

# PROJECT INFORMATION DOCUMENT (PID) CONCEPT STAGE

Report No.: PIDC1098

<b>Project Name</b>	BD: Power Generation Efficiency Improvement Project (P128012)
<b>Region</b>	SOUTH ASIA
<b>Country</b>	Bangladesh
<b>Sector(s)</b>	Energy efficiency in Heat and Power (50%), Thermal Power Generation (50%)
<b>Theme(s)</b>	Infrastructure services for private sector development (100%)
<b>Lending Instrument</b>	Specific Investment Loan
<b>Project ID</b>	P128012
<b>Borrower(s)</b>	Government of Bangladesh
<b>Implementing Agency</b>	Bangladesh Power Development Board
<b>Environmental Category</b>	A-Full Assessment
<b>Date PID Prepared/ Updated</b>	22-Jul-2014
<b>Date PID Approved/ Disclosed</b>	22-Jul-2014
<b>Estimated Date of Appraisal Completion</b>	19-Feb-2015
<b>Estimated Date of Board Approval</b>	17-Jul-2015
<b>Concept Review Decision</b>	

## I. Introduction and Context

### Country Context

1. Bangladesh's economy has grown significantly since 1991 and its GDP growth rate averaged around 6% since last several years. This economic growth has largely been dependent on a reliable and affordable supply of electricity. Bangladesh's economy could have performed much better if the energy infrastructure had developed in line with the economic demands. Per capita consumption of electricity in the country is only 279 kWh/year (compared with the average of 555 kWh/year in the South Asia region, 2,631 kWh/year in China, and 8,283 kWh/year in OECD countries) while about 55% of the households have access to electricity and only 7% have access to natural gas. Peak electricity demand in the country is about 8,000 MW and the available generation capacity of 6,500 to 7,500 MW is insufficient to meet this demand. To address the current and future shortages, the Power Sector Master Plan (PSMP 2010) suggested for the addition of 30,000 MW of capacity by 2030 at an estimated cost of \$59 billion.

2. More than 75% of the power generation in Bangladesh is based on natural gas, whilst imported liquid fuels (Diesel/HFO) are used for 19%, hydro-generation for 3% and coal for 3% of the total generation mix. Although Bangladesh is rich in natural gas reserves, current gas production of 2,200 mmcf/d is about 500 mmcf/d below demand due to a low level of exploration work and inadequate gas transmission systems. Availability of gas through further gas exploration works will likely to take longer time. On the other hand, the country's huge coal reserves remain unutilized as the government is yet to finalize the coal policy to make way for domestic coal extraction. To reduce its high dependency on gas-based generation, the government has recently awarded contracts based on imported coal that is also facing challenges due to its infrastructure constraints. Meanwhile, about one third of the available generation capacity is based on gas-based steam cycle technology, operating at very low efficiency. In line with the apparent shortages in natural gas production, improving the efficiency of the gas based power plant and prioritizing gas supply for higher efficient power plants have become critical in order to improve the effectiveness of gas utilization in the whole power sector.

### **Sectoral and Institutional Context**

3. In the context of severe power shortages throughout the country, the Government of Bangladesh (GOB) has embarked upon an ambitious generation expansion plan that envisages adding 11,500 MW to the national grid by the year 2018. However, implementation of this target within the timeline has faced huge challenges, as some of the planned activities are already behind schedule. As part of the plan, a number of large gas-fired/dual fuel power plants (total capacity around 1,500 MW) and several large coal fired plants based on imported coal (around 4,000 MW capacity) were awarded to the private sector but they are yet to add capacity to the grid because of delay in reaching financial closure. As an emergency/interim measure, GOB had contracted about 2,400 MW of rental and quick rental plants (for 3-5 year terms) that are running on expensive liquid fuel.

