

Ex-Ante Evaluation (for Japanese ODA Loan)

1. Project Name

Country name: The Republic of the Union of Myanmar

Project name: Hydropower Plants Rehabilitation Project

L/A Signing date: April 25, 2017

Approved amount: 10,787 billion yen

Borrower: The Government of the Republic of the Union of Myanmar

2. Background and Necessity of the Project

(1) Current state and Issues of the Development of the Electric Power Sector in Myanmar

In the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar"), the total generator facility output for domestic use is approx. 4,651 MW (as of Nov. 2015), but the average supplied power is 1,823 MW (FY 2015). In particular, the gap in power supply and demand during times of maximum power demand is approx. 250 MW, at an average supply performance base. Furthermore, according to the "National Electricity Master Plan" (2014, Draft) of the Myanmar Ministry of Electricity, which JICA supported the drafting of, it is expected that the maximum power demand will reach approx. 14,500 MW by 2030, and improving power supply capability is an urgent issue. In this kind of situation, considering that constructing new power plants takes a long time for the construction period as well as to gain a consensus among citizens, it is necessary to renovate existing power plants in order to swiftly improve the power supply capability.

In the configuration of power sources for existing power plants, the generated output for hydropower plants is, as of Nov. 2015, at 3,011 MW (including 421 MW for export to China), and the facility capacity for hydropower plants comprise approx. 65% of the total output. Particularly in the 1980s to the 1990s, power plants that started operation could not receive sufficient spare parts and the like under economic sanctions, and so the power plants were not appropriately renovated and have become deteriorated.

The targets for this project, Baluchaung No. 1 Hydropower Plant (began operation in 1992, 28 MW) and the Sedawgyi Hydropower Plant (began operation in 1989, 25 MW), have not been overhauled since they began operating and have become deteriorated. Equipment failures due to fires or water leakage have also necessitated unplanned generation shutdowns. Baluchaung No. 1 Hydropower Plant has experienced 40 hours and Sedawgyi Hydropower Plant has experienced 275 hours of unplanned generation shutdowns per year. As long-term generation shutdowns are a possibility, renovating both power plants is a pressing issue. Both power plants provide power to Yangon and Mandalay respectively, two major cities that are areas

with power demand in Myanmar, and generation shutdowns at either power plant effects Myanmar's economic development.

(2) Development Policies for the Electric Power Sector in Myanmar and Priority of the Project

To achieve sustainable economic development and reduce poverty, Myanmar's "National Energy Policy" (2014) prioritizes the achievement of increased capacity for power generation, transmission, and distribution. In the economic policy announced by the new administration (July 2016), one of the administration's goals gives priority to "swift development of basic economic infrastructures, such as power supply, roads, and ports," and the maintenance of power infrastructure is a vital issue for Myanmar. Hydropower plants are the main source of power in Myanmar. The Hydropower Plants Renovation Project (hereinafter, "this Project"), which aims to renovate those hydropower plants that are facing the end of their operating life and thus ensure power generation, matches these policies of the government of Myanmar.

(3) Japan and JICA's Policy and Operations in the Electric Power Sector

"Japan's Projected Economic Cooperation to the Republic of the Union of Myanmar" determined in April 2012 lists the "Assistance for development of infrastructure and related systems necessary for sustainable economic development" as a field for focus. This Project will renovate generating facilities and transformer facilities to contribute to the promotion of sustainable economic growth, and matches the said policy. Of the power plants to be renovated in this Project, Baluchaung No. 1 Hydropower Plant was constructed through support of a Japanese ODA loan, "Baluchaung No. 1 Hydropower Plant Project" (1982). Furthermore, we are providing the Japanese ODA loan "Urgent Rehabilitation and Upgrade Project Phase 1" (2013), which renovates primary generators and transformers in the Yangon area, as well as the grant aid "Project for Rehabilitation of Baluchaung No.2 Hydropower Plant" (2013).

