor near such areas. The flow of water in the river is reduced because water is taken for electric power generation, but water discharge will be controlled to keep the river functioning properly. For these reasons, the Program is likely to have minimal adverse impact on the natural environment.

Transmission lines will be routed in a way to run along the existing roads as much as possible, and the surrounding area consists mainly of rice and vegetable fields, woodlands, and grasslands. For these reasons, the installation of transmission lines is unlikely to have significant adverse impacts on the natural environment.

6) Impacts on the Social Environment

The Program involves the acquisition of approx. 225.99 ha of land and the involuntary movement of four households. All households have been moved and the land has been acquired according to a plan developed based on the

JBIC Guidelines for Confirmation of Environmental and Social Considerations and the domestic procedures in the country. Discussion with some ex-residents about compensation for the loss of farming opportunity is under way. In addition, there is a plan to improve the irrigation and water intake facilities and develop water supply facilities in the water reduction section.

7) Other Considerations and Monitoring

In the Program, the executing agency will monitor the quality of river water, the flow of irrigation water, and other conditions based on the environmental management plan (RKL) and the environmental monitoring plan (RPL).

(7) Cross-Cutting Issues

1) Climate Change Control Project

The Program contributes to reducing greenhouse gas (GHG) emissions with the use of renewable energy, and is expected to mitigate climate change. The Program is expected to reduce GHG emissions by 147,114 t/year.

2) Measures to Combat AIDS and Other Infectious Diseases

The construction companies are taking measures to protect workers from AIDS and the novel coronavirus. After 33 staff members of local contractors were affected with the virus in October 2020, PLN recognized anew that the safety of those involved in the Program is a matter of priority, and agreed to take necessary measures to combat these infectious diseases through consulting services and construction companies based on the relevant domestic laws and regulations and guidance.

(8) Category of Gender: [Not applicable] ■ GI (gender mainstreaming needs assessment and analysis project)

<Reason for classification> Although gender mainstreaming needs were studied and checked for the Program, it includes no specific efforts that contribute to gender equality or women's empowerment.

(9) Other Important Issues

None in particular.

4. Targeted Outcomes

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicators)

	Indicator		Baseline (Actual value in 2005)	Target (by 2025) [1 year after the completion of the Program]
1)Construction of power plants	Maximum power output (MW)		N/A	88.0
	Rate of utilization of facilities (%)		N/A	32.3
	Power generation at transmission end (annual) (Gwh/Year)		N/A	245.6
	Downtime by cause (Hrs./Year)	Human error	N/A	0
		Mechanical failure	N/A	96.0
		Planned downtime	N/A	0
2)Development of electric distribution networks	Annual accidental power outage time per consumer (house) (Hrs./year/house)		39.6	8.3
	Electrification rate of households in the target area (%)		78.3	100.0
	Distribution loss rate in Aceh Province (%)		15.3	7.5
	Maximum power output in Aceh Province (MW)		212.0	643.7
	Amount of power sold in Aceh Province (GWh)		763.85	3,223.2

(2) Qualitative Effects

Regional economic development by improving investment environments; rehabilitation and reconstruction of Aceh Province; and reduced burdens on the global environment through the use of renewable energy

(3) Internal Rate of Return

Based on the following assumptions, the economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) for the Program are 8.49% and 5.70%, respectively.

[EIRR]

Cost: Project cost (tax excluded), and operating and maintenance expenses (tax excluded)

Benefit: Capacity value and power generation cost compared against the case where alternative power sources (coal-fired and gas turbine power generation facilities) are constructed

Project life: 30 years

[FIRR]

Cost: Project cost, and operating and maintenance expenses

Benefit: Revenue from selling electric power

Project life: 30 years

5. External Factors and Risk Control

(1) Preconditions: None in particular.

(2) External Conditions: None in particular.

6. Lessons Learned from Past Programs

In a past similar program in the energy sector ("North-West Sumatra Inter-connector Transmission Line" in Indonesia), during which transmission lines outside the scope of the ODA loan program were partially affected by a flood, new land was acquired and the affected section was reconstructed at the other party's expense. The land for the section was acquired behind schedule, which delayed the start of power transmission and the appearance of program effects. Based on this past program, we have learned that installing transmission lines in a program requires an understanding that the entire transmission network is inseparable, regardless of the scope of the program. We have also learned that it is necessary to consistently monitor the matters to be implemented by the other party and other necessary matters from the beginning, and to secure a budget and check the implementation status of construction and other matters to be implemented by the other party to ensure that they proceed as scheduled.

In the Program, matters to be implemented by the other party, such as securing a budget for their own expenses and registering a budget for the loan, were confirmed in the examination. The system for sharing information with the relevant offices was reinforced to ensure that the construction work will be conducted as

scheduled, and an agreement was reached to implement the confirmed matters steadily.

