Ex-Ante Evaluation (for Japanese ODA Loan)
Southeast Asia Division 4, Southeast Asia and Pacific Department,
Japan International Cooperation Agency (JICA)

1. Basic Information

Country: Republic of the Union of Myanmar
Project: Infrastructure Development Project in Thilawa Area (Phase 3）
Loan Agreement: March 31, 2020

2. Background and Necessity of the Project

（１）Current State and Issues of the Development of the Electric Power Sector in Myanmar and Positioning of the Project

Myanmar's total installed capacity for domestic and overseas use is approximately 5,806 MW (as of April 2019), of which the total installed capacity intended for use within Myanmar is approximately 5,100 MW, and power generation capacity for domestic use is around 4,600 MW. However, Myanmar's power demand has been growing rapidly due to development and investment in recent years. According to the electricity master plan, whose formulation was supported by JICA through the Project for Formulation of the National Electricity Master Plan in 2014, maximum power demand was recorded as 3,075 MW in 2017, but by 2020 is forecast to reach 4,531 MW in the high case and 3,862 MW in the low case. Therefore, improving power generation capacity is considered an urgent issue.

Given these circumstances, the National Energy Policy (2014) sets a priority of increasing capacity in terms of power generation, transmission and distribution in order to achieve sustainable economic growth and reduce poverty. The rapid development of the basic economic infrastructure including electricity, roads and ports, has also been set as a key policy in the current government's Economic Policy (July 2016) launched in March 2016. Furthermore, in the Myanmar Sustainable Development Plan (MSDP) of August 2018, the ability to "provide affordable and reliable energy to populations and industries via an appropriate energy generation mix" has been established as one of the country's key strategies. Thus, capacity building for power generation is a key issue for Myanmar.

Under support of the Japanese ODA loan project "Infrastructure Development Project in Thilawa Area (Phase 1)" (L/A signed in June 2013), a thermoelectric plant in Thilawa with an output of 50 MW began operation in the Thilawa Special Economic Zone ("Thilawa SEZ"). Even so, given that maximum power demand is expected to exceed output by 2025 due to intense activity and business expansion in the area, improving

power generation capacity in Thilawa area is urgently needed.

The purpose of the Project is to convert Thilawa Thermal Power Plant, whose construction was supported by the "Infrastructure Development Project in Thilawa Area (Phase 1)" Japanese ODA loan project, to a combined cycle power plant. This goal is consistent with the above-mentioned Myanmar government policy of aiming to boost the country's power supply.

（２）Japan and JICA's Cooperation Policy, etc. in the Electric Power Sector and the Positioning of the Project

In Japan's Economic Cooperation Policy for Myanmar, established in April 2012, "support for the development of infrastructure and systems necessary for sustainable economic growth" was designated as one of the priority areas. The Electricity Master Plan, whose formulation was supported by JICA in the Project for Formulation of the National Electricity Master Plan (2014) also plans for significant increases in power generation and transmission facilities. In the Japan-Myanmar Cooperation Program announced in November 2016, "Energy cooperation to enable industrial development" is listed as one of the nine most important sectors. The Project contributes to sustainable economic growth by improving power supply in Myanmar, and is consistent with this cooperation policy.

The Project is also one of the key strategies in the Myanmar Sustainable Development Plan announced by the Myanmar government in August 2018, namely to "provide affordable and reliable energy to populations and industries via an appropriate energy generation mix." It also contributes to Sustainable Development Goal (SDG) 7: to "ensure access to affordable, reliable, sustainable and modern energy for all."

（３）Other Donors' Activities

The World Bank has provided support for constructing a combined cycle gas-fired power plant (119 MW output) in Thaton, Mon State (completed in April 2019), and the formulation of the National Electrification Project. Meanwhile, Asian Development Bank has been providing support for formulation of the Myanmar Energy Master Plan since 2014 (officially announced in January 2016).

3. Project Description

（１）Project Objective

The objective of the Project is to the economic and social development of Myanmar by enhancing power generation capacity through the conversion of Thilawa Thermal Power Plant to a combined cycle plant.

（２）Project Site/Target Area

Thilawa SEZ/ Yangon Region

（３） Project Components

1) Civil engineering work, procured equipment, etc.

Upgrading of steam turbine generators (25 MW), waste heat recovery boilers, air-cooled condensers, etc.

2) Consulting services

Support for detailed design review, bidding assistance, construction supervision, environmental and social considerations and technical transfer, etc.

（４） Estimated Project Cost

9,103 million yen (including ODA loan of 7,339 million yen)

（５） Project Implementation Schedule

The Project is scheduled to be implemented from March 2020 to May 2025 (63 months in total). Project completion is defined as commencement of operation of the power plant (May 2024).

(6) Project Implementation Structure

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

2) Guarantor: None

3) Executing Agency: Electric Power Generation Enterprise ("EPGE")

4) Operation/Maintenance and Management Agency: EPGE

(7) Collaboration and Division of Roles with Other Projects and Donors, etc.

1) Japan's Assistance Activities: Japan has supported the development of Thilawa Thermal Power Plant, the target of the Project, through the "Infrastructure Development Project in Thilawa Area (Phase 1)". Since the Project supports the expansion of power plants in Thilawa SEZ, it also contributes to improve the investment environment of Thilawa SEZ, for which JICA extends development support through a private sector Investment finance.

