



**Detailed Terms of Reference as well as EOI Document
For**

**Detailed Feasibility study, Initial Environmental Examination (IEE),
Environmental Impact Assessment (EIA) & Social Impact Assessment
(SIA) for 100MW Grid tied Solar Park & Fisheries Project at Chandpur,
Kotiadi of Kishoreganj District, Bangladesh.**

February-2018

INSTRUCTION TO THE APPLICANTS

1. Application of the interested firms must include:

- i) In case of Joint Venture/Consortium/Association Agreement (JVCA), name of the Lead Firm & Associated Firm with complete address, Cable, Fax, Telephone Nos., E-mail address etc. should be mentioned;
- ii) In case of Joint Venture/Consortium/Association Agreement (JVCA), notarized Joint Venture/Consortium/ Association Agreement (JVCA) on Non-Judicial Stamp of the firms for the said consulting service. The value of Non-Judicial Stamp should be Taka 300.00 (Taka Three hundred);
- iii) No firm should form Joint Venture / Consortium / Association (JVCA) with more than one firm;
- iv) The name of the employees/owner(s) of the firms and corporate profile of the firms;
- v) The name and qualification of the Management/Administrative Personnel;
- vi) Brochures should be submitted by the Applicants, summarizing their facilities and areas of expertise;
- vii) Description of similar assignments;
- viii) Supporting documents should be submitted by the Applicants, proving experience in similar operating environments and conditions;
- ix) Documentary evidence proving Managerial strength and financial capacity (Summary sheet of Turn Over statement and year wise Audited financial reports of the applicant) should be submitted by the Applicant.
- x) List and qualification of the key-personnel likely to be involved in the proposed consulting service. The proposed fields of expertise for the said consulting service would be at least the following:

Sl. No.	Position	Number of Persons	Months	Person- Months
1.	Solar Energy/Technical Expert (Team Leader)	1	4.0	4.0
2.	Power Transmission & Protection Expert	1	1.5	1.5
3.	Civil and Structural Design Engineer	1	1.5	1.5
4.	Financial/Economic Analyst	1	0.5	0.5
5.	Environment health and Safety Expert	1	2.0	2.0
6.	Soil and Agriculture Specialist	1	1.0	1.0
7.	Fisheries Specialist	1	1.0	1.0
8.	Socio Economist	1	1.0	1.0
9.	RS and GIS specialist	1	1.0	1.0
	Total:	9	13.5	13.5

(xi) Identity, Structure, Organization of the firm(s) including copies of the documents defining the constitution or legal status, place of registration and principal places of business and/or principal offices of the company/firm.

(xii) Details of vehicles, instruments & office equipment the firm owns.

(xiii) Audited Financial Statements of the firm for the last five fiscal years.

2. Applicant must submit information (as per Serial no. 17 of EOI Notice) using the attached table/format [Annexure-1 to 6] with the document. The submitted document must be sealed and signed by a person duly authorized by the consulting firm.



(Md. Rafiquddaula)
Manager (Procurement)

Ashuganj Power station Company Ltd.
Ashuganj, Brahmanbaria, Bangladesh.



Specimen form for Similar Experience of the Firm

The following format should be used to indicate the similar experience of the firm in projects.

Project Name		
Project Location	Start Date (M / Y)	Completion Date (M / Y)
Name of the Client with address and Contact number		
Contract amount		
Name of the associated firm (if any)		
Narrative description of actual service provided by the firm for the project:		

Name of the Firm.....

Signature.....




Experience of the firm in other works (for last ten years).

Sl. No.	Name of Services	Name of Client with address and Contact number	Contract amount	Start date	Completion time



Curriculum Vitae (CV) for Each Proposed Professional Staff

1	PROPOSED POSITION FOR THIS PROJECT	<i>[From the Terms of Reference, state the position which the Consultant will be engaged. Only one candidate shall be nominated for each position].</i>																		
2	NAME OF PERSON	<i>[state full name]</i>																		
3	DATE OF BIRTH																			
4	NATIONALITY																			
5	MEMBERSHIP IN PROFESSIONAL SOCIETIES	<i>[state rank and name of society and year of attaining that rank].</i>																		
6	EDUCATION:	<i>[list all the colleges/universities which the consultant attended, stating degrees obtained, and dates, and list any other specialised education of the consultant].</i>																		
7	OTHER TRAINING	<i>[indicate significant training since degrees under EDUCATION were obtained, which is pertinent to the proposed tasks of the consultant].</i>																		
8	LANGUAGES & DEGREE OF PROFICIENCY	Language	Speaking	Reading	Writing															
		<i>e.g. English</i>	<i>Fluent</i>	<i>Excellent</i>	<i>Excellent</i>															
9	COUNTRIES OF WORK EXPERIENCE																			
10	EMPLOYMENT RECORD	<p><i>[The Consultant should clearly distinguish whether as an "employee" of the firm or as a "Consultant" or "Advisor" of the firm].</i></p> <p><i>[starting with position list in reverse order every employment held and state the start and end dates of each employment]</i></p> <p><i>[The Consultant should clearly indicate the Position held and give a brief description of the duties in which the Consultant was involved].</i></p> <table border="0"> <tr> <td>EMPLOYER 1</td> <td>FROM:</td> <td>TO:</td> </tr> <tr> <td></td> <td><i>[e.g. January 2009]</i></td> <td><i>[e.g. December 2012]</i></td> </tr> <tr> <td>EMPLOYER 2</td> <td>FROM:</td> <td>TO:</td> </tr> <tr> <td>EMPLOYER 3</td> <td>FROM:</td> <td>TO:</td> </tr> <tr> <td>EMPLOYER 4 (etc)</td> <td>FROM:</td> <td>TO:</td> </tr> </table>				EMPLOYER 1	FROM:	TO:		<i>[e.g. January 2009]</i>	<i>[e.g. December 2012]</i>	EMPLOYER 2	FROM:	TO:	EMPLOYER 3	FROM:	TO:	EMPLOYER 4 (etc)	FROM:	TO:
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EMPLOYER 3	FROM:	TO:																		
EMPLOYER 4 (etc)	FROM:	TO:																		
11	WORK UNDERTAKEN THAT BEST ILLUSTRATES YOUR CAPABILITY TO HANDLE THIS ASSIGNMENT	<i>[give an outline of experience and training most pertinent to tasks on this assignment, with degree of responsibility held. Use about half of a page A4].</i>																		

CERTIFICATION *[Do not amend this Certification].*

I, the undersigned, certify that (i) I was not a former employee of the Client immediately before the submission of this proposal, and (iii) to the best of my knowledge and belief, this bio data correctly describes myself, my qualifications, and my experience. I understand that any wilful miss-statement described herein may lead to my disqualification or dismissal, if engaged.

Signature

Date of Signing

Day / Month / Year

A handwritten signature in black ink, appearing to be 'K. S. S.', with a long vertical line extending downwards from the end.A handwritten signature in black ink, appearing to be 'A.', enclosed within a circle.

Name and Qualification of Management/Administrative Personnel

Serial No	Name of the Personnel	Position at the Firm	Temporary/ Permanent	Educational Qualification	Experience in years

1



Details of Vehicles, Instrument and Office Equipment

Sl, No.	Name, Brand of the Vehicles/Equipment, Year of Manufacture	Model No., Serial No./ Registration No.	Present Condition



Financial Statement**Summary of Assets & Liabilities:**

Sl. No.	Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
1	Total Assets					
2	Total Liabilities payment					
3	Total investment					
4	Operative Expenditure					
5	Taxes Paid					
6	Profit after payment of Taxes					
7	Turnover [Sl. No. 2+3+4+5+6]					




Description of the Services [TOR]

Terms of Reference for Consultancy services for Detailed Feasibility Study, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) for 100 MW Grid Tied solar Park & Fisheries Project at Chandpur, Kotiadi of Kishoreganj District, Bangladesh.

