Terms of Reference
For
Appointment of Consulting Firm for
Feasibility Study for Development of Utility-ScaleSolar PV and Wind Projectin Bangladesh
(Package No. S-89)

I. BACKGROUND

1. Power and energy infrastructure of Bangladesh is growing in a rapid pace. Electricity is the major source of power for most of the country's economic activities. The per capita power consumption in Bangladesh has risen to 371kWh. About 75% of the population has access to electricity including about 13% from renewable energy. Total installed electricity generation capacity is 12,229 MW as of March, 2016. About 67% of generated power comes from natural gas and the rest is from liquid fuel, coal, hydropower and renewable energy. The present share of renewable energy is about 3.5% of the total installed capacity.

2. Government of Bangladesh (GOB) has taken a systematic approach towards renewable energy development. The initiative includes development of relevant policy and institutional development. As per the National Renewable Energy Policy 2008, the plan is to add generation capacity of 2,000 MW by 2020from renewable sources.In addition, the Ministry of Power, Energy and Mineral Resources has announced in 2013 to develop 500 MW of installed generation capacity from solar energy through Asia Solar Energy Initiative (ASEI).

3. Bangladesh has received concessional climate financing from the Scaling-up Renewable Energy Program in Low Income Countries (SREP) of the Climate Investment Funds (CIFs) for implementing the SREP Investment Plan for Bangladesh that was prepared by GOB and endorsed by the SREP Sub-Committee. The Investment Plan includes i) grid-connected renewable energy and ii) off-grid solar PV mini-grids and solar irrigations. Under the grid-connected renewable energy project supported by the World Bank, Bangladesh plans to use concessional resources from SREP to leverage financing for the development of 170 MW of utility-scale solar PV and 32MW of grid-connected rooftop solar PV. SREP support would help catalyze private investment in a first round of ground- and roof-mounted solar PV plants, and show the potential for deploying solar PV on a commercial basis.

4. In the course of promoting renewable energy development program, the Electricity Generation Company of Bangladesh Limited (EGCBL) has identified a potential grid-connected renewable energy project. The proposed project is to develop 100 MWpthrough solar PV and 100 MW from wind, subject to further wind resource assessmentat SonagaziUpazilla under Feni District. This project is considered to be the first one to be supported by the World Bank and SREP under the utility-scale solar PV project.In addition, other potential pipeline projects need to be identified to meet the target capacity of utility-scale development. A separate study of renewable energy resource assessment that are both site-specific and nationwide will be conducted in parallel to help assess the potential and feasibility of pipeline more accurately.

5. The purpose of this feasibility study is to assess the Fenisite for possible solar PV and wind system installations and estimate the costs, tariff, performance, and site impacts of different technology options. In addition, the study would explore various development and financing options, ranging from pure public development to public-private partnership (PPP) and

independent power producer (IPP) modalities, and recommend options that could assist in the implementation of the proposed solar power plants at the proposed site. Other potential sites, determined in discussion with GOB, will be included in this site-specific assessment.

6. The study would be carried out by the "Power Cell", Power Division, Ministry of Power, Energy, & Mineral Resources (the Client), and will be financed by the World Bank under the ongoing Rural Electrification and Renewable Energy Development II (RERED II). A consultant firm will be hired to carry out a feasibility assessment on grid-connected solar PV generation to establish its technical, financial, economic, social and environmental viability covering seasonal variations and subsequent impacts. The consultant firm will work closely with the Sustainable and Renewable Energy Development Agency (SREDA), Electricity Generation Company of Bangladesh Limited (EGBCL), and other agencies owning potential sites.

II. OBJECTIVE

7. The overall objective of the study is to determine feasibility of grid-connected utility-scale solar PV power plant(s), of approximately 200 MW of aggregate installed capacity. In-depth feasibility studies are required for the identified project site at SonagaziUpazilla under Feni District as well as three to four other potential sites to be determined by the Client. The purpose of thesestudies is to assess possible solar PV and wind system installation and estimate the construction cost, assessment of tariff, performance, and site impacts of different PV options. In addition, the study would explore various development and financing options, ranging from pure public development to public-private partnership (PPP) and independent power producer (IPP) modalities, and recommend options that could assist in the implementation of the proposed solar power plants at the site.