2) Other Donors' Assistance Activities: None

(8) Environmental and Social Considerations/ Cross-Cutting Issues/Gender Classification

1) Environmental and Social Considerations

① Category: B

② Reason for Categorization: The Project is not considered a large-scale thermal power generation and substation sector as listed in the “JICA Guidelines for Environmental and Social Considerations” (effective as of April 2010). It is also judged to have no significant negative effects on the environment. Further, it does not fall under the category of a project with sensitive characteristics or sensitive areas according to the Guidelines.

③ Environmental Permits: Myanmar's domestic law requires that an Environmental Impact Assessment (EIA) report be prepared for the Project, and the EIA is scheduled to be approved by October, 2021.

④ Anti-Pollution Measures: During construction, it is expected that air pollution, water pollution, noise and vibration, and waste will cause some negative effects. However, these negative effects are expected to be minimal due to the implementation of mitigation measures that include the use of construction equipment with outstanding exhaust gas and noise suppression, treatment of wastewater and seepage, and storage of waste in storerooms. During operation, negative effects will be minimized by implementing mitigation measures that include the use of nitrogen oxide (NOx) inhibiting equipment, the use of air-cooled condensers that do not generate hot water discharge, the use of soundproof covers, and regular maintenance and management of the facilities and equipment.

⑤ Natural Environment: The Project area is not in a sensitive area such as a national park, nor in the surrounding area of such; therefore, adverse impact on the natural environment should be minimal.

⑥ Social Environment: No new land acquisition or involuntary resettlement will occur since the project will be implemented on land owned by EPGE.

⑦ Other/Monitoring: During construction and operation, the construction contractors and EPGE will monitor air quality, water quality, noise, waste, etc.

2) Cross-Cutting Issues

① Climate Change-related Issues: The Project will contribute to the reduction of greenhouse gas (GHG) emissions since the upgrading to combined cycle equipment at Thilawa Thermal Power Plant portion of the project will improve the thermal efficiency of the existing thermal power plant. The climate change mitigation effect (estimated GHG emission reductions) of the Project will be equivalent to approximately 134,096 tons of CO_2 per year.

3) Gender Classification:

[Not applicable] ■GI (project requiring a gender mainstreaming needs survey and analysis)

<Description of activities and reason for classification>

At this time, specific activities that contribute to gender equality and women's empowerment have not been determined in detail and will be considered at a later date. (It has been agreed a woman will act as moderator at stakeholder meetings to encourage women to speak at meetings. There are plans to review the development state of the counterpart government's guidelines, etc., and consider the ratio of male

and female workers).

(9) Other Important Issues

None in particular.

4. Targeted Outcomes

(1) Quantitative Effects

1) Outcomes (Operational and Effect Indicators)

Indicator	Baseline (actual value in 2017)	Target (2026) (2 years after project completion)
Maximum output (MW)	50	75
Generating end generation efficiency (%)	31.33	46.78
Transmission end power generation (GWh/year)	109	525*

* Calculated assuming an 80% equipment utilization rate.

(2) Qualitative Effects

The domestic power supply-demand balance is stabilized and economic and social development advanced

(3) Internal Rate of Return

Based on the assumptions below, the Economic Internal Rate of Return (EIRR) of the Project is 32.29% and Financial Internal Rate of Return (FIRR) is 11.51%.

[EIRR]

Costs: Project costs, operation and maintenance costs (all excluding taxes)

Benefits: Improved cost-effectiveness over alternatives (diesel generators in industrial use; kerosene lamps in consumer use)

Project life: 35 years

[FIRR]

Costs: Project cost, operation and maintenance cost

Benefits: Electricity sale income

Project life: 35 years

5. Prerequisites and External Factors

（１） Prerequisites: None in particular

（２） External Factors: None in particular

6. Lessons Learned from Past Projects and Application of Lessons Learned to the Project

Based on the results of ex-post evaluations etc. of the "Sylhet Combined Cycle Power Plant Construction Project" in the People's Republic of Bangladesh, an important lesson learned was that achieving the proper operation of power plants and maintenance of facilities requires not only securing an adequate number of staff to maintain and manage the power plant's facilities, but also the implementation of technical training on operation and maintenance of the plant and equipment.

Based on the above lessons learned, an investigation was carried out which verified that there are no issues with regard to experience or systems for the operation and maintenance of a combined cycle power plant. At the time of the project appraisal, it was also agreed that technical support will be provided through consulting services, etc., to improve capabilities in the operation and maintenance of the generator equipment to be installed.

7. Evaluation Results

The Project conforms to the development issues and policies of Myanmar and the assistance policies and analysis of Japan and JICA. By strengthening power generation capacity, the Project will contribute to improving the power supply in Thilawa SEZ, Yangon Region, and Myanmar overall. It will also contribute to Sustainable Development Goal 7: to "ensure access to affordable, reliable, sustainable and modern energy for all." For these reasons, it is deemed highly necessary for JICA to provide support for the implementation of the Project.

8. Plan for Future Evaluation

(1) Indicators to be Used

As provided in 4. (1) to (3).

(2) Future Evaluation Schedule

Ex-post evaluation: Two years after the project completion