1.0 Background

Electricity is the driving force of modern civilization as well as the back-bone of all development activities of the country. Bangladesh Government's vision is to provide access to affordable and reliable electricity to all by the year 2021 and in line with this government's mission is to ensure uninterrupted and quality power supply for all by 2021 through improvement in generation, transmission and distribution system.

Present generation capacity of the country is not sufficient enough to meet the prevailing load demand of the country and causes insurmountable impedance to the development activities in industrial, commercial, agriculture and social sectors. Furthermore, the load demand is increasing at a faster rate which needs installation of more power plants to generate electricity to support the overall development activities of the country. To cope up with the growing load demand as well as to comply with the policy of the Government, enough generation of electricity needs to be added. According to the renewable energy policy- 2008 from SREDA, Government made a plan to increase its Generation capacity with renewable energy (RE) such as solar, wind, tidal energy etc. to 10% of total generation of Bangladesh by 2021. In line with this policy, APSCL has been given to increase its capacity with 100 MW RE by installing a Solar Power Plant.

In compliance to reach the target, APSCL has primarily selected about 400 Acres of land located at Chandpur, Kotiadi of Kishoreganj District, Bangladesh. The selected site is low land area and remain under water almost whole of the year. Hence the proposed plant will be implemented by proper use of the Solar Plant area; providing multipurpose facilities on & above the water surface & top of the steel Structure, like fisheries in the water & mushroom cultivation or similar in the shadow of the PV panel etc. The fisheries project will be beneficial for developing economic condition of the country.

A detailed impact analysis as well as cost estimation is required for Power evacuation of the Solar Plant which is to be connected with the National Grid by a single Circuit line (132 KV, 9 Km approx.) from Plant Site, Kotiadi to Bazitpur, Kishoreganj Substation (132/33 KV).

Therefore, the Feasibility study, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) and social Impact Assessment (SIA) are required for smooth function of this project.



2.0 Objective

Consultancy Services for the Pre-Feasibility Study, Detailed Feasibility Study, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Social Impact Assessment (SIA) on 100 MW Grid Tied solar Park and Fisheries Project at Kotiadi of Kishoreganj District.

3.0 Scope of Services

The scope of services under this assignment includes the following but not limited to:

- 3.1** Detailed Feasibility Study
- 3.2** Brief description of the selected site
- 3.3** Technology options and best suitable technology considering the site location and grid system
- 3.4** Civil construction requirement
- 3.5** To investigate if the site is suitable for making the Solar Power Plant on a Steel Structure or alternative.
- 3.6** To determine Procedure and Scope to fill up the Land by dredging sand or other means if needed.
- 3.7** Major equipment required for installation of the solar PV system.
- 3.8** Analysis of the solar radiation data of the location.
- 3.9** Yield calculation using PV simulation software (It includes month wise energy generation, Loss diagram over the whole year, Specific energy yield, Month wise performance ratio etc.)
- 3.10** Description of impact analysis and requirement of power evacuation system & cost analysis for High Voltage line (132 KV, 9 Km approx.) from plant site to Bazitpur Substation (132/33 KV) with Bill of Quantity (BOQ) of cost estimation for making a bay.
- 3.11** Description of impact analysis of solar power plant project on grid due to the connection with system. Detail Impact analysis need to be assessed and certified by BUET or equivalent technical support organization. Their mitigation should be suggested by Technical Expert.
- 3.12** Detailed technical specification of each equipment of power plant (from PV panel up to transmission line)
- 3.13** Detailed technical specifications of the mandatory spare parts
- 3.14** Preparation of Bill of Quantity (BOQ) with Cost estimation.
- 3.15** Preparing Financial Model for the project (According to the financial arrangement of APSCL).
- 3.16** Estimated cost of the project
- 3.17** Calculation of levelized tariff considering Solar PV power Plant Project and Fisheries Project with mushroom cultivation or similar.

- 3.18 Preparation of operating budget
- 3.19 Preparation of Tender document
- 3.20 Preparation of Standard Power Purchase Agreement
- 3.21 Risk and Risk mitigation plan for the project
- 3.22 Complete Plant Layout including all equipment dimensions
- 3.23 Complete single line diagram of power plant including all protection and metering system
- 3.24 Detail description of single line diagram
- 3.25 Solar PV panel mounting structure design
- 3.26 Initial Environmental Examination (IEE)
- 3.27 Environmental Impact Assessment (EIA)
- 3.28 Social Impact Assessment (SIA)
- 3.29 Arrange DOE Approval.

Scope of Services in Details-

4.0 Solar Energy Resources

- 4.1 Provide the detail description of the solar energy resources considering overview at the project area and the solar energy resources map.
- 4.2 Analyze and collect PV engineering long term observation data that includes the monthly radiation data of many years (such as direct radiation, heat radiation, total radiation data), monthly sunshine data for many years (sunshine duration or sunshine percentage data), rainfall, temperature and other meteorological data, inter annual variation chart of solar radiation, inter annual variation of sunshine duration and yearly variation chart, laws of sunshine duration. And measure the optimum angle and height for PV Cells. PV cells may affect each other which should be considered during study.
- 4.3 Based on the collected reference long term observation data, analyze the effects of various special weather conditions to PV generation engineering.
- 4.4 **The consultant have to generate the following Diagram and Figure**
 - 4.4.1 **Diagram:** Including the statistics chart of maximum wind speed, temperature, air pressure, rainfall, dust, storms, typhoon and other meteorological factors for many years in meteorological station.
 - 4.4.2 **Figures:**
 - 4.4.2.1 The solar energy resources map for PV generation project area.
 - 4.4.2.2 Reference to long-term observation data for at least 5 (Five) years in total solar radiation variation histogram
 - 4.4.2.3 Reference to long-term observation data for monthly average solar radiation histogram
 - 4.4.2.4 Reference to long-term observation data for at least 5 (Five) years in sunshine duration histogram
 - 4.4.2.5 Reference to long-term observation data for monthly average sunshine duration histogram
 - 4.4.2.6 The representative year to monthly total solar radiation histogram for PV generation project area
 - 4.4.2.7 The representative year to monthly sunshine duration histogram for PV generation project area
 - 4.4.2.8 The representative year to special sunshine duration total radiation distribution curve for PV generation project area
 - 4.4.2.9 The representative year to monthly special sunshine duration total radiation distribution curve for PV generation project area

5.0 Engineering geology

5.1 Overview

- 5.1.1 Description of the PV power generation project overview.

5.2 Regional geological and structural stability

- 5.2.1 Conducting the seismic safety assessment.
- 5.2.2 Evaluation of regional tectonic stability.

5.3 Geological condition of engineering

- 5.3.1 Explain the landform and geomorphic type of plant site.
- 5.3.2 Analyze and propose the building (structure) based on the proposal that was bearing stratum and pile bearing stratum, made of rock (soil) resistivity.
- 5.3.3 Analyze the Hydro-geological conditions, describe foundation base rock aquifer type, characteristics, burial conditions, recharge and discharge conditions and hydro-geological parameters of the water layer and the like. Evaluate the corrosion of ground water for concrete, steel.

5.4 PV project site engineering geological evaluation

- 5.4.1 Evaluate the stability of the proposed construction area and adaptability of construction site.
- 5.4.2 Conducting the geological zoning of the site area. Assessment to the main engineering geological problems, including foundation bearing stratum carrying capacity and depth, stability against sliding, deformation and uneven settlement, sand seismic liquefaction of soft soil subsidence earthquake, soft soil seismic subsidence, rock (soil) body vibration liquefaction and etc.
- 5.4.3 Propose strength index recommendations value for foundation base of each rock (soil) layer, bearing capacity of pile foundation parameter values and recommended values, etc.

