

DRAFT TERMS OF REFERENCE FOR
“TECHNICAL ASSISTANCE PROJECT WITH FEASIBILITY STUDY FOR
MADUNAGHAT – BHULTA 765kV TRANSMISSION LINE PROJECT”

A. INTRODUCTION

1. Justification for Project Preparation Assistance

PGCB has requested a Project Preparation Special Fund (PPSF) from the Asian Infrastructure Investment Bank (AIIB) to prepare an investment project for 765 kV transmission line “Madunaghat-Bhulta” and reliable electricity access (main development project). This PPSF is required to prepare detailed Feasibility study, design studies, environmental and social assessment for the Project. To satisfy AIIB’s due diligence requirements, it is required to review the existing studies to develop the project viability in terms of technical, financial, economic, environmental, social, institutional and legal aspects, sector policies and safeguard contexts, in conjunction with the country partnership strategies, operational experiences and lessons learned from the evaluation of previous similar projects. The PPSF resources will be used to prepare these additional analyses and documentation to be then considered by AIIB Board for a loan to the Project.

2. Brief Description of the Implementation Organization:

The Project will be implemented by Power Grid Company of Bangladesh (PGCB). PGCB was formed under the restructuring process of the Power Sector in Bangladesh with the objective of bringing about commercial environment including an increase in efficiency, the establishment of accountability and dynamism in accomplishing its objectives. PGCB was incorporated in November 1996 with an authorized capital of Tk.100 billion. It was entrusted with the responsibility to own the national power grid to operate and expand the same with efficiency. Pursuant to a decision by the Government to transfer transmission assets to PGCB from Bangladesh Power Development Board (BPDB) and Dhaka Electric Supply Authority (DESA), PGCB completed taking over all the transmission assets on 31.12.2002 and assumed full responsibility for establishing, owning and operating the high voltage grid network in Bangladesh.

At present, the generated power of different power plants all over the country, as well as cross-border imported power, is evacuated and transmitted through PGCB's integrated grid system by 400 kV, 230 kV and 132 kV transmission lines and substations. In 1996 when PGCB was formed, the total length of 230 kV and 132 kV lines were 838 ckt km and 4755 ckt km respectively which increased to 1144 ckt km and 4962 ckt km respectively in the 2000-01 fiscal year. At present, there are 861 ckt km of 400 kV line, 3657.9 ckt km of 230 kV line and 7974.6 ckt km of 132 kV line throughout Bangladesh under PGCB. PGCB has established an optical fiber network (OPGW) for a secure and reliable digital communication system to improve the control and monitoring of the transmission system and to lease “dark fiber” to the telecommunications companies.

3. Project description and rationale

Bangladesh's electricity demand is growing very rapidly. To meet the growing demand the Government is giving priority for electricity generation projects. Due to the inadequacy of primary fuel/energy resources in the country, and to ensure fuel security the Government has

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focused on imported fuel based power plants near coastal areas, especially at Barisal, Khulna and Chattogram regions.

According to the latest electricity generation plan of Bangladesh Power Development Board (BPDB), about 5040 MW of power plants will be installed at Moheshkhali area up to 2030 and later it will be a major generation hub for Bangladesh. To evacuate this electricity from the planned power plants to the load centers in Dhaka and Chattogram Zone several high capacity transmission lines will be required from Moheshkhali to Dhaka and Chattogram Zone. It may be noted that Meghnaghat – Madunaghat – Matarbari 400 kV transmission line is under construction funded by other financial institutions. 400kV double circuit another transmission line between Madunaghat–Matarbari is also planned to be implemented for evacuating generated power of Matarbari and adjacent areas.

In addition to the 400 kV network between Matarbari-Madunaghat, 765 kV systems would be essential for bulk power evacuation from Moheshkhali region to load centers in a secured and economic manner.

Within the Project, it is planned to construct a 765 kV line from Madunaghat to Bhulta which will be initially charged at 400 kV voltage level. The Project's objective is to upgrade and strengthen the transmission network and promote reliable electricity access in Bangladesh. The Project aims to build an ultra-high voltage transmission corridor between the major economic centers of Chattogram and Dhaka. The Project includes two phases:

Phase 1: Project preparation (January 2022 – December 2023), including comprehensive detailed project studies and Environmental and Social Impact Assessment and preparation of bid documents with the use of AIIB Special Fund grant;

Phase 2: Project bidding process (January 2024 –November, 2024) and implementation (January 2025 – December, 2029) – construction of 765 kV transmission line “Madunaghat – Bhulta” (250 km) and, necessary 400 kV bay extensions at Bhulta and Madunaghat substations for the line to be charged and operated at 400 kV voltage level initially, with the use of AIIB long-term sovereign loan.

