

## Ex-Ante Evaluation

### 1. Name of the Project

Country: People's Republic of Bangladesh

Project: Dhaka-Chittagong Main Power Grid Strengthening Project

Loan Agreement: December 13, 2015

Loan Amount: 43,769 million Yen

Borrower: The Government of the People's Republic of Bangladesh

### 2. Background and Necessity of the Project

#### (1) Current State and Issues of the Power Sector in Bangladesh

In the People's Republic of Bangladesh (hereinafter referred to as "Bangladesh"), the electrification rate and annual per-capita electricity consumption are very low, at approximately 62% and 321kWh, respectively (as of 2013). With rapid economic growth in recent years, the power demand is projected to continue to grow at around 8.5% per annum to reach 33,708MW by 2030 (estimated in 2010); nevertheless, the maximum power supply capacity has remained at around 80% of the demand (in FY 2012-2013, the actual maximum power supply capacity was 6,350MW while the potential peak power demand was 8,349MW), which leading to regular planned power cuts.

Currently, approximately 70% of electricity is generated by gas-fired thermal power plants using domestic natural gas; however, there is a need to diversify the energy sources because of the growing demand for domestic gas and the elevated risk of running out of it in recent years. Against this backdrop, the Government of Bangladesh has formulated the Power System Master Plan 2010, according to which the Government is planning to develop the deep-sea port to import natural gas, coal and other fuels and construct power plants using these imported sources of energy in the Chittagong Division. While the power generation capacity in the division is expected to continue to expand in years to come, this electricity needs to be transmitted to the Dhaka Metropolitan Area (accounting for around 50% of the demand for electricity), for securing a stable supply of high-quality electricity is a key to sustainable economic development in Bangladesh.

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

As the most important national development strategy, the Sixth Five Year Plan (from FY2011-2012 to FY2015-2016) identifies the power sector as one of the most important areas for economic development leading to poverty reduction. The Power System Master Plan 2010 aims to raise power generation capacity as well as develop and expand high-voltage transmission networks. The Master Plan also points out the necessity of transmitting power to the Dhaka area, where there is a high demand for electricity, from other areas. Meanwhile, the Bangladesh Climate Change Strategy and Action Plan 2009 outlines a course of action to develop infrastructure that can improve the efficiency of power generation, transmission, and

distribution in order to create a low-carbon society. This Project is in line with these policies of Bangladesh.

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

The JICA Country Analysis Paper for Bangladesh (issued in April 2013) identifies the stable supply of electricity as an important issue. The Country Assistance Program for Bangladesh (issued in June 2012) also points out that the power supply shortage is the greatest impediment for the country's economic development and that it is essential to make a significant improvement in electricity and energy supply (in terms of quantity and efficiency). Thus, this Project is consistent with the policy and analysis of the Japanese Government and JICA. Major cooperation projects implemented in the electricity sector are listed below. In addition to the projects below, Japan has also extended active support for climate change measures, as represented by the Programme for Improvement of Solid Waste Management in Dhaka City toward the Low Carbon Society (Grant Aid for Environment Program in 2009), because the Japanese Government has identified it as an important issue in Bangladesh.

- Loan assistance: New Haripur Power Plant Development Project (in 2007 and 2009), Central Zone Power Distribution Project (in 2009), Rural Electrification Upgradation Project (in 2010), Bheramara Combined Cycle Power Plant Development Project (in 2013), National Power Transmission Development Project (in 2013), and Matarbari Ultra Super Critical Coal-Fired Power Project (I) (in 2014)
- Technical cooperation: Dispatch of Power Sector Advisor (in 2014), The study for master plan on coal power development in the People's Republic of Bangladesh : power system master plan 2010 (PSMP2010), The project for development of energy efficiency and conservation master plan in Bangladesh (in 2014), etc.

(4) Other Donor's Activity

The World Bank is supporting the power sector reform, the promotion of rural electrification, and the development of renewable energy. Meanwhile, the Asian Development Bank is supporting the extension of electrification, the improvement of energy efficiency, the promotion of privatization, the facilitation of international electricity interconnections, and the promotion of renewable energy development and energy conservation.