5.5 Conclusion and suggestion: Propose the conclusion and suggestion of engineering geology assessment.

5.6 The consultant have to generate the following Diagram and Figure

5.6.1 Diagram

- 5.6.1.1 Physical and mechanical properties of Statistics index for rock (soil) layer
- 5.6.1.2 Analytical and statistical tables for ground water quality

5.6.2 Figure

- 5.6.2.1 The exploration site layout
- 5.6.2.2 Engineering geologic columnar profile
- 5.6.2.3 Site test outcomes
- 5.6.2.4 Indoor test outcomes
- 5.6.2.5 Engineering geology longitudinal cross-sectional view
- 5.6.2.6 Regional geological structure diagrams

6.0 Engineering task and scale

6.1 Engineering task

- 6.1.1 The consultant have to analysis of compliance and coordination of photovoltaic project site and land use planning and other related planning. Explain reasonability of PV project sites range and duration of use, and analyze the passive factors of land mitigation and environmental protection for photovoltaic power generation project, and then propose photovoltaic power generation projects land mitigation measures and engineering measures for taken.
- 6.1.2 Comprehensively consider the Client's requirement to project, then propose the development task.

6.2 Project scale

- 6.2.1 The consultant have to analyze the installed capacity for PV project and choose the main affected factors, such as conditions of solar energy resources, development and construction, phased development and temporal evaluation etc.

- 6.2.2 According to energy resources, power system status and planning of photovoltaic power generation project area, the project's impact on the system and requirements, as well as project development conditions, taking into account the manufacturing level of photovoltaic modules, and then demonstrating and determining the installed capacity and plant site scope of photovoltaic power generation.
- 6.2.3 If it is phased development projects, the scale and scope of each project will be briefly described, and propose the schematic site of plant scope.

6.3 Project construction necessity

- 6.3.1 The consultant shall have to give an overview of domestic and international energy supply situation, environmental protection and tackling climate change, reducing greenhouse gas emissions requirements, the need for national renewable energy development planning and etc. from the angle of national energy strategy needs, analysis and demonstration of renewable energy and the development of photovoltaic power generation is necessary.
- 6.3.2 The consultant shall have briefly introduce local coal, hydropower, wind energy and other energy and development conditions, local solar energy resources, current status of power generation, power development planning and power demand characteristics, requirements for power supply and power structure optimization of power network. Demonstrate the necessity of the development of photovoltaic power generation project from the perspective of rational utilization of energy resources.
- 6.3.3 Analysis the regional, economic and social promoting effect of the construction of this project.
- 6.3.4 Summarize the construction conditions, environment and economic benefits of this PV power generation project.

7.0 Design of system overall plan and generating capacity calculation

7.1 PV module selection: The consultant have to find out the recommended PV module and manufacturer, based on manufacturing level, technical maturity, technical performance and price of PV module, in combination with solar radiation characteristics, installation conditions and environmental conditions of PV power generation project, and the main parameters of PV modules, such as the form of PV modules and the rated power according to technical and economic comparison.

7.2 Operation mode selection of PV array

- 7.2.1 The consultant shall have to find out the operation mode of PV array, such as fixed mode, single automatic sun tracking mode, double automatic sun tracking mode, with comprehensive analysis of operation reliability, equipment price, maintenance cost, failure rate and power generation efficiency etc.

7.3 Inverter type selection

- 7.3.1 The consultant shall have to determine the capacity range of single inverter, according to the manufacturing level of inverter, technical maturity, technical performance and price, combined with installation capacity and condition of the equipment transportation of PV power generation project.
- 7.3.2 The consultant shall have to determine the form and main technical parameters of inverter, according to the capacity range of the selected single inverter, considering about matching of PV module, operation and maintenance of the project.

7.4 Design of PV array

- 7.4.1 The consultant shall have to find out PV array capacity after comparison of the technology and economy, with comprehensive considering about step-up transformer, high and low voltage switch cabinet, low voltage DC power transmission, high voltage AC cable and other factors.

- 7.4.2 The consultant shall have to protocol the selection scheme of PV array layout, according to the solar energy resources distribution and specific terrain conditions of PV power generation project.
- 7.4.3 The consultant shall have to determine final layout scheme of PV array, according to comprehensive technical and economic comparison of the layout scheme of the PV array, and draw out the PV array layout arrangement.

7.5 Design of PV sub array

- 7.5.1 The consultant shall have to select PV sub array capacity after comparison of the technology and economy, with comprehensive considering about PV array capacity, local combiner box, DC bus screen, inverter and other factors.
- 7.5.2 The consultant shall have to carry out series and parallel design of PV modules according to the form and parameters of selected PV module and inverter, combined with the data of hourly solar radiation quantity, wind speed and temperature etc. The consultant also shall have to determine the optimal layout in the designing of arrangement of the solar cell array, after comparing among multi plan and comprehensive considering about technical and economic indicators.
- 7.5.3 The consultant shall have to select the suitable bracket and mountain structure for PV modules for the PV power generation project.
- 7.5.4 The consultant shall have to determine the final layout scheme of PV sub array, and draw out PV sub array layout arrangement.

7.6 Design of array connection wire.

- 7.6.1 The consultant shall have to select suitable DC lightning protection combiner box and DC lightning protection distribution box and to determine the location, form, size of the combiner box, connection way of combiner box and connection scheme of the inverter unit, according to layout of PV sub array, series and parallel connection scheme of PV module and selected inverter scheme.
- 7.6.2 The consultant shall have to determine the overall layout of the inverter and inverter indoor electrical equipment layout, according to layout scheme of PV sub array and connection scheme of inverter unit.
- 7.6.3 According to layout scheme of PV sub array and overall layout of the inverter, the consultant shall have to determine configuration of the step-up transformer, connection diagram, layout location, capacity, voltage level.

7.7 Auxiliary technical schemes: According to specific geographical conditions and other factors at project area, the consultant shall have to determine the auxiliary technical scheme, includes the environmental monitoring scheme, the PV module cleaning scheme and the salt and fog corrosion prevention scheme for the project.

7.8 Yearly on-grid energy calculation of PV power generation project

- 7.8.1 The consultant shall have to calculate generating capacity on the first year of PV power generation project, according to the solar radiation intensity data and PV module characteristics, combined with the site climate characteristics, control system characteristics and efficiency of PV power generation project.
- 7.8.2 The consultant shall have to calculate power generation capacity for 25 years after the first year, according to the annual attenuation coefficient of PV module.
- 7.8.3 The consultant shall have to determine the total efficiency of PV power generation project, according to PV module efficiency, low voltage bus and inverter efficiency, AC grid efficiency, etc. among which:



- 7.8.3.1 Removing the lost energy from PV array in the energy conversion process, the rest is PV module efficiency. The lost energy include loss from matching PV modules, loss because of surface dust blocking, Non-available solar radiation loss, loss by temperature impact, and other kinds of loss etc.
- 7.8.3.2 Low voltage bus and the inverter conversion efficiency mainly considering about the low voltage line loss and inverter efficiency.
- 7.8.3.3 AC grid efficiency is the transmission efficiency from the inverter output to the high voltage power grid, including step-up transformer efficiency and AC loss efficiency etc.
- 7.8.4 According to the local solar energy resource characteristics and system overall scheme, The consultant shall estimate theoretical generating capacity of PV power generation project and need to carry out a variety of reasonable discount, estimate the average annual on-grid power generating capacity.
- 7.8.5 The consultant shall have to analyze the rate of change of output and characteristics of output about the PV power generation project and to make all kinds of charts, according to characteristics of solar radiation quantity changes in PV power generation projects.