Another ultra-high voltage electricity transmission line between Madunaghat and Moheshkhali (100 km) will be built simultaneously by the Government, with the aid from other financial institutions. Both projects will form a joint trunk energy infrastructure for the exchange of electricity between Moheshkhali, Chattogram and Dhaka, therefore their implementation is to be coordinated. The Moheshkhali - Madunaghat 765kV transmission line will also be initially charged at 400 kV voltage level.

Furthermore, high capacity lines would be constructed in the future as per the recommendation of the studies to evacuate power from the Moheshkhali area.

Scope of works of the main development project includes the following:

- a) Madunaghat - Bhulta 765 kV line (Hexa Bundle ACSR Cardinal): 250 km;
- b) Extension of 400 kV Bhulta Substation (2 nos. 400kV bays);
- c) Extension of 400 kV Madunaghat Substation (2 nos. 400kV bays);
- d) Engineering Layout/Single line diagram and identification of suitable space location for Madunaghat and Bhulta 765 kV substations to be built in the future.

As 765kV falls within ultra-high voltage class which is completely new in Bangladesh, a comprehensive engineering study by a competent and experienced international Consultant is required. The consulting firm will be recruited following quality and cost-based selection procedures (QCBS 80:20).

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B. SCOPE OF WORK

Consulting services for detailed feasibility study report of Madunaghat- Bhulta 765kV transmission line:

Terms of Reference. Consultants will prepare a full-fledged detailed Feasibility Study Report comprising system studies, engineering layouts, design memoranda, equipment specifications, cost estimates, necessary studies of Major Rivers along the route, environment and social assessment, financial and economic analysis, risk assessment, risk mitigation plan and risk transfer plan, bid documents for transmission line and bay extensions with knowledge sharing. Based on the study further action will be taken and Development Project Proposal (DPP) will be prepared. The Consultants will also be responsible for assisting PGCB in preparing the DPP. After the approval of DPP, Consultants will prepare bidding documents, then tender will be floated and the Consultants will assist in bid evaluation and contract award. Consultant will also prepare Engineering Layout, Single line diagram, basic cost estimate and identification of suitable space location for Madunaghat and Bhulta 765 kV substations to be built in future. The engineering support will last about 36¹ months from award.

1. Technical due diligence on the feasibility of the Project

- 1.1. Engineering studies and preparation of design memoranda for the 765kV Madhunaghat-Bhulta transmission line, including but not limited to the tower (both foundations and superstructure), ratings of insulators, type of conductors, bundle size of the conductors, ground wire and other associated line materials and hardware. Studies will include preparatory studies of the soils on route, assessments of the route surveys conducted, assessment and appraisal of the environment and social assessment reports, assessment of road, rail, and river crossings along with Morphology Study (if necessary). The memoranda will cover applicable standards, span criteria, design criteria, tower classifications and single line drawings (Line and Clearance diagram), foundation classifications and drawings, choice of conductor configurations, ground wire, sagging calculation, insulators, hardware and other line materials, tower footing earthing drawings, optimization of the route and transmission line costs, detailed cost estimation, contract packaging, and preparation of technical documentation for bid procurement. Technical Specification, BoQ shall be prepared as per PGCB and AIIB's Standard. The Consultant will recommend the conductor system loading, tower spotting data. The Consultant shall study initially on three routes and recommend one route from those three routes along with comparison. Survey data (easting, northing and elevation) to be supplied in Microsoft Excel file and the routes will be submitted in AutoCAD along with hardcopy.
- 1.2. System Planning Studies: This will cover load flow, short circuit, stability, Contingency and reactive compensation studies. Based on these studies, the Consultant will recommend the design parameters of the 765kV system so that it integrates well with the existing 400kV and 230kV systems of Bangladesh.
- 1.3. Design of 400kV Bays: The Consultant will propose standards, layouts, clearances, dimensions of sites and equipment, key equipment and basic parameters, costs, and procurement schedules. The choice of equipment should take into account the

¹ Detailed Feasibility study Preparation (and corresponding consultancy expenses) will take first 15 months, technical specifications and preparation & finalization of bidding documents will take another 9 months, and the rest of the time will be used for bidding evaluation.