4. In the present generation mix, about 42% of the total installed capacity is owned by the Bangladesh Power Development Board (BPDB). Private Power Producers (rentals and Independent Power Producers) account for 43% of installed capacity and the rest is held by corporations owned by the State. Most of BPDB's generation fleet has not been modernized and as a result, the average efficiency of these plants is around 30%. This contrasts starkly with modern Combined Cycle plant efficiencies of 60%. Of particular concern are the approximately 2,100 MW of gas-fired steam cycle plants, which operate at about 31% efficiency. Repowering of these facilities presents a ripe opportunity for expanding generation capacity as a least cost option using scarce natural gas more efficiently.

5. Since steam power plants can remain operational for many decades, it is an attractive proposition for older plants to be repowered to drastically improve their efficiency and produce higher levels of power with increased operating flexibility. It is not uncommon for a 30-year-old steam power plant to remain operational for an additional 20 to 30 years as part of a modern combined cycle plant. Such conversion technology can be a better alternative for a country like Bangladesh to a new combined cycle green-field project considering the current gas availability situation in the country for which government's focus has shifted towards coal based generation. GOB has, thus, accorded top priority to improving the efficiency and availability of the existing units. The same is also reflected in the road map of PSMP.

6. The financial position of the power sector has been deteriorating since 2009, because of the high tariffs associated with the rental and quick rental plants. As a result, there has been a

significant increase in budgetary transfers to BPDB to cover payments to the private generation plants. In 2012, the budgetary transfer amount was US\$840 million, which declined to US\$ 540 million in FY13 due to phased tariff adjustments since February 2011; the subsidy in FY14 has again gone up to US\$750 mill. This deficit will not go down further unless the contracts of the short term rentals are terminated and replaced by low cost base load power plants.

7. As the low cost base load power plants could not come into operation as planned, some of these rental contracts have been renewed to meet the generation shortfall at a negotiated tariff, lower from the original contract. Few rental contracts have been renewed with ‘no power, no payment’ basis (i.e. the capacity payment of the tariff component in rental contracts is excluded in the renewed contracts if no electricity is produced). In the long run, it is expected that the bulk and retail tariffs will continue to increase and generation costs will decline with the commissioning of the large power plants (including conversion of the existing steam plants to combined cycle) permitting the retirement of the costly liquid fuel plants. GOB therefore projects a reduction in budget support to a more sustainable level from FY15 onwards, with a long-range view of a commercially sustainable (unsubsidized) sector.

8. The power sector is organized under the Ministry of Power, Energy, and Mineral Resource (MPEMR). Since independence in 1971, the Bangladesh Power Development Board (BPDB) under MPEMR had been the single entity in the power sector to generate, transmit and distribute electricity. In 1977, the Rural Electrification Board (REB) was formed to build and operate electricity distribution in rural areas using a rural electric cooperative model. Bank’s support to BPDB started in 1979 and continued in three independent operations covering public sector generation, system loss improvement in transmission and distribution and strengthening of BPDB’s organizational and institutional performance. The last operation was closed in 1999, and since then the Bank has had no direct lending engagement with BPDB. While the generation project (Ashuganj) with BPDB (completed in 1988) went well, the development objectives of the other two operations with BPDB could not be achieved successfully. This was primarily due to weaknesses of the parastatal system, as demonstrated by high level system losses and accounts receivables. In this context, IDA (together with other sector donors) maintained a continuing dialogue with GOB on the need to introduce fundamental reforms to unbundle, commercialize and introduce substantial private sector participation in the sector.

9. The 1996 power sector reform policy set in motion a sector unbundling process which created a series of corporate entities. In this process, the Power Grid Company of Bangladesh (PGCB) was established to manage the country’s power transmission assets. Gas Transmission Company Limited (GTCL) was formed with the objective of establishing a balanced and reliable gas transmission network in the country. Separate power distribution companies were also created with few of them yet to be fully corporatized (South Zone Power Distribution Company (SZPDC), Central Zone Power Distribution Company (CZPDC) and North West Power Distribution Company (NWPDC)). On the generation side, the Ashuganj Power Station Company (APSCL), Electricity Generation Company (EGCB) and Northwest Power Generation Company (NWPGL) have been created as part of the unbundling process with BPDB still retaining some generation and distribution assets under its balance sheet.