8.0 Electrical

8.1 First electric system

- 8.1.1 The consultant shall have to submit list the detail engineering specifications, technical standards and documents.
- 8.1.2 According to planning installation capacity, installation capacity of this period and special design of access power system of the PV power generation project, The consultant shall briefly introduce scheme of PV power generation project access to power system, specify the connection scheme of PV power generation system and power system, transmission voltage level, circuit number of outgoing line, transmission capacity, transmission distance and supporting transmission project etc.
- 8.1.3 Consultant shall have to do the overall impact assessment of power evacuation to grid from solar power plant project site area.
- 8.1.4 **The step-up transformer substation (or switching station) site selection:**
The consultant shall select the site location of step-up transformer substation (or switching station), and determine the arrangement of step-up transformer substation (or switching station) after comparing and analyzing the technical and economic, according to the position of the project, installation capacity, scheme of access to system, PV array layout scheme and terrain and geological conditions of the power station, comprehensive considering about design, construction, operation and maintenance, investment, construction land and other factors.
- 8.1.5 **Main electrical connections**
 - 8.1.5.1 **Main electrical connections of PV power generation project:**
 - 8.1.5.1.1 The consultant shall briefly introduce the PV array layout scheme, configuration mode of step-up transformer and square array connection scheme etc.
 - 8.1.5.1.2 The consultant shall determine the collecting power lines scheme of PV power generation project, circuit number of collecting power lines, number of PV arrays connected to each collecting power line and maximum delivery capacity and cable specification and quantity used between arrays, according to scheme of PV array layout and selected step-up transformer substation (or switching station) site, and comparison of technical and economic factors.

- 8.1.5.1.3 The consultant shall calculate and check the voltage drop of the collecting power lines and thermal stability of the project, and meet the requirements of the relevant specifications.
- 8.1.5.2 Main electrical connection of step-up transformer substation (or switching station)**
- 8.1.5.2.1 The consultant shall determine the step-up transformer substation, selection of the main transformer capacity, the numbers of transformer and main parameter is required
- 8.1.5.2.2 The consultant shall calculate the single phase ground connection capacitance current value of PV power generation project and put forward the corresponding arc harmonic elimination measures.
- 8.1.5.2.3 The consultant shall determine the equipment and connection mode of power supply and security power supply for step-up transformer substation (or switching station).
- 8.1.6 Selection of main electrical equipment**
- 8.1.6.1 **Calculation of short current:** The consultant shall calculate the short-circuit current at different voltage level.
- 8.1.6.2 **Selection of main electrical equipment:** The consultant shall make choice of the main power equipment such as circuit breaker, isolating switch, load switch, fuse, power cable, bus bar etc.
- 8.1.7 Lightning protection, ground connection and over-voltage protection.**
- 8.1.7.1 The consultant shall briefly introduce the over voltage protection method of PV array, combiner box and inverter.
- 8.1.7.2 The consultant shall briefly introduce ground connection design scheme of PV array and estimate the engineering quantity.
- 8.1.7.3 The consultant shall determine the lightning protection measures and ground connection scheme of Step-up transformer substation (or switching station), and estimate the ground connection engineering quantity.
- 8.1.7.4 The consultant shall determine the insulation coordination principle of step up substation (or switching station), and put forward the method of over voltage protection.
- 8.1.7.5 The consultant shall determine the grounding method with diagram of the power station.
- 8.1.8 Station-service power and lighting**
- 8.1.8.1 station-service power**
- 8.1.8.1.1 The consultant shall calculate station-service power load for PV power station and estimate station-service power capacity and station-service power consumption rate for PV power station.
- 8.1.8.1.2 The consultant shall determine the power supply and standby power supply mode, voltage grade and connection mode of the step-up transformer substation (or switching station).
- 8.1.8.2 Lighting:** The consultant shall briefly introduce the work, accident lighting and power supply mode, voltage and capacity selection; briefly introduce the choice of lighting lamps in each functional area of building.



8.1.9 Electrical equipment layout

- 8.1.9.1** The consultant shall briefly introduce the layout scheme of PV array and determine the collecting power lines scheme of PV power generation project.
- 8.1.9.2** The consultant shall determine the overhead transmission line, collecting power lines, number of overhead line tower, the tower height, the number of crossing rivers, roads and other power lines.
- 8.1.9.3** The consultant shall determine cable laying route and cable rack diagram of the project
- 8.1.9.4** The consultant briefly introduce the general layout of step-up transformer substation (or switching station), to determine the layout of the main transformer field and high and low voltage power distribution equipment, electrical equipment layout on each layer of architecture and way of line out(in), etc.

8.2 Secondary electric system

- 8.2.1 Design reference and principle**
 - 8.2.1.1** Detailed technical specification of each equipment of power plant
 - 8.2.1.2** List main technical standard and documents adopted. Briefly describe secondary electric design principle.
- 8.2.2 Monitoring system:** The consultant shall briefly describe relation between PV project and electric power dispatch management system and information exchange way, realization way, main channel and spare channel between PV project and dispatching system.
- 8.2.3 Relay protection and safety automation device:** The consultant shall determine relay protection and other safety protection device of PV electric system and switchyard system such as-
 - 8.2.3.1** Confirm the relay protection plan of PV power generation, Inverter device and its voltage-boosting device.
 - 8.2.3.2** Confirm the relay protection configuration plan in switchyard, according to main electric connection line.
 - 8.2.3.3** Confirm the fault recorder type and its configuration, according to switchyard outgoing voltage grade and electric system requirement.
- 8.2.4 Protection Device:** Confirm protection plan of PV power generation project with various relay protection device.
- 8.2.5 Secondary wiring connection**
 - 8.2.5.1** Confirm designing of secondary wiring system, like electric measurement, operation, etc. for PV power generation, current combination, inverter device and voltage-boosting device.
 - 8.2.5.2** Select secondary wiring system designing plan for switchyard's main electric device's electric measurement, signal, operation, miss-operation prevention & blocking, etc.
 - 8.2.5.3** Confirm configuration and main parameter of CT (current transformer) and PT (voltage transformer). Propose precision requirement for CT and PT at metering point between PV power generation system and grid. And propose arrangement plan for metering devices.
- 8.2.6 Control power system**
 - 8.2.6.1 DC power source.** Confirm designing plan and main equipment configuration of PV power generation system and switchyard DC system.



8.2.6.2 Uninterrupted Power Supply system (UPS)

8.2.6.2.1 Explain capacity and discharge time of uninterrupted Power Supply system (UPS) needed by PV power generation, current combination, inverter system and voltage-boosting equipment.

8.2.6.2.2 Confirm capacity, connection way and main equipment configuration of AC control power needed by PV switchyard surveillance system and relay protection system.

8.2.7 Automatic fire alarming system: Confirm fire alarming system designing plan, according to arrangement plan of PV power generation, current combination, inverter system and voltage-boosting equipment.

8.2.8 Video security monitoring system: Confirm structure, main function and main configuration of video security monitoring system, according to arrangement plan and related technical standard of PV power generation, current combination, inverter system and voltage-boosting equipment.

8.2.9 Electric Lab: Equip certain amount of instruments to adjust, test, maintain and inspect newly-installed or operating electric device, according to PV project management principle and needs.

8.2.10 Arrangement of secondary electrical equipment: Brief description of secondary electrical equipment arrangement plan.

8.3 Communication

8.3.1 Briefly describe communication way within PV power plant

8.3.2 Select communication way and main equipment of switchyard, according to the communication designing requirement of system being connected.

8.3.3 Information management and report system of PV power plant

8.4 Attached tables and diagrams

8.4.1 Attached tables

8.4.1.1 Technical and economic comparison table for switchyard main electric connection plan

8.4.1.2 Technical and economic comparison table for collecting power line within the plant.

8.4.1.3 List of main primary electric equipment

8.4.1.4 List of collecting power line main equipment

8.4.1.5 List of main secondary electric equipment

8.4.1.6 List of main equipment in communication system.

8.4.2 Attached diagram

8.4.2.1 Wiring diagram at the location of electric power system connected by PV system

8.4.2.2 Main electric wiring diagram of switchyard

8.4.2.3 Layout of PV collecting power lines

8.4.2.4 Wiring diagram of station service power

8.4.2.5 Electric equipment layout and longitudinal profile of switchyard

8.4.2.6 Layout of switchyard High & Low voltage power distribution device.

8.4.2.7 Electric device arrangement plans in each floor of main control building

8.4.2.8 Relay protection and measurement device deployment diagram of PV plant and switchyard

8.4.2.9 Computer surveillance system diagram in PV plant

8.4.2.10 Computer surveillance system diagram in switchyard

8.4.2.11 Organization chart for communication in PV plant

8.4.2.12 System diagram for communication in PV plant

9.0 Civil works

9.1 Safety standard design

- 9.1.1 Confirm grade of architecture (structure) and corresponding flood- prevention standard, anti- seismic standard, according to each single building's scale and related standard.
- 9.1.2 List safety standard for main architecture and major structures.