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maintenance philosophy proposed to be adopted and logistic constraints in Bangladesh's rail, road, and river transport systems. Based on these engineering studies, the Consultant shall prepare a detailed bill of materials required for 400kV Bay Extensions at Madunaghat and Bhulta substations. The Consultant shall then prepare a detailed cost estimation, contract packaging and preparation of technical documentation for bid procurement.

The Consultant will prepare detailed SCADA/Communication and protection schemes for the 400kV network of Bangladesh and specify the bill of quantities along with technical specifications, cost estimates.

Using this information, the Consultant shall prepare bid document(s) suitable for procurement through international competitive bidding.

- 1.4. **Design of the 765kV Madunaghat and Bhulta Substations:** The Consultant will prepare single line diagram, layouts, location and dimensions of sites, basic cost estimate, basic parameters for the Madunaghat and Bhulta 765kV substations. Consultant will make a comparative analysis between 765/400kV AIS and GIS type substation, in case of GIS similar analysis will be required for indoor and outdoor type substation. Consultant will suggest suitable 765kV substation considering land requirement, operation flexibility and other important factors. The Consultant will also identify the land suitable for construction of these substations in future.

2. Economic and Financial analysis

Experts will assess the economic viability of the Project and conduct project economic analysis including assessment of all economic costs and benefits with sensitivity analyses and evaluation of economic internal rates of return.

Experts will undertake financial analysis of the proposed Project and assess the financial performance and the financial management capabilities of the implementation agency. They will identify all risks for revenues and costs with sensitivity analyses and evaluate financial internal rates of return, propose risk mitigation and risk transfer plans as necessary. Economic and financial analysis shall cover the life of the project.

3. Environmental and Social Impact Assessment

In accordance with the applicable national requirements, international best practices, including those promulgated by other international financial institutions and AIIB's Environmental and Social Framework (2016), the Consultant will (i) prepare environmental assessment and review framework and (ii) prepare Environmental and Social Impact Assessment (ESIA) report including the Environmental and Social Management Plans (ESMPs), Biodiversity Management Plan, updated IEE.

In line with AIIB's Environmental and Social Framework (2016), the Consultant will (i) prepare resettlement and indigenous people's plans and a resettlement framework, as required; (ii) review the government policies and strategies for poverty reduction and gender development; (iii) conduct a social analysis and (iv) prepare social action plans, if required.

4. Procurement assessment and planning

The Consultants are engaged to prepare a project delivery strategy(PDS) as well as procurement plan (PP) in accordance with AIIB's Procurement Policy (2016), Procurement Instructions for Recipients and complete tender documentation. Experts shall develop a PDS/PP for project packaging and sequencing for procurement and shall confirm the appropriate contract type for each package along with the detail technical specifications, BoQ, schedules and drawings for

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bidding of the project on a Plant-Design basis (EPC basis). They shall provide recommendations covering the key contract conditions and arrangements and prepare the Quality Assurance Plan for implementation during the construction. Consultant will help PGCB to issue the clarification during bidding process for transmission line and bay extensions. The Consultants will assist in bid evaluation and contract award. The whole procurement process shall be conducted in accordance with the AIIB Procurement Policy and Procurement Instructions for Recipients which can be downloaded from the AIIB external website.

C. EFFORTS

The TOR will require a total of about 128 person-months of effort, as shown in the table below:

<u>Positions</u>	<u>Person-months</u>
International	
Power System Development Specialist, Concurrently Team Leader	24
Transmission Line Design Specialist	18
Power System Studies Specialist	6
Substation Design Specialist	10
Civil Engineer	6
Power System Economist	2
Financial Specialist	4
Environment Specialist	3
Social Development Specialist	3
Procurement Specialist	4
Route Survey/Topographical Expert	3
Total International	<u>83</u>

<u>Positions</u>	<u>Person-months</u>
National	
System Planning Specialist	6
Detailed Engineering Specialist	6
Procurement Specialist	4
Environment Specialist	10
Social Development Specialist	10
Civil Engineer	3
Geotechnical Expert	3
Route Survey/Digital Mapping Expert	3
Total National	<u>45</u>

D. CONSULTANTS QUALIFICATION AND EXPERIENCE

I. International Consultants:

1. Power System Development Specialist (Team Leader) (international 24 person- months):

The international expert should have a degree (at least B.Sc. degree) in electrical engineering, minimum 15 years of experience in a power transmission utility/engineering company with a track-record in at-least 400 kV or higher voltage systems with international experience. The

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expert must have at least 8 years' experience in 765 kV/higher voltage class projects. Expert should provide testimonials from previous employers, if any.