7. Evaluation Results

The Program is consistent with the development issues and policies of Indonesia, as well as Japan's and JICA's cooperation policies and analyses. It helps to reduce burdens on the global environment through the use of renewable energy. The Program will also likely contribute to two of the SDGs: Goal 7 (Ensure access to affordable, reliable, sustainable and modern energy for all) and Goal 13 (Take urgent action to combat climate change and its impacts). All of these aspects suggest that it is highly relevant to support the implementation of the Program.

8. Plan for Future Evaluation

(1) Indicators to be used

As indicated in section 4.

(2) Timing

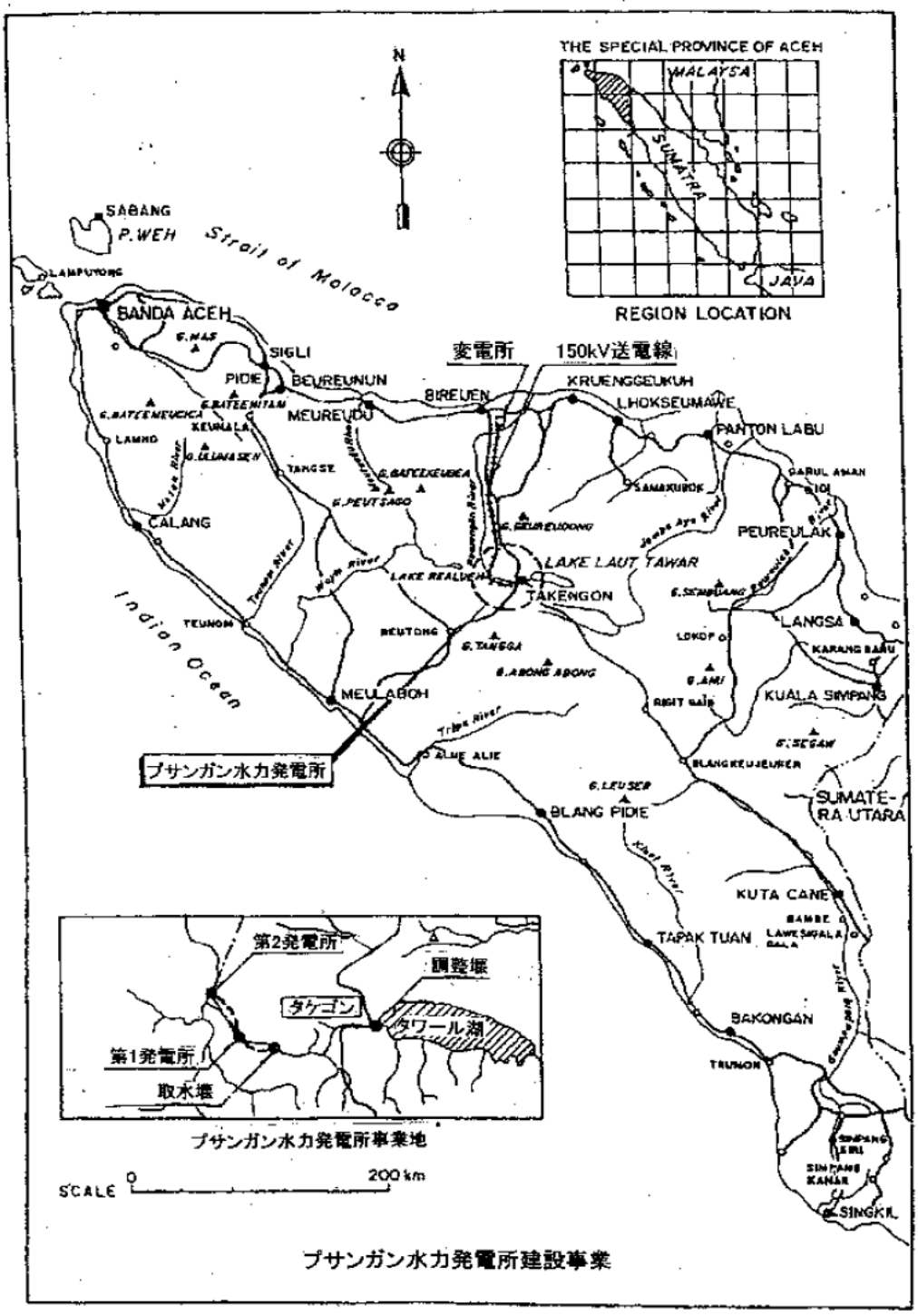
Ex-post evaluation: 1 year after program completion

Attachment: Map - Peusangan Hydroelectric Power Plant Construction Project

End

Attachment

Map - Peusangan Hydroelectric Power Plant Construction Project



Source: Records of board appraisal in Phase I