9.2 Basic information and design reference

- 9.2.1 Basic information
 - 9.2.1.1 Brief description of terrain, landform, engineering geology, hydrogeological condition, geotechnical property, etc.
 - 9.2.1.2 Explain geo- mechanics parameters, PV arrays and other building design load, etc. of site.
 - 9.2.1.3 List average annual wind speed, maximum wind speed and its occurrence time, prevailing wind direction, etc.
 - 9.2.1.4 List hazardous weather conditions, like sandstorm, thunder, heavy rain, hail, etc. in project area in recent 30 years.
 - 9.2.1.5 List flood prevention standard of the building power plant and fisheries project.

9.3 PV array foundation and inverter room design

- 9.3.1 PV array basic design and foundation treatment
 - 9.3.1.1 Calculate PV arrange design load, according to structure gap, size, foundation document provided by supplier, and local natural environment condition.
 - 9.3.1.2 Confirm PV array foundation type, structure size and foundation treatment plan, according to engineering geological condition within PV power plant site.
- 9.3.2 Establish the PV array foundation and inverter room, according to selected plan.

9.4 Design of collecting power line within site: Explain direction, length and laying method of collecting power line within site. Propose structure arrangement, structure calculation result, etc. of civil works in collecting power line.

9.5 Switchyard

- 9.5.1 Confirm general layout of switchyard and Central Control Room (CCR) and draw general floor layout of selected plan.
- 9.5.2 Confirm scale, structure type and architecture standard of main architecture. Flat & cross- section structure layout of selected plan should be drawn.
- 9.5.3 Confirm production water supply, domestic water supply and waste water treatment way of switchyard and centralized control room.
- 9.5.4 Confirm heating and ventilation of switchyard and centralized control room.
- 9.5.5 Calculate and propose civil work quantity of switchyard and centralized control room, according to selected plan.

9.6 Project for prevention and control of geological hazard: Propose the design of supporting facilities for projects which may cause geological hazards or may be suffered from geological hazards after evaluation, according to collected information of wind, sand, mud- rock flow, ice & snow, etc.

9.7 The consultant shall have to submit following attached table and diagram

- 9.7.1 Attached table: Summary sheet of major civil works
- 9.7.2 Attached diagram: PV array foundation structure flat & cross- section layout, inverter room structure flat & cross- section layout, switchyard & CCR general flat layout, and major building structure flat & cross- section layout.

10.0 HVAC System Design in Project

- 10.1 Briefly suggest and describe the overall Heating Ventilation and Air Conditioning system of the PV power generation project according to ASHRAE rules and regulations (if required.)



- 10.2 Provide detailed Layout drawing with system descriptions and specifications.
- 10.3 Provide Data and calculation of cooling load of the required rooms.
- 10.4 Suggest Cost estimate of the HVAC Design.
- 11.0 Fire- fighting design in project**
 - 11.1 General design of project fire- fighting plan
 - 11.2 The consultant shall briefly introduce the general layout of fire- fighting plan
 - 11.3 Determine the fire-fighting power load, power configuration type and cable selection in the PV power generation project.
 - 11.4 Detail description the overall design scheme of the emergency lighting and evacuation signs indicating in the PV power generation project.
 - 11.5 Detail description the overall design scheme for the automatic fire alarm system and the system configuration.
 - 11.6 Briefly describe the overall design scheme of fire communication.
 - 11.7 Briefly describe the design of fire ventilation system, the selection of ventilator and motor, the smoke evacuation and emergency ventilation design.
 - 11.8 Briefly describe the fire-fighting program regarding flammable and explosive places, construction boat machine fire risk areas, etc. during the construction of PV power generation project.
- 12.0 Construction organization design:** The consultant shall have to give an overview of project location and natural conditions, such as topography, geological conditions and air temperature, ground temperature, precipitation, wind, fog, dust storms etc.
 - 12.1 The consultant shall give a detailed description of field area project construction conditions, sources and supply conditions of the main building materials, construction water, electricity supply and local repair capacity.
 - 12.2 Define the range and area of temporary road, temporary construction facilities and other temporary land that may be used in other construction processes, calculate permanent land area of the project.
 - 12.3 Based on the land policy of the local region at the plant location the consultant shall calculate the cost of permanent and temporary land.
 - 12.4 Consultant shall find out the sources of filling sand and calculate its required amount and way & means of carrying the same to the plant site.
- 13.0 Engineering management organization:** The consultant shall briefly describe the principles of PV power generation and fisheries project management organization, according to the specific circumstances of the photovoltaic power generation, fisheries project and mushroom cultivation or similar, conducting institutional set-up and staffing.
- 14.0 Initial Environmental Examination (IEE) & Environmental Impact Assessment (EIA):** The scope of services for the IEE & EIA study includes the followings:
 - 14.1 Provide an existing baseline assessment enhanced utilizing current assessment methodologies.
 - 14.2 Assessing all project components of the proposed area and providing data, results and analysis for the Project Area, Local Study Area and Regional Study Area, including a cumulative effects assessment.
 - 14.3 Carry out environmental and social impact assessment identifying the maximum generation capacity capable of being installed that will satisfy the applicable environmental requirements, including the laws and bylaws of Bangladesh and World Bank Group's health and safety guidelines.
 - 14.4 Land use/ Land cover including ecologically critical area, national parks, forest, orchard, cultural heritage site etc. (if any), in the site selected for the power plant.
 - 14.5 Identify map unique sites or special features such as Parks and Protected Areas, Heritage Rivers, Historic Sites, Environmentally Significant Areas, culturally significant sites and other designations

- 14.6 Meteorological data collection of the site from Bangladesh Meteorological Department (BMD);
- 14.7 Hydrological and morphological data collection from BWDB and BIWTA;
- 14.8 Primary and Secondary Socio-economic data collection;
- 14.9 Water resources and soil salinity data collection from BWDB and SRDI;
- 14.10 Agro-ecological zones data collection from AEZ report.
- 14.11 Agricultural data collection from BBS and DAE
- 14.12 Collection of Environmental quality data including soil investigation, air quality, water quality, noise level etc. for the selected site;
- 14.13 Sources of water during construction and operation;
- 14.14 Establish the environmental and social baseline condition in respect of water resources, air quality, noise level, land resources including land use/land cover, agriculture, fisheries, ecosystems and socio-economic condition;
- 14.15 Conduct public consultation meetings;
- 14.16 Identify the Important Environmental and Social Components (IESC);
- 14.17 Assessment of initial impacts of the proposed power plant on the environmental and social components.
- 14.18 Preparation of preliminary Environmental Management Plan (EMP);
- 14.19 Preparation of preliminary Resettlement Action Plan (if any);
- 14.20 Risk and hazard analysis;
- 14.21 Collection of data on access to port/railway/road from Port Authority, Bangladesh Railway and Roads and Highway Department.
- 14.22 Topographical survey of the selected project site.
- 14.23 Soil investigation of the selected site.
- 14.24 Seismic analysis.
- 14.25 Carry out hydrological investigation and power evacuation facilities required.
- 14.26 Thermal plume modeling will be completed considering the proposed power plant including nearby industrial installations (if any).
- 14.27 Identify the baseline climatic and air quality conditions including:
 - 14.27.1 The type and frequency of meteorological conditions that may result in poor air quality.
 - 14.27.2 Appropriate ambient air quality parameters.
 - 14.27.3 Carry out air quality Modeling
- 14.28 Identify components of the Project that will affect air quality
 - 14.28.1 Describe the potential for reduced air quality (including odors and visibility) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;
 - 14.28.2 Estimate ground-level concentrations of appropriate air quality parameters;
 - 14.28.3 discuss any expected changes to particulate deposition, nitrogen deposition or acidic deposition patterns;
 - 14.28.4 identify areas that are predicted to exceed Potential Acid Input (PAI) critical loading criteria;
 - 14.28.5 discuss interactive effects that may occur resulting from co-exposure of a receptor to all emissions;
 - 14.28.6 describe air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, soil resources, vegetation resources, and water quality.
- 14.29 Identify stages or elements of the Project that are sensitive to changes or variability in climate parameters, including frequency and severity of extreme weather events. Discuss what impacts on the change to climate parameters may have on elements of the Project that are sensitive to climate parameters.