Job responsibilities:

- i) Team Leader will be in charge of overall Consulting Services under the contract.
- ii) The Consultant will be the contact point of PGCB for all services.
- iii) As a team leader his/her responsibility is to divide tasks specified in TOR and as per requirements of AIIB and PGCB to the appropriate personnel/team members, coordinating the team of experts and consolidating and delivering high quality of deliverables needed for AIIB and PGCB.

2. Transmission Line Design Specialist (international 18 person- months):

Transmission Line Design Specialist should have a degree (at least B.Sc. degree) in electrical/mechanical/civil engineering with minimum 15 years of experience in a power transmission utility/engineering company with track-record in at-least 400 kV or higher. The expert must have 5 years' experience in design and/ or construction supervision of 765 kV/higher voltage class transmission line projects.

Job responsibilities:

- (i) The Consultant should review the survey data carried out by the route survey experts and examine at least three possible routes of the transmission line;
- (ii) Prepare the scope, detailed design and equipment specifications of the transmission towers, conductor, OPGW, and associated hardware fittings and make necessary inputs and prepare project designs and bidding documents;
- (iii) Assist PGCB in evaluation of technical and financial bids to be received against ICB for engagement of turnkey contractor, preparation of bid evaluation reports, contract negotiations and draft contract agreements as per requirements of AIIB and submission of documents to PGCB for review and approval;
- (iv) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

3. Power System Studies Specialist (international 6 person- months):

The international expert should have a degree (at least B.Sc. degree) in electrical engineering with minimum 15 years' experience as a power system analyst especially in high voltage transmission systems. The expert must have experience in Power System Simulation Software like PSSE/ PSAF / Equivalent software.

Job responsibilities:

- (i) The Consultant should review the most recent Transmission Master Plan and other reports of planned transmission and generation expansion plans as well as planned generation in the area of project.
- (ii) The Consultant will then review existing load flow modeling, contingency analysis, short circuit calculations, transient stability analysis, reactive compensation studies, insulation coordination studies, etc, for the mentioned transmission line under study and determine the extent to which refinements or the extensions of models are necessary to make it sufficient basis for base design.

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(iii) The studies would also determine the reactive power compensation (capacitors/reactors, series/shunt) for normal and disturbed condition of system. The work involves expanding the substations and this review should also establish load transfer schemes to reconnect the circuits to the newly expanded substations.

(iv) The Consultant shall collect all required data/information/drawings from all concern departments/authorities with the administrative support of PGCB.

(v) The Consultant will carry out all necessary analyses for transformer sizing, overhead primary and secondary conductor sizing, conductor loading limits, short circuit rating of switchgears and operating characteristics etc.

(vi) Consultant will recommend the design parameters of the 765kV system so that it integrates well with the existing 400kV and 230kV systems of Bangladesh.

(vii) PSSE or equivalent software should be used for load flow and other system studies. But the output/softcopies of the studies must be provided in such a format that it can be checked using PSSE software by PGCB.

(viii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

4. Substation Design Specialist (international 10 person- months):

The expert should have a degree (at least B.Sc. degree) in electrical engineering with minimum 15 years' experience as a Sub-station Engineer/ Design Engineer/ Protection Engineer especially in High Voltage (at least 400 kV/higher) transmission system. The expert must have 5 years' experience in 765 kV/higher voltage class projects as well.

Job responsibilities:

i) The Consultant will propose standards, layouts, clearances, dimensions of sites and equipment, key equipment and basic parameters, costs, and procurement schedules of the 400kV bay extensions at Madhunaghat and Bhulta substations. The choice of equipment should take into account the maintenance philosophy proposed to be adopted and logistic constraints in Bangladesh's rail, road, and river transport systems.

ii) Based on these engineering studies, the Consultant will prepare a detailed bill of materials required for 400kV Bay Extensions at Madunaghat and Bhulta substations.

iii) The Consultant will prepare a detailed cost estimation, contract packaging and technical documentation for bid procurement for bay extension.

iv) The Consultant will prepare detailed SCADA/Communication and protection schemes for the 400kV network of Bangladesh and specify the bill of quantities along with technical specifications, cost estimates for bay extension.

v) The Consultant will prepare bid document(s) suitable for procurement through international competitive bidding for bay extension.

vi) The Consultant will prepare single line diagram, layouts, location and dimensions of sites, basic cost estimate, basic parameters for the Madunaghat and Bhulta 765kV substations.

vii) Consultant will make a comparative analysis between 765/400kV AIS and GIS type substation, in case of GIS similar analysis will be required for indoor and outdoor type substation.