8. The Consulting Firm will obtain available solar resource data (from NREL, NASA etc) and the previously generated solar maps as a basis of feasibility studies, but also should work closely with other consultants conducting renewable energy resource assessment (e.g. on-going wind resource assessment funded by USAID). As more accurate information on resource potential becomes available, the Consulting Firm will produce and update the feasibility studies for the selected projects.

9. In addition, due to significant land scarcity in Bangladesh, a pre-feasibility study is required to explore various options to deploy utility-scale solar PV other than ground- or rooftop-mounted. This study will cover existing and future business options, including floating solar PV on rivers or canals, at ports, and the use of idle lands at airports and railways, as well as some hybrid options that combine other business opportunities (e.g. fish culture/agriculture under solar PV) to assess the financial and economic viability of the business options.

III. SCOPE OF WORK

10. **Task 1: Project Inception and implementation planning.** This task will include the following key activities: Within 2 weeks of the contract signing, the Consulting Firm shall carry out an Inception Mission to Dhaka, Bangladesh in coordination with the Client and in association SREDA and EGCBL. The objective of this mission should be to explain and refine the proposed methodology and timeline, identify and meet the interested stakeholders and gather all the information required to conduct the detail analysis. All of the background documents and technical information available to the Client at project inception requires to be provided to the ConsultingFirm. The ConsultingFirm will be responsible for their own logistics (including

getting to/from meetings and site visit locations). On completion of the inception mission, the ConsultingFirm shall prepare a detailed report on implementation plans for all tasks and confirm the timing and planning of the task components with the Client in association with SREDA and EGCBL.

11. **Task 2: Feasibility studies.** Based on the resource information available (the ground-measured resource assessment will be carried out under a separate consultancy), the ConsultingFirm will prepare four to five feasibility studies, including SonagaziUpazilla. As a minimum, each feasibility study should include:

- The project site and boundary area and approximated site plan and layout. This will include topographic mapping of the site(s). Available geophysical, soil, climate, solar and weather data will have to be included.
- A conceptual design of the project, including estimation of installed capacity depending on the type of best available technology.
- Cost-benefit analysis for different technological options for solar PV and wind (to be agreed with the Client), depending on module type, mounting options (fixed vs. tracking system), inverter type and potential use of electric storage and/or capacitors. Availability, inter-operability, reliability, scalability and maintenance aspects; defining communication, command and control systems, load consumption, system architecture definition and roadmap (including layout, modules, inverters, transformers, meters, etc.), relationship between the features, system output and performance should be taken into account.
- Detailed shading analysis report
- Estimated energy yields for a number of technologies (to be agreed with the Client – see third bullet point above), that are most suitable for the identified sites. The energy yield should include:
    - An assessment of the inter-annual variation and yield confidence levels.
    - Consideration of site-specific factors, including soiling or rain, and the cleaning regime.
    - Shading analysis including near and far shading.
    - Electrical losses Influence of temperature variances on the efficiency of the plant
- The cost estimates for development, construction and operation of the project and predicted revenue, based on the available resource data, as well as indicative quotes or comparison with similar projects.
- The land ownership and land use status. The Consultant(s)/Firm should advise the Client whether the preferred option is for the Government to provide the land to the project or require the winning bidder to acquire the land in case of public-private partnership (PPP).
- Transmission line and grid connection, including cost and potential barriers to achieve grid connection.
- Power off-take options (what voltage, who the off-taker would be etc. through analysing available existing grid condition).
- The status and roads and accesses, water pipeline, green belt requirement and other associated facilities.
- Permitting requirements and expected timeline and estimated costs for achieving these issues.
- Financial modelling detailing financial assumptions, energy yield, and evaluation of results depending on available primary and secondary data.

- Financial and economic analysis for the technology suitable (to be agreed with the Client) for commercial utility-scale grid connected solar power plants at each of the selected sites specifying the investment cost ($/kW), levelized cost of energy ($/kWh), subsidies, incentives (e.g. applied to the equipment's costs, etc.), energy tariffs, costs and benefits, total cost of ownership/life-cycle costs of plant, payback time, insurances costs, costs recovery, etc. SREP funds should be taken into account, along with development models explored above.
- The investment plan analysing stakeholders and community acceptance, value to power-sector, demand and market sizing, customer profiling, return on investment, costs and revenues trajectory, running and recovery costs, distribution channels, risks, and profitability and performance analysis
- The estimated local and global environmental benefits including climate, annual GHG reduction benefits attributable to the renewable energy generation for the site.
- Complete tender and bidding documents based on World Bank Procurement Guidelines for procurement of EPC contractor or reverse auction for private sector developers, depending on the development option (to be agreed with the Client). Plus highlighting financing structure, modularity, installation process, and maintenance needs as required.
- Any other related activities as may be reasonably requested by the Client.