- 14.30** Provide representative baseline noise levels at receptor locations and carry out noise Modeling
- 14.31** Identify components of the Project that have the potential to increase noise levels and discuss the implications. Present the results of a noise assessment. Include:
- 14.31.1** Potentially-affected people and wildlife;
 - 14.31.2** An estimate of the potential for increased noise resulting from the development; and
 - 14.31.3** The implications of any increased noise levels.
- 14.32** Identify Project components and activities that have the potential to affect groundwater resource quantity and quality at all stages of the Project and carryout water quality modeling.
- 14.33** Identify the nature and significance of the potential Project impacts on groundwater with respect to:
- 14.33.1** Inter-relationship between groundwater and surface water in terms of surface water quantity and quality;
 - 14.33.2** Potential implications of seasonal variations; and
 - 14.33.3** Ground water withdrawal for Project operations, including any expected alterations in the groundwater flow regime during and following Project operations.
- 14.34** Describe programs to manage and protect groundwater resources including:
- 14.34.1** The early detection of potential contamination;
 - 14.34.2** Groundwater remediation options in the event whose adverse effects are detected; and
 - 14.34.3** Monitoring groundwater production or dewatering impacts.
- 14.35** Provide surface flow baseline data, including:
- 14.35.1** Seasonal variation, low, average and peak flows for watercourses; and
 - 14.35.2** Low, average and peak levels for water bodies.
- 14.36** Provide map existing critical or sensitive areas such as spawning, rearing, and over-wintering habitats, seasonal habitat use including migration and spawning routes.
- 14.37** Identify the current and potential use of the fish resources by aboriginal, sport or commercial fisheries.
- 14.38** Describe and quantify the current extent of aquatic habitat fragmentation and carryout baseline aquatic survey.
- 14.39** Ability for the developers of the power generation projects to satisfy all national regulatory requirements and international obligations related to health and human safety and the environment in the construction, operation, and maintenance of the projects of the anticipated size at the identified sites.
- 14.40** Assess and evaluate the ability of each of the project (and any expansion projects at the site) to comply with all health, safety and environmental laws of Bangladesh and the requirements of the World Bank group. Identify any restriction that should reasonably be imposed on the developers of the power generation projects to ensure that expansion projects can be designed, constructed and operated in compliance with all such laws, regulations and requirements and also international obligations.
- 14.41** Evaluate the impact on environment in line with Bangladesh and/or World Bank requirement for the solar power plant and transmission line to ensure that the power generation facilities and transmission facilities can be designed, constructed and operated in compliance with all applicable environmental requirements.



14.42 Describe the socio-economic impacts of construction and operation of the Project, including:

14.42.1 impacts related to:

14.42.1.1 local training, employment and business opportunities,

14.42.1.2 regional and provincial economic benefits,

14.42.1.3 housing,

14.42.1.4 recreational activities,

14.42.1.5 hunting, fishing, trapping and gathering, and

14.42.1.6 impacts to traditional land use and social and cultural implications;

14.42.2 Impacts of the Project on the availability of affordable housing and the quality of health care services. Provide a summary of any discussions that have taken place with the local municipalities and the local environmental public health office concerning housing availability and health care services respectively;

14.42.3 Identify any impacts expected on primary and secondary highway systems and other regional roads caused by anticipated traffic changes;

14.42.4 The impact on local and regional infrastructure and community services, including consideration of municipal "hard services", education/training services, social services, urban and regional recreation services, law enforcement and emergency services; and

14.42.5 Describe municipal growth pressures as they relate to the Project and the need for additional Crown land to meet those needs

14.43 Arrange DoE approval for 100MW Grid Tied Solar Park and Fisheries project.

15.0 Engineering design estimation

15.1 Project summary provides an overview of engineering construction site, construction scale, foreign transportation condition, construction period, its source and the proportion of capital; Express the project total investment, static investment and unit kilowatt investment.

15.2 Preparation principle and basis. Express the regulations adopted by the engineering design for tendering, the quota and the expense standard, the design documents, the price level of the static investment preparation and so on. Design estimation should be established according to the engineering budgetary (estimate) calculate and charge standards.

15.3 Explain the unit price of manual budget, the prices of main materials and the principles and basis of its basic price calculation.

15.4 The principles and basis of determining the original price and mode of transportation of the main equipment.

15.5 Express the unit price of the equipment installation and the rate index of the construction unit price calculation.

15.6 Explain the basic currency reserve funds rate, annual rising prices index, the lending rate etc.

15.7 Original total estimated cost, estimated cost of equipment and installation project, estimated cost of construction engineering, other expenses, annual investment estimative table (Considering maximal construction).

15.8 The budget price calculation table of the main materials, the fee calculation table of the main construction machinery, the unit price summary of the installation project, the unit price summary table of the construction engineering, the engineering cost calculation table, survey and design calculation, and artificial material equipment budget price and cost information.



16.0 Financial evaluation and social effect analysis

16.1 Overview: Briefly introduce the scale, the annual average electricity, construction period and the financial evaluation calculation period (including construction period and operation period) of the photovoltaic power generation and fisheries and mushroom cultivation or similar project and introduce the basis of financial evaluation.

16.2 Financial Evaluation:

16.2.1 Project investment and financing. Briefly introduce the structure of the construction funds of the project, including the fixed capital investment, interest of the construction period, liquidity etc. Explain the financing schemes and loan repayment condition.

16.2.2 Analysis and evaluation

16.2.2.1 The total cost calculation: The value of fixed assets and cash flow calculation; the total cost calculation of the photovoltaic power generation and fisheries project, including the operating costs, depreciation, amortization and interest expenses. Total operating costs include maintenance, staff wages, welfare, insurance, cost of raw materials and other fees, Tax calculation etc.

16.2.2.2 Power generation benefit calculation: Express the calculation method of the power generation benefit and the parameters. The content includes the power generation benefit, annual income (note that photovoltaic modules output power attenuation characteristics caused by the power generation benefits change year by year), the input tax deductions, and distribution of profits, etc.

16.2.2.3 Fisheries and Mushroom cultivation or similar project benefit calculation: The consultant shall have to calculate the fisheries and mushroom cultivation or similar project benefit, annual income, Internal Rate of Return, benefit cost ratio.

16.2.2.4 Solvency analysis: The loan servicing and asset liability calculation, the analysis of debt paying ability of the project, put forward the interest of coverage ratio, Debt Coverage Ratio and asset-liability ratio.

16.2.2.5 Profitability analysis: Project financial cash flow calculation, the capital financial cash flow calculation; Results calculated based on the financial profit ability, and compare the internal rate of return of investment profit before and after income tax, the capital profit margin and financial evaluation indicators.

16.2.2.6 Financial viability Analysis: Cash flow calculation of the financial plan.

16.2.2.7 Sensitivity analysis. The uncertainty factors of the photovoltaic power generation project mainly are the internal power feed-in tariff, the investment of fixed assets, and the internal power price and so on. Calculate the change of the financial internal rate of return by these changes, or under the yield benchmark calculate the internal power changes and the fixed assets investment on the influence of the feed-in tariff of internal electricity price, analyze the resistance ability of the photovoltaic power generation project.

16.2.3 Financial evaluation conclusion: Prepare the financial evaluation index summary table, and put forward the project financial feasibility evaluation conclusion.



16.3 Social benefit evaluation

16.3.1 Analyze and evaluate the reality and the long-term influence of projects on the economic development of urban construction, the labor employment and the ecological environment, etc.