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viii) Consultant will suggest suitable 765kV substation sites considering land requirement, operation flexibility and other important factors. The Consultant will also identify the land suitable for construction of these substations in future and PGCB will help the Consultant to identify the land by visiting the proposed site with the Consultant.

ix) Assist PGCB in evaluation of technical and financial bids for the 400 kV bay extensions to be received against ICB for engagement of turnkey contractor, preparation of bid evaluation reports, contract negotiations and draft contract agreements as per requirements of AIIB and submission of documents to PGCB for review and approval;

x) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

5. Civil Engineer (international 6 person- months):

The international expert should have a degree (at least B.Sc. degree or equivalent) in civil engineering with minimum 15 years' experience in design/construction supervision of at least 400kV / higher voltage transmission line projects as a civil engineer. The expert must have 5 years' experience in 765 kV / higher voltage class projects as well.

Job responsibilities:

(i) Take necessary actions on transmission line structural matters including foundation for towers;

(ii) Prepare the foundation design for tower;

(iv) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

6. Power System Economist (international 2 person- months):

The international expert should have a Graduate/Master's degree in Economics or comparable qualification with minimum 8 years of work experience in power system economic analysis and work experience with Multilateral Development Banks (MDBs) (i.e AIIB/ADB/WB or equivalent). Experience in power sector projects /high voltage transmission line projects as Economist will be preferable.

Job responsibilities:

The Consultant will analyze the economic viability of the project as per International and Bangladesh standard and norms. The major responsibilities are:

i) Analyze the economic viability of the project. Identify all economic costs and benefits along with sensitivity analyses and evaluate Economic Net Present Value, Economic Benefit Cost Ratio and Economic Internal Rates of Return.

ii) Prepare risk assessment as necessary. Economic analysis should cover the life of the project.

iii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

7. Financial Specialist (international 4 person- months):

The international expert should have at least Bachelor's degree on finance or accounting or comparable qualification from a reputable institution with minimum 8 years of relevant financial experience. Experience with Multilateral Development Banks (MDBs) (i.e AIIB/ADB/WB or equivalent) in power sector projects in Asia will be preferred.

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Job responsibilities:

The Consultant will analyze the financial viability of the project as per International and Bangladesh standard and norms. The major responsibilities are:

- i) Analyze the financial viability of the project. Identify all financial costs and benefits along with sensitivity analyses and evaluate Financial Net Present Value, Financial Benefit Cost Ratio and Financial Internal Rates of Return.
- ii) Prepare risk assessment as necessary. Financial analysis should cover the life of the project.
- iii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

8. Environment Specialist (international 3 person- months):

The international expert should have Graduate/Master's degree in environmental science or similar with at least 8 years of experience in technical assistance of development institutions (i.e AIIB/ADB/WB or equivalent), particularly in the power sector. Experience in power sector projects/High Voltage Transmission Line Projects as Environment Specialist will be preferable.

Job responsibilities:

- i) Review safeguard issues and prepare an Environment Impact Assessment of the project including impact of land acquisition and resettlement.
- ii) Guidelines for Environmental consideration through assessment of environmental check list, outline of environmental related law and regulation of Bangladesh and details of environmental impact assessment of Bangladesh require for the project report. The EIA shall also be compliant with AIIB's requirements.
- iii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.
- iv) Based on the above assessment and analyses, in accordance with the applicable national requirements, international best practices, including those promulgated by other international financial institutions and AIIB's Environmental and Social Framework (2016), the Consultant will prepare Environmental Impact Assessment (EIA) report including the Environmental Management Plans (EMPs) and submission of documents to PGCB.

9. Social Development Specialist (international 3 person- months):

The international expert should have Graduate/Master's degree in sociology, anthropology or similar subject with at least 8 years of experience preparing resettlement and other social development plans in accordance with Multilateral Development Banks (MDBs) (i.e AIIB/ADB/WB or equivalent) guidelines.