12. The annexes to the Feasibility Study Report should include, but not limited to the following annexes:
    - Annex 1: Statements for information verification and sign off from each advisor to the Project
    - Annex 2: Project reference modeland financial model in excel (files in editable mode).
    - Annex 3: Risk assessment and comprehensive risk matrix and recommended mitigating measures, as applicable.
    - Annex 4: Document list (list of all documents related to the Project, where they are kept, and who is responsible for ensuring that they are updated)
    - Annex 5: Attach as annexure all other documents that have informed the Feasibility Study and that are of decision-making relevance to the Project.

13. The Final Feasibility Study Report, comprising all the above deliverables, must be compiled in a single report in Word format (with relevant annexes), and delivered as both electronic and hard copy documents. All financial models must be in Excel format, and must clearly set out all assumptions; sensitivity analyses carried out; and model outputs. The financial models must be sufficiently adaptable for use by others at later stages. The Feasibility Study must be presented with a thorough executive summary and must be accompanied by a PowerPoint presentation that encapsulates all the key features of the study. The executive summary and PowerPoint presentation must be compiled in such a manner that they can be used by the senior government officials for decision-making purposes.

14. **Task 3: Pre-feasibility studies for other options.** This task is to explore other options to deploy solar PV technology given the severe land scarcity that Bangladesh faces. The ConsultingFirm will identify various development options for solar PV that are non-traditional and different from ground-mounted utility-scale solar PV on a dedicated large land and rooftop-mounted solar PV, and assess the feasibility of each identified model in the context of Bangladesh. The study should include:

- The non-traditional development options that are being attempted in other countries, including floating PV on rivers and canals and ground-mounted PV on idle lands of railways and airports.
- The estimated potential for development for each option
- The project sites and boundary areas to be assessed as an example of each option
- A conceptual design of the project, including estimation of installed capacity depending on the type of technology.
- Simplified cost-benefit analysis for different technological options for solar PV (to be agreed with the Client), depending on module type, mounting options (fixed vs. tracking system), inverter type and potential use of electric storage and/or capacitors.
- Estimated energy yields for a number of technologies (to be agreed with the Client – see third bullet point above), that are most suitable for the identified sites.
- The approximate costs for development, construction and operation of the project and predicted revenue, based on the available resource data, as well as indicative quotes or comparison with similar projects.
- The land ownership and land use status.
- Transmission line and grid connection, including cost and potential barriers to achieve grid connection.
- Permitting requirements and expected timeline and estimated costs for achieving these.
- Financial modelling detailing financial assumptions, energy yield, and evaluation of results
- Any other related activity as may be reasonably requested by the Client.

15. **Task 4:LegalDue-Diligence in Environmental and Social Impact Analysis (ESIA) including Disaster Impact Analysis (DIA)**. Under this task the Consultant(s)/Firm shall conduct the following activities aimed at ensuring that the legal compliance is warranted. This shall include, but not limited to:

- Identifying regulatory framework that needs to be complied with; approvals required; and key challenges to risk allocation.
- Identify licensing, permitting and other legal risks that need to be addressed and allocated.
- Ensure all necessary approvals and permissions will be obtained for the selected projects before commencement of tender process, in particular to allow the relevant Government entity to sign the tender documents and contract.
- Conduct preliminary assessment of social, disaster and environmental impacts of the project at the selected site. This preliminary assessment must comply with the reference guidelines for the World Bank that will provide financing for the projects. The assessment shall include an analysis of current formal/informal land use in the project area as well as impacts associated to connecting the PV plants to the grid.
- Based on primary and secondary collected data the Environmental impacts and subsequent mitigation and management requires to be reflected in the EIA/ ESIA.
- Disaster Impact Assessment along with possible mitigation and management requires to be added as part of the full scale feasibility report.
- Institutional arrangement for environmental, social, disaster monitoring and management for this project.
- Other unattended issues may be added in the EIA/ ESIA and DIA report.