16.3.2 Analyze the energy conservation and emissions reduction benefits of this project

17.0 Study/Service Schedule: The study is proposed to be commenced immediately and is scheduled for completion in maximum 6(Six) months. The study team is expected to mobilize immediately after the award of contract and the notice to proceed.

18.0 Reporting requirement: The following reports in connection with the detailed Feasibility Study, Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) for 100 MW Grid Tied Solar Park & Fisheries Project at Kotiadi of Kishoreganj District are required to be prepared by the consultant and to be submitted to the Project Director or Head of the Concerned Division.

The assignment is single phased.

The assignment is to be completed within Six (6) months.

18.1 Inception Report is to be prepared and submitted within 15 days from the date of commencement of the study;

18.2 Monthly progress report is to be prepared and submitted within 7 days of the next month.

18.3 Draft IEE Report is to be prepared and submitted at the end of 45 (forty five) days from the date of commencement of the study;

18.4 Draft EIA Report is to be prepared and submitted at the end of 120 (one hundred twenty) days from the date of commencement of the study;

18.5 Draft detail-feasibility study report including detailed technical specification of each equipment of power plant (from PV panel up to transmission line), bill of quantity (BOQ) with cost estimation, complete plant layout, Tender document and standard power purchase agreement (PPA) are to be prepared and submitted at the end of 150 (one hundred fifty) days from the date of commencement of the study;

18.6 Final IEE Report is to be prepared and submitted at the end of 60 (sixty) days from the date of commencement of the study;

18.7 Final EIA Report are to be prepared and submitted at the end of 165 (One hundred sixty five) days from the date of commencement of the study;

18.8 Final detail-feasibility study report including detailed technical specification of each equipment of power plant (from PV panel up to transmission line), bill of quantity (BOQ) with cost estimation, complete plant layout, Tender document and standard power purchase agreement (PPA) are to be prepared and submitted at the end of 180 (One hundred eighty) days from the date of commencement of the study

18.9 Detailed Report of fisheries project investment, benefit, annual income, Internal Rate of Return, benefit cost ratio are to be prepared and submitted at the end of 180 (One hundred eighty) days from the date of commencement of the study.

18.10 All reports are to be submitted in 5 (five) sets in original with a soft copy.

18.11 All the reports must be prepared as per international standards and acceptable to APSCL.

19.0 Responsibilities of the Client (APSCL)

The consultant shall work under the direct supervision of the Project Director. The concerned offices of Ashuganj Power station Company Ltd. shall assist the study team as required. In case of any unforeseen events in terms of physical or social obstacles at field levels; the concerned field offices of the Ashuganj Power station Company Ltd, will take initiatives to solve it and ensure good working environment.



20.0 Responsibilities of the Consultant

The consultants shall carry out the study as detailed in the "Scope of services" and "Responsibilities" in the best interest of the Company for the successful realization of the project with all reasonable care, skill sound engineering, administrative and financial practices and shall be responsible to the company (Ashuganj Power Station Company Ltd.) for discharge of responsibilities.

For smooth completion of the study; the Consultant shall collect and carryout of the following data, services and facilities:

20.1 Hydrological, meteorological, morphological data and records on irrigation and drainages systems.

20.2 Hydrological, morphological, environmental, social and institutional aspect of the study.

20.3 Available maps such as planning map, project index maps, contour maps, mouza maps etc.

20.4 Studies carried out in relation to generation of secondary information and future plans.

20.5 Agricultural and environmental data, etc.

21.0 Staffing

21.1 For Detail-feasibility Study: The person-months and field of expertise of the professional for the detail-feasibility study should include the following:

21.2 Staffing requirement:

SN	Position	Number of Persons	Months	Person-Months
1	Solar Energy/Technical Expert (Team Leader)	1	4	4
2	Power Transmission & Protection Expert	1	1.5	1.5
3	Civil and Structural Design Engineer	1	1.5	1.5
4	Financial/Economic Analyst	1	0.5	0.5
5	Environment health and Safety Expert	1	2.0	2.0
6	Soil and Agriculture Specialist	1	1.0	1.0
7	Fisheries Specialist	1	1.0	1.0
8	Socio Economist	1	1.0	1.0
9	RS and GIS specialist	1	1.0	1.0
Total		9	13.5	13.5

21.3 Qualification and Experience:

21.3.1 Solar Energy/Technical Expert (Team Leader)

Qualification:

- 1) He/she should hold a M.Sc. degree in Renewable Energy and Bachelor degree in Electrical Engineering/ Mechanical Engineering/Applied Physics.
- 2) He/she should have at least 20 years working experience in the power and energy sector in Bangladesh and 10 years' experience in the solar energy field in Bangladesh.
- 3) He/she should have successfully completed feasibility study of at least 5 grid connected solar PV power plant in Bangladesh and out of which at least 2 should have minimum capacity of 100MWp

Responsibilities:

His/her tasks and responsibilities shall include but not limited to: He/she will

- 1) Oversee the assignment and the consultant team, and act as the team's point of contact with APSCL.
- 2) Review all scope of services; manage the project including administration procedures for the implementation of the project.

- 3) Prepare the technical specifications; choose the best technology options considering the site location and grid system; Prepare the Project implementation schedules, and drawings for bidding of the power plant on a turn-key basis.
- 4) Advice and assist APSCL to develop and maintain a project quality assurance plan
- 5) Prepare the sample of Testing Procedures for plant Major Equipment.
- 6) Review of hazard evaluation of Power Plant.
- 7) Prepare the detailed description of Major equipment required for installation of the solar PV system
- 8) Analysis of the solar radiation data of the location
- 9) Yield calculation using PV simulation software (It includes month wise energy generation, Loss diagram over the whole year, Specific energy yield, Month wise performance ratio etc.)
- 10) Prepare the detailed technical specifications of the mandatory spare parts
- 11) Prepare the Solar PV panel mount structure design
- 12) Conduct other duties and responsibilities as required by the TOR.
- 13) Attend meetings with the client as and when required.
- 14) Preparation of the reports at different stages of the study;
- 15) Others as necessary.

21.3.2 Power Transmission & Protection Expert

Qualification:

- 1) He/she shall be at least Bachelor in Electrical Engineering, Master in Electrical Engineering will carry maximum credit.
- 2) He/she shall have experience in similar nature of works for minimum 8 years. 15 years of experience in similar nature of works will carry maximum credit.
- 3) He / she have must have through knowledge and working experience in power Grid System. He/she should have fair idea about the Electric High Voltage Grid line construction & experience of High Voltage (132/33KV) Substation set up. He/she should have fair idea about the power plant set up & Power system protection. He/she must have proven records of leading and working with multi-disciplinary and multi-cultural teams.

Responsibilities:

His/her tasks and responsibilities shall include but not limited to: He/she will

- 1) Maintain liaison with the team leader
- 2) Prepare the requirement of power evacuation system
- 3) Literature review on electrical interventions of power plant
- 4) Preparation of specifications of substation and transmission line both High voltage & Low voltage
- 5) Preparation of cost estimates of substation and transmission line
- 6) Analyze the impact and requirement of power evacuation system for High Voltage line (132 KV, 9 Km approx.) from plant site to Bazitpur grid substation.
- 7) Attend meeting with team leader as and when required by the client.
- 8) Assist the Team Leader in preparation of the reports at different stages of the study.
- 9) Others as necessary.

21.3.3 Civil and Structural Design Engineer

Qualification:

- 1) He/she shall have at least a Bachelor degree in Civil/Water Resources Engineering; Master in relevant field will carry maximum credit.
- 2) He/she shall have experience of 06 years in similar of works nature. 15 years' experience will carry maximum credit.
- 3) He / she must have experience of construction and reviewing of literature on interventions of power plant, determining the availability of land for the ultimate capacity of the power stations.




- 4) He/she must have proven records of leading and working with multi- disciplinary and multi-cultural teams.