Job responsibilities:

- i) Determine Social Impact of the project including Social resettlement.
- ii) Prepare land acquisition and Resettlement Action Plan and describe mitigation measures (if required).
- iii) Review of safeguard issues regarding social impacts, involuntary resettlement and indigenous peoples
- iv) Determine Mitigation Measures including budget estimation

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v) In line with AIIB's Environmental and Social Framework (2016), the Consultant will prepare resettlement and indigenous people's plans and a resettlement framework, as required; review the government policies and strategies for poverty reduction and gender development; conduct a social analysis and prepare social action plans, if required.

vi) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

vii) Any Clarification/review raised by the concerned authorities shall be explained by the consultant.

viii) Based on the above assessment and analyses, in accordance with the applicable national requirements, international best practices, including those promulgated by other international financial institutions and AIIB's Environmental and Social Framework (2016), the Consultant will prepare Social Impact Assessment (SIA) report including the Social Management Plans (SMPs) and submission of documents to PGCB.

10. Procurement Specialist (international 4 person- months):

The international expert should have at least Graduation in any Engineering field/Post-Graduation in Procurement/supply Chain Management/Business Administration or any relevant subject with minimum 10 years' experience in procurement in power sector projects and experience with Multilateral Development Banks (MDBs) (i.e AIIB/ADB/WB or equivalent) funded projects. Experience in bid document preparation, evaluating bids/proposals for internationally advertised complex supply and installation/works procurements. Experience in Bangladesh would be beneficial.

Job responsibilities:

(i) Prepare a procurement plan in accordance with AIIB's Procurement Policy (2016) and complete tender documentation for the project covering the implementation schedule, right-of-way acquisition, permitting, procurement of works (and supply and installation) services, contractor mobilization, construction, commissioning/testing, handover, Defect liability and warranty periods, and contract close out for each contract. Experts shall develop a plan for project packaging and sequencing for procurement and shall confirm the appropriate contract type for each package.

(ii) Prepare cost estimates based on quantities taken from the design and realistic unit prices derived from ongoing or recently completed similar works in Bangladesh and in the region by international and local contractors. Project costs shall also include a physical contingency sum based on perceived risk, and a price contingency sum, taking into account appropriate cost escalation factors and the period of time over which the works will be designed, procured, and constructed. the Consultant should develop a Unit Price Analysis for each work item and a Cost Estimate, for each work item, work category, section as may be defined and contract package as a whole.

(iii) Prepare and finalize the bidding documents following similar works in Bangladesh along with detail technical specifications, Bill of Quantities (BoQs), schedules and drawings for bidding of the project and submit documents with incorporation of suggestions from approving agencies.

(iv) The expert will provide recommendations covering the key contract conditions and arrangements and prepare the Quality Assurance Plan for implementation during the construction.

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(v) Consultant will assist PGCB to issue the clarification during bidding process for transmission line and bay extensions. The Consultant will assist PGCB on preparation of technical and financial bid evaluation reports and contract negotiations and draft contract agreements and contract award.

(vi) Perform other functions as may be reasonably requested by AIIB through PGCB from time to time during the time of assignment.

11. Route Survey/ Topographical Expert (international 3 person- months):

The expert will be in charge of Route Survey/Topographical Consultant under engineering consulting services. He/She should graduate in Environmental Science/Geography/Engineering and must have at least ten (10) years' experience in the relevant field as a consulting engineer for the 400 kV/higher voltage transmission line project.

Job responsibilities:

i) Carry out the desk study and walkover survey of at least three possible routes of each transmission lines;

ii) Carry out the detail survey of the final route alignment following the modern international practices/standards of detail surveying of High Voltage transmission line route. The survey shall be carried out by using state-of-the-art survey techniques and instruments having error within the standard acceptable limit.

iii) Carry out Topographic Survey of entire substation area of each transmission line, covering all the features within and outside the Substation boundaries

iv) Preparation of plan and profile drawings of the recommended route by following the internationally accepted practices.

v) The final route alignment along with all the towers spotted shall be overlaid with the cadastral map of area through which line passes. The land plots over which tower shall be erected and under the right of way of lines shall be clearly shown in the cadastral map.

vi) Shall perform an assessment of the final proposed route and tower locations through the lens of prospective works contractors, identifying the likely equipment needed, access requirements, and corresponding production rates and labor requirements taking into account a reasonable means and methods anticipated during construction.

