

## Ex-Ante Evaluation (for Japanese ODA Loan)

### 1. Name of the Project

Country: The Republic of the Union of Myanmar

Project: National Power Transmission Network Development Project Phase II

Loan Agreement: October 16, 2015

Loan Amount: 41.115 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 Power Sector in Myanmar

The electric demand in Myanmar has been rising rapidly against the backdrop of its steep economic growth. In 2013, peak demand for power in Myanmar nationwide was around 1,500 MW, and the Yangon area accounts for the half (around 900 MW) of it. As the backbone of the country's power network, the 230 kV transmission line plays a crucial role. According to the "National Electricity Master Plan" (2014), which was formulated with support from JICA, it is estimated that the electrical power transmission volume on the 230 kV trunk transmission line has already exceeded its capacity in some sections in 2014. Additionally, the long transmission distance from the north to the south caused voltage drop, resulting in a high transmission loss rate of 25.5%. Furthermore, since there is only a single circuit on the existing 230 kV transmission line, and deteriorated equipment has been used for many years in an overloaded state, the risk of accidents is high, and large-scale power outages were also a concern. Under such circumstances, it is necessary to construct and reinforce a trunk transmission line and related substations as well as to upgrade the higher voltage 500 kV system by maximizing the transmission capacity from north to south by connecting the trunk transmission lines.

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

President U Thein Sein, in his address on August 9, 2013, expressed the electrical power sector as a priority issue for socioeconomic development. The development of 500 kV transmission lines and related substations, which are included in this project, is also described in the Five Year Plan (2011 to 2015) formulated by Ministry of Electrical Power in Myanmar. The project is therefore in line with the country's development policies described in its power system development plans.

#### (3) Japan and JICA's Policy and Operation in the Power Sector

Japan's Country Assistance Program for Myanmar (April 2012) suggests a policy of "Assistance for development of infrastructure and related systems necessary for sustainable economic development" as one of the priority areas. This project will contribute to sustainable economic growth by developing the power transmission network, and is therefore in line with the policy. Additionally, the "National Power

Transmission Network Development Project Phase I" (2015) is financed as a Japanese ODA loan project, and development of two substations for the trunk transmission lines located in the Mandalay Region and Bago Region is underway. JICA has also implemented the "Urgent Rehabilitation and Upgrade Project Phase I" (2015) in order to improve major power stations and substations in the Yangon region.

#### (4) Other Donors' Activities

In relation to this project, for the 500 kV transmission line from Meikhtila to Taungoo (235.6 km), MEPE (Ministry of Electric Power Enterprise) is carrying out construction using equipment provided by the Serbian government. As of September 2015, foundation work for the transmission line and steel tower construction are underway, and construction is scheduled to be completed in 2017. The Export-Import Bank of Korea's Economic Development Cooperation Fund (hereinafter, "EDCF") is expected to provide assistance in the construction of the 500 kV transmission line (188.4 km) from Taungoo to Phayargyi (Loan Agreement was signed in November 2014). As of September 2015, consultant is being selected, for which construction is scheduled to be completed between 2018 and 2019. Other activities by other donors include those of the Asian Development Bank, which is assisting with the rehabilitation of the existing transmission and distribution network in order to improve the power supply and electrification rate. The World Bank Group is also assisting Thaton district of Mon State with their gas-fired power plant repair project as well as with the privatization of the Yangon City Electricity Supply Board by the International Finance Corporation.

#### (5) Necessity of the Project

As described above, the project is consistent with Myanmar's development agenda and policies, as well as the assistance priority areas of the Japanese government and JICA. Therefore, the necessity and relevance for JICA's support in implementing the Project is high.

### **3. Project Description**

#### (1) Project Objectives

The objective of the Project is to increase transmission capacity and improve system reliability by constructing a 500kV transmission line between Phayargyi and Hlaingthayar, and related 500/230 kV substations along the north to the south, thereby contributing to economic development in Myanmar.

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

Bago Region, Yangon Region

#### (3) Project Components

##### 1) Construction of the Phayargyi 500/230 kV Substation

Two 500 MVA transformers, 16 hybrid gas insulated switchgear, etc.

##### 2) Construction of the Hlaingthayar 500/230 kV Substation

Two 500 MVA transformers, 12 hybrid gas insulated switchgear, etc.

3) Construction of a 500 kV transmission line between Phayargyi and Hlaingthayar (95 km)

(4) Estimated Project Cost

46.474 billion yen (Loan amount: 41.115 billion yen)

(5) Schedule

From October 2015 to January 2021 (total of 64 months). Project completion is defined as when the facility is officially provided. (January 2020).

(6) Project Implementation Structure

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

2) Guarantor: N/A

3) Executing Agency: Ministry of Electric Power, Myanmar Electric Power Enterprise (MEPE)

4) Execution, Operation/Maintenance, Management: Ministry of Electric Power, Myanmar Electric Power Enterprise (MEPE)

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

1) Environmental and Social Considerations

(i) Category: B

(ii) Reason for Categorization: The project does not fall under the category of large-scale transmission lines, substations, and distribution lines of power sector as specified in the "Japan International Cooperation Agency Guidelines for Environmental and Social Considerations" (issued in April 2010, hereinafter, referred as the "JICA Guidelines"), and is deemed to have minimal adverse impacts on the environment. In addition, the project does not include any characteristics likely to cause an impact or areas susceptible impacts as specified by the JICA Guidelines.