(4) Other Donor's Activities

The Asian Development Bank (ADB) began support in 2014 for establishing the "Myanmar National Energy Master Plan" (officially announced in January 2016), and is implementing the Power Distribution Network Improvement Project in areas such as Yangon, Mandalay, and Sagaing (ADB loan: 60 million dollars, L/A signed in January 2014). The World Bank supported the determination of the "National Electrification Plan" (not yet officially announced by Myanmar's government), and is implementing a gas-fired power generator renovation project (140 million dollars, loan contract signed in October 2013) in Thaton, Mon State, as well as the National Electrification Project (total project cost of 567 million dollars, World Bank loaning 400 million dollars thereof, loan contract signed in November 2015).

(5) Necessity of the Project

This Project will contribute to the improvement of power provision in Myanmar through the rehabilitation of Baluchaung No. 1 Hydropower Plant and Sedawgyi Hydropower

Plant, is in line with the development issues and development policy of Myanmar and the assistance policy of Japan, and as it contributes to improving access to power, will contribute to Sustainable Development Goal 7 (Ensure access to affordable, reliable, sustainable and modern energy for all). For these reasons, there is significant necessity for JICA to support implementation of this Project.

3. Project Description

(1) Project Objective(s)

By implementing rehabilitation for the generating and related equipment at Baluchaung No. 1 Hydropower Plant and Sedawgyi Hydropower Plant, this Project will reduce unplanned generation shutdowns and extend the operating life of the hydropower generation facilities, thereby contributing to the stabilization of domestic power provision in Myanmar, and thereby contributing to the promotion of economic and social development, and improvement of citizens' lives.

(2) Project Site / Target Area

Kayah State and Mandalay area

(3) Project Components

- 1) Procurement and installation of facilities (hydraulic turbines, generators, control panels, penstock gates, etc.) at Baluchaung No. 1 Hydropower Plant (28 MW) and Sedawgyi Hydropower Plant (25 MW)
- 2) Procurement and installation of transformer facilities (transformers, switch gears, etc.)
- 3) Consulting services (Basic design, bid assistance, construction supervision, organizational capability improvement, etc.)

(4) Estimated Project Cost

12,186 billion yen (of which 10,787 billion yen is covered by a Japanese ODA loan)

(5) Schedule

Planned for April 2017 to February 2026 (total of 107 months). The project shall be considered complete when the power plants begin providing power (February 2025).

(6) Project Implementation Structure

- 1) Borrower: the Government of the Republic of the Union of Myanmar
- 2) Guarantor: None
- 3) Project executing agency: Electric Power Generation Enterprise (EPGE)
- 4) Operation and management / maintenance, and administration: Electric Power Generation Enterprise (EPGE)

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

1) Environmental and Social Considerations

- ① Category: B
- ② Reason for the Categorization: This Project does not correspond to the

large-scale classification for the hydropower / transformer sector listed in the "JICA Guidelines for Environmental and Social Considerations" (distributed April 2010) and has been deemed not to have a significant negative effect on the environment, and furthermore, does not correspond to characteristics that easily have an impact or areas that are easily impacted listed in the said Guidelines.

- ③ Environmental Permit: Creation of an environmental impact assessment (EIA) report for this Project is not required by the law in Myanmar. However, an Environment Management Plan (EMP) must be submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC). It has already been confirmed by that Ministry and, in light of information from the basic design, is expected to be approved for the environmental compliance certificate (ECC) by March 2018.
 - ④ Anti-Pollution Measures: While it is expected there will be a negative impact during construction, such as air pollution, noise, water pollution, and waste, it is also expected this negative impact can be minimized by implementing mitigating measures such as using construction machinery with excellent exhaust gas control and quiet properties, processing leachate, reusing construction panels, and storing waste in a storehouse. No extreme impact is expected after provision.
 - ⑤ Natural Environment: This Project site does not correspond with a site easily impacted, such as a national park, or the periphery thereof, and so it is expected that the negative impact on the natural environment will be minimal.
 - ⑥ Social Environment: This Project is rehabilitation for existing facilities and does not involve land acquisition or involuntary resident relocation.
 - ⑦ Other / Monitoring: The contractor and EPGE will perform monitoring for air and water pollution, waste, and noise during construction.
- 2) Promotion of Poverty Reduction: None in particular.
- 3) Promotion of Social Development: We made arrangements to encourage statements by women in meetings by holding a stakeholders meeting with a female chairperson. Furthermore, we investigated the maintenance situation of the partner government's guidelines and encouraged them to consider the male/female ratio of workers.
- (8) Collaboration with Other Donors: None in particular.
- (9) Other Important Issues: As this Project will extend the operating life of the hydropower plants, it will contribute to reducing the emissions of greenhouse gases (GHG). The mitigating effect that this Project will have on climate change (estimated amount of GHG emissions reductions) is approx. 85,760 t-CO₂ per year.