10. The performance of these state-owned enterprises and the corporations has been mixed, affected by limited human capacity, blurred lines of accountability among Government, corporate boards, and management, and an uneven governance record. To address these weaknesses, the Power

Division of the Ministry has initiated a performance monitoring process and signed Memoranda of Understanding between the Power Division and the corporate entities, allowing Government to set annual targets to be achieved by the entities. This is a promising initiative, and additional measures are planned to ensure transparency and accountability.

11. Measures currently underway to promote accountability, transparency and efficiency include a re-structuring of BPDB's major assets and staff by assigning them to Strategic Business Units (SBUs) under a BPDB corporate umbrella. Each SBU is expected to operate quasi-independently, with its own board and management structure, a performance based employee evaluation system, etc. In support of this initiative, GOB had already issued a notice forming separate boards for each of these SBUs. However, the implementation of such SBUs is still facing challenges. The Government has requested the Bank to support this BPDB institutional governance initiative through a lending operation and AAA.

### **Relationship to CAS**

12. The proposed Project is consistent with the Country Assistance Strategy (CAS) for FY11-15, which aims to invest in new generation, rehabilitation, expansion of transmission capacity and to enhance the natural gas supply for power and other applications. The proposed Project contributes directly to this CAS objective by increasing generation capacity and efficiency in gas use by an existing public sector plant. The proposed Project also aligns with the Bank's strategic focus on mitigating climate change impacts and enhancing transparency and accountability in Bangladesh program. The Project would contribute to the reduction in carbon dioxide (CO<sub>2</sub>) emissions. This is very much in line with GOB's road map in the PSMP that aims to realize a low carbon society by introducing high efficient power supply and low CO<sub>2</sub> emission technology. The Project will also provide an opportunity to continue dialogue on improving overall governance in the energy sector, including engagement with the relevant authorities on good practice procurement processes for large contracts.

## **II. Proposed Development Objective(s)**

### **Proposed Development Objective(s) (From PCN)**

The proposed development objective of the Project is to increase generation supply and efficiency;

### **Key Results (From PCN)**

- a) Increase in power generation output of the targeted unit measured by GWh delivered;
- b) Efficiency gains of the targeted unit measured by fuel consumption per GWh output;

## **III. Preliminary Description**

### **Concept Description**

14. The proposed Project would re-power one of the four 210 MW gas-fired steam units at the Ghorashal power station complex by adding one gas turbine & generator (GTG) and a heat recovery steam generator (HRSG) to the existing steam turbine (ST) unit for an upgraded capacity of about 400 MW. This unit is currently generating 170MW and the overall efficiency of the unit is around 31%. The targeted unit for re-powering was identified through a feasibility study (completed in July 2012). The feasibility study looked into the full range of alternatives for increasing efficiency, including new combined cycle (CC) technology as well as other re-powering options (feed water, hot windbox, hybrid and full re-powering). Full re-powering came out to be the most economically viable options. According to the feasibility study, the proposed investments would increase the gross plant

efficiency of the identified unit to 54%, double its generation capacity, and reduce fuel consumption (per GWh) by 43%. The proposed Project will also be designed to operate the new gas turbine and existing steam plant independently from each other through a bypass stack allowing operational flexibility.

15. The project would be built at the existing site and most of the existing civil structures would be retained. This would reduce construction cost by 10 per cent as compared with new construction on a green-field site. Existing auxiliary equipment would be re-used with some modification and refurbishment. Repowering of the facility will help achieve reduction in operation and maintenance (O&M) cost, reduction in emissions and other discharges and minimization of capital cost expenditures.

