



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

Handwritten signature and a circular stamp with a signature inside.

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> <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>			
	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:		
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 (ii) 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



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.

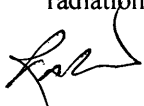


- 3.18 Preparation of operating budget
- 3.19 Preparation of Tender document
- 3.20 Preparation of Standard Power Purchase Agreement
- 3.21 Risk and Risk mitigation plan for the project
- 3.22 Complete Plant Layout including all equipment dimensions
- 3.23 Complete single line diagram of power plant 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

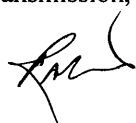
- 7.2.1 The consultant shall have to find out the operation mode of PV array, such as fixed mode, single automatic sun tracking mode, double automatic sun tracking mode, with comprehensive analysis of operation reliability, equipment price, maintenance cost, failure rate and power generation efficiency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