II. National Consultants:

1. System Planning Specialist (national 6 person- months):

The national expert should have at least Graduate in Electrical Engineering with minimum 10 years of experience in a power transmission utility as Power System Planning/Load dispatch Engineer.

Job responsibilities:

i) The Consultant will assist the International Consultant in the review of the most recent Transmission Master Plan and other reports of planned transmission and generation expansion plans as well as planned generation in the area of project.

ii) The Consultant will assist the International Consultant in the review of existing load flow modeling, contingency analysis, short circuit calculations, transient stability analysis, insulation coordination studies, etc, for the mentioned transmission line under the study and determines the extent to which refinements or the extensions of models are necessary to make it sufficient basis for base design.

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iii) The studies would also determine the reactive power compensation (capacitors/reactors, series/shunt) for normal and disturbed condition of system. works involves expanding the substations and this review should also establish load transfer schemes to reconnect the circuits to a newly expanded substation.

iv) The Consultant will assist the International Consultant in carrying out all necessary analyses for transformer sizing, overhead primary and secondary conductor sizing, conductor loading limits, short circuit rating of switchgears and operating characteristics etc.

2. Detailed Engineering Specialist (national 6 person- months):

The national expert should have at least Graduation in Electrical Engineering with minimum 8 years' experience in design, specification, bid preparation, evaluation, construction, testing and commissioning of 230 kV or higher EHV transmission line/Substation. Experience in 400 kV transmission line/substation will be preferable.

Job responsibilities:

i) Assist the international Consultant in performing base engineering designs of the transmission line with detailed technical specifications including detailed design calculations for the 765kV transmission lines and substations extension.

3. Procurement Specialist (national 4 person- months):

The national expert should have at least Graduation in any Engineering field/ Commerce/Business Studies or other relevant field with Post-Graduation in Procurement/supply Chain Management/Business Administration or any relevant subject with minimum 10 years' experience in bid document preparation, evaluating bids/proposals for internationally advertised complex supply and installation/works procurements of power sector projects. Experience with foreign bank/organization funded projects is preferable.

Job responsibilities:

i) Assist the international Consultant in preparing a procurement plan in accordance with AIIB's Procurement Policy (2016) and complete tender documentation for the project.

ii) Assist the international Consultant in preparation of cost estimates based on quantities taken from the design and realistic unit prices derived from ongoing or recently completed similar works in Bangladesh and in the region by international and local contractors. Project costs shall also include a physical contingency sum based on perceived risk, and a price contingency sum, taking into account appropriate cost escalation factors and the period of time over which the works will be designed, procured, and constructed.

iii) Assist the international Consultant in evaluation of technical and financial bids to be received against ICB for engagement of turnkey contractor, preparation of bid evaluation reports, contract negotiations and draft contract agreements as per requirement of AIIB and submission of documents to PGCB for review and approval for transmission line and bay extension and contract award; and

iv) Perform other functions as may be reasonably requested by the International Consultant from time to time during the time of assignment.

4. Environment Specialist (national 10 person- months):

The national expert should have at least Graduate/Master degree in Environment Management or relevant subject with minimum 7 years' experience in Environment Impact Assessment. Experience in EIA for power sector projects is preferable.

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Job responsibilities:

- i) Assist the International Experts through data gathering, route surveys, technical assessments, meetings with affected parties, and other activities as may be needed for preparation of an EIA
- ii) Assist the International experts through preparation of an outline of environmental related law and regulation of Bangladesh and details of environmental impact assessment of Bangladesh require for the project
- iii) Assist the international Consultant in review of safeguard issues regarding environmental impacts, involuntary resettlement and indigenous people.

5. Social Development Specialist (national 10 person- months):

The national expert should have at least Graduate/Master's degree in Social Science or relevant subject with minimum 5 years' experience in Social Impact Assessment. Experience in SIA for power sector projects is preferable.

Job responsibilities:

- i) Assist the International expert in review and preparation of the Social Impact Assessment Study, including review of the land acquisition and resettlement plans, and suggest mitigative measures.
- ii) Assist the international Consultant in preparing guideline for social consideration through assessment of check list, outline of related law and regulation of Bangladesh and details of social impact assessment of Bangladesh require for the project
- iii) Assist the international Consultant in preparation of land acquisition and Resettlement Action Plan and describe mitigation measures.
- iv) Assist the international Consultant in review of safeguard issues regarding social impacts, involuntary resettlement and indigenous people. Facilitate discussions with project affected persons.