16. With a nameplate capacity of 950 MW (including other two 55MW steam units), Ghorashal is the largest power station in the country. The identified steam turbine unit at Ghorashal was installed in 1989. However, they are very robust machines, and the feasibility study has confirmed that there are good prospects for cost effective refurbishment and upgrade of this unit that can increase its useful life to another 25 years once repowered. Incorporating these machines into a new combined cycle configuration is a challenging exercise, although international experience has demonstrated its practicality

17. As planned currently, the proposed operation has four components, notionally estimated at US\$400 million, of which US\$300 million is proposed for IDA financing. In addition to repowering of unit 4, the feasibility study recommended upgrading the associated power evacuation system and installing a gas pipe line. These two additional components have been included in the preliminary project scope at this stage, and their inclusion will be reassessed during project preparation.

18. Component 1: Re-powering of the target unit (\$250 million): This component would finance the attachment of a new gas-fired gas turbine to the existing 4th steam unit at Ghorashal and a heat recovery steam generator, power generator, and associated ancillary equipment for the full repowering of the identified unit. Draft Pre-qualification document and Bid document (with preliminary technical specifications) for this component have already been prepared by the consultants following the Bank guidelines and reviewed by BPDB. Technical Specifications will be finalized after the Quick Scan RLA (Residual Life Assessment) is complete and during the subsequent pre-bid conference with the potential developers.

19. Component 2: Installation of a new 230 kV GIS substation and 230 kV high voltage line (\$25 million): For evacuation of the additional power from the proposed project, a new 230 kV GIS substation and a new 27 km long high capacity 230 kV double circuit transmission line to Tongi grid substation need to be installed by Power Grid Company of Bangladesh (PGCB). The new GT has to be connected to the new 230 kV GIS substation by means of a step-up transformer, a 230 kV cable and a 230 kV switchgear bay.

20. Component 3: Installation of a new gas pipe line (US\$15 million): At present gas is supplied to Ghorashal Power Station from Titas Gas Transmission & Distribution System through a 16 inch diameter pipeline and a Regulating & Metering Station (RMS) situated at the north east corner of the Power Station complex. Due to space constraint, a new gas station will need to be installed at the space available west of the proposed repowering site. One 16" gas line from inlet header of Titas RMS to be installed up to the bus of the gas station as mentioned above. From this

bus, several gas lines will branch out. Individual branch will lead through gas compressor and associated facilities prior to connection to the individual unit to be repowered. This component, if agreed, will be implemented by Gas Transmission Company Limited (GTCL).

21. Component 4: TA for institutional strengthening support (\$10 million): To sustain the gains of the conversion through re-powering, it would be necessary to build up implementation and O&M management capacity and better monitoring and evaluation (M&E) of plant performance at the power station. This component would finance an Owner's Engineer (implementation support consultant) to support effective management of the construction and initial operation of the new power plant. This component would also support BPDB in the development and implementation of processes, procedures, standards, monitoring and management for the SBU model. Relevant training and study tours for the core BPDB project team and power plant personnel would be organized to enhance familiarity with the operation of the proposed installation. During preparation, BPDB will explore whether the experience under the IDA financed Siddhirganj project which uses Enterprise Resource Planning (ERP), would be relevant for this project and could be implemented at Ghorashal covering all the units.

#### IV. Safeguard Policies that might apply

<b>Safeguard Policies Triggered by the Project</b>	<b>Yes</b>	<b>No</b>	<b>TBD</b>
Environmental Assessment OP/BP 4.01	x		
Natural Habitats OP/BP 4.04	x		
Forests OP/BP 4.36		x	
Pest Management OP 4.09		x	
Physical Cultural Resources OP/BP 4.11	x		
Indigenous Peoples OP/BP 4.10			x
Involuntary Resettlement OP/BP 4.12	x		
Safety of Dams OP/BP 4.37		x	
Projects on International Waterways OP/BP 7.50		x	
Projects in Disputed Areas OP/BP 7.60		x	

#### V. Financing (in USD Million)

Total Project Cost:	400.00	Total Bank Financing:	300.00
Financing Gap:	0.00		
<b>Financing Source</b>			<b>Amount</b>
BORROWER/RECIPIENT			100.00
International Development Association (IDA)			300.00
Total			400.00

#### VI. Contact point

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