(5) Necessity of the Project

This Project is in line with the priority areas of the Government of Japan and JICA as well as the development issues and policies of the Government of Bangladesh; therefore, it is highly necessary and relevant for JICA to implement this Project.

<b>3. Project Description</b>
-------------------------------

(1) Project Objective

By constructing high-voltage main power lines between Dhaka and Chittagong, this

Project aims to ensure a stable supply of electricity in Bangladesh, thereby contributing to its economic growth and mitigation of climate change.

(2) Project Site/Target Area

Dhaka and Chittagong Divisions

(3) Project Components

- 1) Construction of 400kV transmission lines (from Dhaka to Matarbari Ultra Super Critical Coal-Fired Power Plant)
- 2) Construction of new 400kV/230kV substations and expansion of a 230kV/132kV substation
- 3) Consulting services: detailed design (D/D), tender assistance, construction supervision, etc.

(4) Estimated Project Cost (Loan Amount)

70,011 million Yen (Loan Amount: 43,769 million Yen)

(5) Schedule

This Project is planned to run from December 2015 to March 2022 (76 months in total). Project completion is defined as when all the facilities start to operate (in March 2021).

(6) Project Implementation Structure

- 1) Borrower: The Government of the People's Republic of Bangladesh
- 2) Guarantor: N/A
- 3) Executing Agency: Power Grid Company of Bangladesh Limited (PGCB)
- 4) Operation and Maintenance System: The Operation and Maintenance Department of PGCB is responsible for the operation and maintenance of the transmission grid, substations, and other relevant facilities of this Project.

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

1) Environmental and Social Consideration:

① Category: B

② Reason for Categorization:

It is because the Project does not fall under any of the categories in the list of sensitive sectors, characteristics, and areas provided in the JICA Guidelines for Environmental and Social Considerations (published in April 2010), nor is likely to have any significant adverse impact on the environment.

③ Environmental Permit:

The Initial Environmental Impact Examination (IEE) Report was approved by the Department of Environment, the Ministry of Environment and Forests, the Government

of Bangladesh, in September 2014. Moreover, the Environmental Impact Assessment (EIA) Report of the Project is to be submitted by PGCB to obtain approval from the Department of Environment, the Ministry of Environment and Forests, the Government of Bangladesh, by April 2016.

④ Anti-Pollution Measures:

During construction, the contractor will take following actions: measures to prevent air pollution, such as sprinkling water, covering loading trucks to minimize dust emissions, and ensuring the proper management of vehicles and heavy equipment; measures to prevent water pollution, such as routing the transmission lines in a way that no transmission towers will be built on steep slopes and reinforcing slopes to control muddy water; and measures to manage waste, such as ensuring the separation of construction waste and the proper treatment of hazardous waste to prevent water, soil, and other pollution.

⑤ Natural Environment:

The Project sites (the substation construction sites and transmission line route) are not located in or around sensitive areas such as nature reserves, habitats of precious species, and national parks. Moreover, this Project is planned to install bird deterrents on the transmission lines to prevent bird strikes as well as take necessary measures, including slope reinforcement, to prevent geological and geographical damage. Therefore, the Project is likely to have a minimum negative impact on the natural environment.

⑥ Social Environment:

This Project will require land acquisition of approximately 100 hectares for the construction of Meghnaghat Substation. Because the land is held by a government agency, the ownership of the land is to be transferred from the agency to PGCB. This Project will also acquire approximately 10 hectares of agricultural land for the construction of Madunaghat Substation. This process will be managed in accordance with the regulations of Bangladesh and the resettlement action plan. Compensation for replacement costs will be offered to the 46 owners of the agricultural land. Moreover, the tenant farmers who will lose their livelihood as a result of the land acquisition will receive compensation for the loss of earnings and assistance for the recovery of livelihood. Meanwhile, the land acquisition for the construction of transmission towers will be conducted in accordance with the laws and regulations of Bangladesh and the compensation policies formulated by the executing agency. Neither of the land acquisition processes will entail any resettlement of residents.

⑦ Other/Monitoring:

In this Project, PGCB is responsible for monitoring the land acquisition and compensation payment in the planning stage; the air, noise, water, ecosystem, and other pollution during the construction; and the ecosystem protection, waste management, working environment, and other relevant matters after the commencement of the

operation of the facilities.