Responsibilities:

His / her tasks and responsibilities shall include but not limited to:

- 1) Co-ordinate with team leader.
- 2) Shall carry out all civil and geotechnical activities;
- 3) Guide and co- ordinate all project activities;
- 4) Review of literature on interventions of solar power plant;
- 5) Determine the availability of land for the ultimate capacity of the power stations;
- 6) Find out the land quality and carry out the Geotechnical and Topographic survey;
- 7) Identify all technical requirements/parameters to be specified by APSCL required as part of the development of the Solar PV Power plant
- 8) Preliminary idea of structural design of different components of the power plant;
- 9) Preparation of specification (if required);
- 10) Preparation of cost estimates;
- 11) Assist the Team Leader in preparation of the reports at different stages of the study;
- 12) Attend meetings with the client as and when required.
- 13) Others as necessary

21.3.4 Financial/Economic Analyst

Qualification:

- 1) He/she should have a Master degree in Economics / Finance. Higher degree will be carried the maximum limit
- 2) He/she shall have experience of 08 years in similar works. 12 years' experience will carry maximum credit.
- 3) He/she should have experience in environmental study related to Solar/Gas infrastructure / Highway/Railway/Power transmission infrastructure/ river or waterway embankment and on macro and micro economics, regional planning, assessment of economic potentials of regional development plan, formulation of sectorial policies and strategies for Bangladesh.
- 4) He / she shall have to calculate the fisheries project benefit, annual income, Internal Rate of Return, benefit cost ratio.

Responsibilities:

His /her tasks and responsibilities shall include but not limited to:

- 1) Co-ordinate with team leader
- 2) Perform detail-feasibility level economic and financial analysis;
- 3) Determine detail-feasibility of level cost- benefit ratio and EIRR
- 4) Examine and evaluate the available data related to the socio-economic condition of the study, magnitude and extents of the people sufferings from the proposed power plant.
- 5) Maintain the link with different interested groups like Tribal People, different NGOs who are working in the study area.
- 6) Assist the Team Leader in preparation of the reports at different stages of the study;
- 7) Others as necessary.

21.3.5 Environment Health and Safety Expert

Qualification:

- 1) At least Bachelor degree in Environmental Science or other relevant. Higher degree will be carried the maximum limit.
- 2) Experience in environmental and social safeguard Related Field: 10 years.
- 3) Experience as safeguard specialist same size 1 projects will be carried the maximum limit.
- 4) Experience of working in more than 1 (one) developing countries



Responsibilities:

His / her tasks and responsibilities shall include but not limited to:

- 1) Shall maintain liaison with team leader the sponsor, donor and other concerned agencies;
- 2) Guide and co- ordinate all project activities;
- 3) Interpret the environmental consequences of solar power plant,
- 4) Assess environmental impacts and mitigation measures
- 5) Prepare IEE reports
- 6) Attend meetings with the client as and when required.
- 7) Interpret the environmental consequences marshy land training scheme of solar power plant
- 8) Indicate the effective marshy land training scheme to protect the project site embankment from erosion;
- 9) Literature review on marshy land training scheme;
- 10) Preparation of specifications;
- 11) Preparation of cost estimates;
- 12) Assist the team leader in preparation of the reports at different stages of the study;
- 13) Communication to DOE for approval of the IEE reports.
- 14) Designing the EIA & SIA study plan and develop the methodology for undertaking the study,
- 15) Designing and developing methodology along with collection, completion and analysis of data related to biological resources;
- 16) Establishing baseline condition fisheries and aquatic resources;
- 17) Identifying and assess the possible positive and negative impacts on flora and fauna due to the recommending measures to offset negative impacts and will assist team leader in interpretation of data as well as in preparing the E I A & S I A reports.
- 18) Contribute in developing environmental management plan including mitigation plan and other as necessary.

21.3.6 Soil & Agriculture Specialist**Qualification:**

- 1) He / she should have at least a Bachelor degree/Masters in Agricultural Science.
- 2) He/she shall have experience in Soil and Agriculture for minimum 5 years. 10 years' experience will carry maximum credit.

Responsibilities:

His/her tasks and responsibilities:

- 1) Co- ordinate with team leader
- 2) Establishing baseline condition in respect of land resources and agricultural practice in the project.
- 3) Collecting of historical data on soil and agriculture for the project, condition and compare the same project condition for assessing impacts of the proposed interventions on land resources and agricultural practices including cropping pattern, agricultural input use and crop production. Selecting IECs related to agriculture and coordinated data collection on the selected IECs;
- 4) Suggesting measures for the mitigation plan, enhancement plan and monitoring plan in respect of land resources and agricultural practices of the rehabilitated schemes.
- 5) Suggest feasibility of mushroom cultivation or similar on the project site.
- 6) Others as necessary



21.3.7 Fisheries Specialist

Qualification:

- 1) He/she should have at least a Masters in Fisheries/ Zoology/Marine Biology.
- 2) He/she must have through knowledge and working experience about the impact of aquatic organisms by power plant for minimum 5 years; 10 years' work experience in fisheries sector will carry maximum credit. He/she must have proven records of leading and working with multi-disciplinary teams.

Responsibilities:

His/her tasks and responsibilities shall include but not limited to: He/ She will;

- 1) Co-ordinate with team leader.
- 2) Collecting historical data on fisheries for generating the Future without project (FWOP) condition and compare the same with the Future with project (FWIP) condition for assessing impacts of the proposed solar power plant on fisheries;
- 3) Monitoring the impact on fish production and its diversity during the project implementation and suggest possible mitigation measures;
- 4) Suggesting enhancement measures for increasing benefits of the positive impacts in addition to suggesting a fisheries monitoring plan;
- 5) Examining available data on fish production and its diversity in relation with the changes of drainage condition of the project area of power plant;
- 6) Assess the environmental impact and mitigation measures for fisheries and mushroom cultivation or similar project
- 7) He/ She shall have to assist for calculating the fisheries project benefit, annual income, Internal Rate of Return, benefit cost ratio.
- 8) Others as necessary.

21.3.8 Socio Economist

Qualification:

- 1) He / she should have at least a Bachelor degree / Equivalent in Social sciences/ Masters in Rural Development. Master or higher degree in relevant field will carry maximum credit.
- 2) He / she should have through knowledge about socio-economic survey, resettlement action plan, etc. He / she must have proven records of leading and working with multi-disciplinary teams for minimum 5 years. 10 years of work experience in the relevant field will carry maximum credit.

Responsibilities:

His/her tasks and responsibilities shall include but not limited to:

- 1) Co- ordinate with team leader
- 2) Designing and developing methodology along with collection, compilation and analysis of data related to social and economic activities of solar power plant.
- 3) Establishing baseline condition from socio- economic point of view;
- 4) Identifying and assessing the possible positive and negative impacts in settlements and homesteads due to installation of solar power plant;
- 5) Preparing and conduct consultation meetings with stakeholders and participate in workshops;
- 6) Recommending measures to offset negative impacts and will assist team leader in preparing Environmental Management Plan as well as in preparing the EIA & SIA;
- 7) Examining and evaluating activities of the field researchers;
- 8) Examining the development of conflicts among the different groups and different localities and provide mitigation measures during the process of implementing the power plant and
- 9) Evaluating the overall social benefits like in poverty alleviation, women participation, health.
- 10) Others as necessary.



21.3.9 RS and GIS specialist

Qualification:

- 1) He/ she shall have at least a Master degree in Geography / Geology / Environmental sciences or Bachelor degree in Civil/ Water Resources.
- 2) Engineering with minimum 5 years working experience in the field of GIS and Auto-CAD. Extensive experience is required with Auto-CAD, ARC/INFO, and Arc View software. He/she must have proven records of leading and working with multi-disciplinary team. 10 years' experience in will carry maximum credit.

Responsibilities:

His / her tasks and responsibilities shall include but not limited to:

- 1) Co-ordinate with team leader.
- 2) Prepare all types of maps and drawings required for the study;
- 3) Shall have close co- ordination with all other members of the team for preparation of the maps and drawings of the study;
- 4) Others as necessary.