4. Target Outcomes

(1) Quantitative Effects

1) Outcome (Operation and Effect Indicators)

| Indicators | Baseline (Records in 2015) | Target (2027) [2 years after completion] |
|---|-------------------------------|--|
| Baluchaung No. 1 Hydropower Plant | | |
| Hours for unplanned generation shutdowns (Hours/year) | 40.01 | 0 |
| Generator operation rate (%) | 64 | 81 |
| Generated amount (GWh/year) | 156.782 | 200.000 |
| Maximum output (MW) | 28.0 | 28.0 |
| Sedawgyi Hydropower Plant | | |
| Hours for unplanned generation shutdowns (Hours/year) | 275.11 | 0 |
| Generator operation rate (%) | 56 | 64 |
| Generated amount (GWh/year) | 116.879 | 135.000 |
| Maximum output (MW) | 25.0 | 25.0 |

(2) Qualitative Effects

Stabilization of domestic power provision, promotion of economic and social development, and improvement of citizens' lives

(3) Internal Rate of Return

Based on the following assumptions, this Project's economic internal rate of return (EIRR) will be 27.6% and the financial internal rate of return (FIRR) will be 2.3%.

[EIRR]

Costs: Project cost (excluding tax), management / maintenance and administration cost

Benefit: Reduction of substitute goods for power

Project life: 47 years

[FIRR]

Costs: Project cost, management / maintenance and administration cost

Benefit: Income from electricity sold

Project life: 47 years

5. External Conditions and Risk Control

The Ministry of Agriculture, Livestock and Irrigation has jurisdiction over the water operation of both power plants and gives priority to irrigation in the operation of reservoirs. Therefore, as there is a risk the water operation of the Ministry of Agriculture, Livestock and Irrigation will affect the result of this Project, it is necessary to periodically check the water operation status.

The capacity of transmission network from Baluchaung No. 1 Hydropower Plant to

the major cities in Myanmar, such as Yangon and Mandalay which have demand for power, is lacking. While the transmission lines are being increased, if there is a delay in the increase, then power cannot be transmitted from Baluchaung No. 1 Hydropower Plant to the national transmission network. Therefore, we require reports regarding the progress of the project to increase transmission lines.

6. Lessons from Past Projects and Application to this Project

(1) Lessons from similar projects

The ex-post evaluation of the "Umiam Hydro Power Station Renovation Project" in India (Evaluation FY: FY 2006) and others pointed out that main machines / parts should be updated from the point of view of preventative maintenance. Also, the lesson that it is vital to thoroughly record the power plant's maintenance and administration data when performing maintenance and administration was gained.

(2) Application of the lesson to this Project

As this Project also plans to renovate main machines / parts, we have determined the machines that must be renovated / updated from the point of view of long-term preventative maintenance in light of the above lesson. Also, we plan to provide technical support related to determining which machines to renovate / update and recording maintenance and administration data through our consulting service.

7. Plan for Future Evaluation

(1) Indicators used in future evaluation

- 1) Hours for unplanned generation shutdowns (Hours/year)
- 2) Generator operation rate (%)
- 3) Generated amount (GWh/year)
- 4) Maximum output (MW)
- 5) Economic internal rate of return (%)
- 6) Financial internal rate of return (%)

(2) Future evaluation timing

- 2 years after project completion

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