2) Promotion of Poverty Reduction:

None in particular.

3) Promotion of Social Development:

This Project is not classified as a gender project since it is hardly possible to take specific actions that can contribute to gender equality.

(8) Collaboration with Other Donors

None in particular.

(9) Other Important issues

None in particular.

**4. Targeted Outcomes**

(1) Quantitative Effects

1) Performance Indicators (Operation and Effect Indicator)

Indicator	Baseline (Actual value in FY2014)	Target (in 2023) [Expected value two years after project completion]
<b>400kV/230kV transformer capacity (MVA)</b>		
Meghnaghat Substation	-	1,500
New Meghnaghat Substation	-	2,250
<b>230kV/132kV transformer capacity (MVA)</b>		
Old Madunaghat Substation	-	900
<b>Average operating ratio of the 400kV/230kV transformers (%)</b>		
Meghnaghat Substation	-	38
New Meghnaghat Substation	-	35
<b>Average operating ratio of the 230kV/132kV transformer (%)</b>		
Old Madunaghat Substation	-	23
<b>Sending-end output of the 400 kV transmission lines (GWh per year)</b>		
Matarbari Power Plant - New Madunaghat Substation	-	12,569
New Madunaghat Substation - Meghnaghat Substation	-	6,878
<b>Transmission loss rate of the 400 kV transmission lines (%)</b>		
Matarbari Power Plant - New Madunaghat Substation	-	1

Indicator	Baseline (Actual value in FY2014)	Target (in 2023) [Expected value two years after project completion]
New Madunaghat Substation - Meghnaghat Substation	-	1

(2) Qualitative Effects

Bangladesh's economic development and mitigation of climate change

(3) Internal Rate of Return

Based on the conditions indicated below, the Economic Internal Rate of Return (EIRR) and Financial Internal Rate of Return (FIRR) of this Project were calculated to be 20.33% and 12.88%, respectively.

**【EIRR】**

Cost: Project costs (excluding taxes), operation and maintenance costs, and electricity purchase costs

Benefit: Reduction in the cost of alternative energy production and consumers' willingness to pay (WTP) for additional electricity to be sold on the market

Project Life: 35 years

**【FIRR】**

Cost: Project costs, operation and maintenance costs

Benefit: Estimated revenue of power transmission

Project Life: 35 years

**5. External Factors and Risk Control**

- (1) Preconditions: None in particular.
- (2) External Factors: None in particular.

**6. Evaluation Results and Lessons Learned from Past Projects**

(1) Results of Evaluation of Similar Past Projects

The results of the ex-post evaluation of the Anpara Power Transmission System Project (1) and (2) in India identified the following lesson: when systems with new specifications, such as super-high voltage transmission lines, are introduced for the first time in the country, it is necessary to formulate a realistic implementation plan based on a sufficient examination of the possibility of difficulties and obstacles arising in terms of administrative procedures because the country may have not established relevant criteria, such as those for permission for deforestation and approval required by the aviation law.

(2) Lessons for the Project

This Project will build the first 400kV extra-high-voltage transmission lines in Bangladesh; therefore, based on the above-mentioned lesson learned, this Project will formulate an implementation plan after confirming the approval processes and administrative procedures required to build high-voltage transmission lines.

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

### (1) Indicators to be Used

- 1) 400kV/230kV transformer capacity (MVA)  
Meghnaghat and New Meghnaghat Substations
- 2) 230kV/132kV transformer capacity (MVA)  
Old Madunaghat Substation
- 3) Average operating ratio of the 400kV/230kV transformers (%)  
Meghnaghat and New Meghnaghat Substations
- 4) Average operating ratio of the 230kV/132kV transformer (%)  
Old Madunaghat Substation
- 5) Sending-end output of the 400 kV transmission lines (GWh per year)  
The transmission line between Matarbari Power Plant and New Madunaghat Substation;  
and  
The transmission line between New Madunaghat Substation and Meghnaghat Substation
- 6) Transmission loss rate of the 400 kV transmission lines (%)  
The transmission line between Matarbari Power Plant and New Madunaghat Substation;  
and  
The transmission line between New Madunaghat Substation and Meghnaghat Substation

### (2) Timing of Next Evaluation

Two years after the completion of the Project (ex-post evaluation)