6. Civil Engineer (national 3 person- months):

The national expert should have a degree (at least B.Sc. degree or equivalent) in civil engineering with minimum 7 years' experience in design/construction supervision of at least 230kV / higher voltage transmission line projects as a civil engineer. Experience in 400 kV transmission line/substation will be preferable.

Job responsibilities:

- (i) Assist the international Consultant on transmission line structural matters including foundation for towers;
- (ii) Assist the international Consultant to collect data and prepare the foundation design for tower;
- (iii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

7. Geotechnical Engineer (national 3 person- months):

The expert should be a graduate in civil engineering and experienced (at least 7 years) in 230kV or above transmission line tower foundations and soil testing.

Job responsibilities:

The Consultant will conduct the tasks including but not limited to:

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- i) Perform geo-technical investigations and field sampling and measurements to determine of site soil conditions in conjunction with other team members;
- ii) Carry out assessment of geological conditions to determine the suitability of site for the tower erection and substation construction. Major geological hazards and constraints will be identified by the F/S team. Taking into account the hazards and constraints, the optimum location for the proposed construction will be selected.
- iii) Take necessary actions on transmission line geotechnical matters; and
- iv) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

8. Route Survey/ Digital Mapping Expert (national 3 person- months):

The expert will be in charge of Route Survey/GIS Mapping Consultant under engineering consulting services. He/She should graduate in Environmental Science/Geography/Engineering and must have at least seven (7) years' experience in the relevant field as a Consultant engineer for the transmission line project/Underground power lines project.

Job responsibilities:

- i) Assist the international Consultant in carrying out the desk study and walkover survey of at least three possible routes of each transmission lines;
- ii) Carry out the detailed survey of the final route alignment following the modern international practices/standards of detail surveying of High Voltage transmission line route. The survey shall be carried out by using state-of- the-art survey techniques and instruments having error within the standard acceptable limit.
- iii) Preparation of plan and profile drawings of the recommended route by following the internationally accepted practices.
- iv) The final route alignment along with all the towers spotted shall be overlaid with the cadastral map of area through which line passes. The land plots over which tower shall be erected and under the right of way of lines shall be clearly shown in the cadastral map.
- v) Shall perform an assessment of the final proposed route and tower locations through the lens of prospective works contractors, identifying the likely equipment needed, access requirements, and corresponding production rates and labor requirements taking into account a reasonable means and methods anticipated during construction.

E. Major Outputs and Activities

Consulting services are required to assess all aspects of the Project and provide sufficient data, information and inputs to prepare Project documents for loan approval by AIIB, project documents required by PGCB for obtaining Government approval as well as soliciting bids for construction of the Transmission lines and Bay extensions, information about 765kV substation as mentioned above. The main output of the PPSF will be a detailed project report consisting of (i) technical, economic and financial due diligence; (ii) detailed project cost estimates; (iii) environmental and social impact assessment in case of category A, including environmental and social management plan and resettlement plans in Bangladesh, if needed; (iv) project delivery strategy, procurement plan and implementation schedule (v) Other studies and sharing of Knowledge for capacity development will be financed under the Project Preparation and (vi) Raw data/information/inputs and casefiles/outputs of all software's prepared by the consultant shall be deliverable to PGCB.

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The major outputs and activities are in the table below:

Major Activities	Expected Completion	Major Outputs
Technical due diligence on the Project	March 2023	Detailed data/casefiles, study report and cost estimates
Financial and economic analyses	March 2023	Reports on economic and financial analyses
Procurement assessment and planning	December 2023	Bidding documents
Environmental and Social Impact Assessment	December 2022	Updated IEE, ESIA Report, RAP Report, Biodiversity management plan, Indigenous people plan framework, Environmental and Social Management Plan.

F. Implementation Arrangements

Main activities under PPSF will be implemented during January 2022– December 2024. Resources of the PPSF will be utilized in accordance with the Rules and Regulations of the AIIB Project Preparation Special Fund (2016). The proposed processing and implementation schedule is shown in the table below:

Major Milestones	Expected Completion Date
Draft Feasibility Study report	December 2022
Submission of final Feasibility Study report	March 2023
Project start-up support including transmission line bidding	April 2023
DPP preparation & Approval. Bid document preparation for Transmission lines and Bay extensions	April 2023 – December 2023
Clarification during bidding process and Bid evaluation of Transmission lines and Bay extensions	January 2024 – November 2024