(iii) Environmental Permit: At this time, preparation of an Environmental Impact Assessment (EIA) report concerning the project is not required. However, if one becomes necessary after the country establishes regulations on environmental protection, a report will be prepared and the necessary applications and permits will be obtained from the Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry.

(iv) Anti-pollution Measures: During construction work, air and water pollution are expected, as are negative impacts from noise and vibrations after the facilities are placed into service. However, measures such as water sprinkling and leachate treatment during construction will mitigate pollution. To decrease noise and vibrations while in service, a noise-suppressing design will be used for the facilities, and sound proof barriers will be installed as necessary. Through these efforts, minimal negative impacts are expected.

(v) Natural Environment: The project's target area is not a sensitive area such as a national park, nor in the surrounding area of such; therefore, adverse impacts on the natural environment is expected to be minimal.

(vi) Social Environment: This project does not require involuntary relocation of residents, but land acquisition of approximately 76.6 ha is necessary. In accordance with JICA environmental guidelines, land acquisition will proceed by following a resettlement action plan created by MEPE. There have been no particular dissenting opinions against project implementation during discussions with affected households; compensation and assistance will be provided in the future by MEPE as per their plan.

(vii) Other/Monitoring : MEPE will monitor air pollution, waste materials, noise, and labor conditions during construction.

2) Promotion of Poverty Reduction: None in particular.

3) Promotion of Social Development (e.g. Gender Perspectives, Measures for Infectious Diseases including HIV/AIDS, Participatory Development, Considerations for People with Disabilities, etc.): None in particular.

(8) Collaboration with Other Donors

None in particular.

(9) Other important issues

This project is projected to contribute to measures for mitigating climate change. Estimated volume of suppressed CO<sub>2</sub> gas emissions: 65,244 tons/year as a result of reduced transmission losses.

#### 4. Target Outcomes

(1) Quantitative Effects

1) Outcome (Operation and Effect Indicators)

Indicator (Unit)		Original (in 2015)	Target (2022) (2 years after project completion)
Transformers Availability factor (%)	Phayargyi substation	-	61%
	Hlaingthayar substation	-	73%
	Transmission line between Phayargyi/Hlaingthayar	-	43%
Annual energy (GWh/year)	Phayargyi substation	-	2,908
	Hlaingthayar substation	-	6,666
	Transmission line between Phayargyi/Hlaingthayar	-	2,562
Voltage Fluctuation rate (%)	Phayargyi substation	-	±5%
	Hlaingthayar substation	-	

## (2) Qualitative Effect

Increased reliability with respect to the stable supply of electricity

## (3) Internal Rate of Return

Based on the following preconditions, the Economic Internal Rate of Return (EIRR) is 10.4% and the Financial Internal Rate of Return (FIRR) is 4.8%.

(Note that, in addition to the Phayargyi and Hlaingthayar substations and 500-kV transmission lines between Phayargyi and Hlaingthayar targeted for this project, these calculations are based on the completion of construction of the Meikhtila and Taungoo substations from the preceding Phase I as well as the 500-kV transmission lines between Meikhtila and Taungoo from another project.)

### 1) Economic Internal Rate of Return (EIRR)

- Costs: Project costs, operation/maintenance costs, project costs between Meikhtila and Taungoo, Taungoo and Phayargyi (excluding taxes)
- Benefits: Reduced costs of alternative electricity generation (for switching from gas-fired power generation to hydroelectric power generation)
- Project life: 30 years

### 2) Financial Internal Rate of Return (FIRR)

- Costs: Project costs, operation/maintenance costs, project costs between Meikhtila and Taungoo, Taungoo and Phayargyi
- Benefits: Increased electricity sales due to decreased transmission losses
- Project life: 30 years

## **5. External Factors and Risk Control**

- Decreased demand for electricity due to a sudden downturn in Myanmar economy.
- Sweeping policy changes in the power sector

## **6. Evaluation of Similar Projects and Lessons Learned from Past Projects**

### (1) Results of Evaluations of Similar Past Projects

It was learned from the ex-post evaluation of a similar past project, the Transmission System and Substation Development Project (7-2) in Thailand that the development of a unique operation and maintenance manual for each substation allows for actual operation and maintenance conditions to be shared between substations. It is thus desirable to strengthen operation and maintenance through development of best practices for such.

### (2) Lessons for the Project

The operation and maintenance manual for 500 kV substations will be prepared for this project as well, which is consistent with the preceding Phase I, with support from the consultant. This manual will not only be used in operation but also utilized as a

reference for improving the operation and maintenance manuals of existing transmission/transformation facilities.

## **7. Plan for Future Evaluation**

### (1) Indicators to Be Used in Future Evaluations

- 1) Substation availability factor (%)
- 2) Transmission line availability factor (%)
- 3) Substation annual energy (GWh/year)
- 4) Transmission line annual energy (GWh/year)
- 5) Substation voltage fluctuation (%)

### (2) Timing of the Next Evaluation

Two years after project completion