16. **Task 5: Project Structuring.** This shall include, but not limited to:

- Prepare financing plans for the proposed projects, evaluate any prospective co-financing, and appropriate counterpart funds for local currency expenditures and other costs, taking into consideration the availability of SREP funds.
- Prepare analysis and recommendations for different models, ranging from pure public development to public-private partnership (PPP), independent power producer (IPP) and other suitable modalities, with several different ownership and operational options while ensuring adequate balancing of benefits and risks. Each option should include:
    - Definition of obligations and responsibilities for the Government.
    - Definition of obligations and responsibilities for the public utility and any other stakeholders involved in the power sector.
    - Definition of obligations and responsibilities for private sector developers.
- If necessary as part of the financing arrangements, advice the Client on modalities for providing SREP and sovereign financing to private investors.

IV. DELIVERABLES AND TIMELINE

17. The expected duration of the assignment is 9 (nine) months. The Consultant(s)/Firm shall appoint the necessary staff including a Team Leader and other required qualified staff with relevant education and experience in the renewable energy sector, solar energy in particular, and has deep familiarity in preparing feasibility studies for grid connected solar power plants. Indicative summary of the implementation schedule will be as follows:

Deliverables/Reports	**Deadlines**
Task 1 Report	Contract signing + 25 days
Task 2 Report	Contract signing + 110 days
Task 3 Report	Contract signing + 140 days
Task 4 Report	Contract signing + 170 days
Task 5 Report	Contract signing + 210 days
All Deliverables Finalized	Contract signing + 250 days

V. TEAM COMPOSTION AND QUALIFICATIONS OF KEY EXPERTS

The following are the ley qualifications required for the experts positions:

- **Project Director/Team Leader:** At leasta Bachelor'sDegree in major engineering disciplines (civil, mechanical, electrical, electronic) together with a Master's Degree in Economics, Business or Finance. The Project Director should have at least fifteen years of experience in power plant design and construction including five years site experience of solar power plant construction. The Project Director will lead and manage the Feasibility Study team. It is possible that the Project Director's role could be combined with one of the roles of Civil Engineer, Mechanical Engineer or Electrical/Electronic Engineer within the Feasibility Study Team. This may provide an overall cost saving, but the Project Director would be required to be on site in Bangladesh during the site commitment period to carry out the engineering discipline work together with providing overall direction to the Feasibility Study.

- **Solar Energy Expert:**At least a Bachelor's Degree in a related Engineering specialization with a minimum of ten years of experience in the solar PV sector including at least five years of experience in PV power plant development covering design, procurement or construction. The solar expert should have good command of PV standards and proven experience on resource assessment and calculation of energy yield for solar PV projects.

- **Wind Energy Expert:**At least a Bachelor's Degree in a related Engineering specialization with a minimum of ten years of experience in the wind power sector including at least five years of experience in wind power plant development covering design, procurement or construction. The wind expert should have good command of wind standards and proven experience on resource assessment and calculation of energy yield for wind projects.

- **Energy Economist:**At least Master's Degree in Economics with a minimum of eight years of experience of the economics of power system planning, project design, economic appraisal of investment projects. Demonstrated experience in economic appraisal of solar power projects.

- **Environmental Specialist:**At least Master's Degree in Environmental Science/ Natural Science; at least eight years of relevant work experience in environmental assessment of infrastructure and energy projects. Good command of International standards, including World Bank safeguard policies, is also required.

- **Social Specialist:** The Consultant team will need to make available a social specialist if some of the proposed sites are in private or community-owned lands, or if proposed government-owned lands are being privately used.

  The Social Specialist will have at least a Master's Degree in Social Science and at least eight years of relevant work experience in social assessment and land acquisition/resettlement issues in infrastructure projects. Good command of International standards, including World Bank safeguard policies, is also required.

- **Disaster Impact Assessment Specialist:**At least Master's Degree in Disaster Impact Assessment/ Disaster Management/ relevant; at least eight years of relevant work experience in Disaster Impact Assessment (DIA) of infrastructures and power projects. Good commands of international standards including World Bank safeguard policies are also required.

- **Financial Advisory Team Leader**: At least a Master's Degree in Economics, Business or Finance. The Financial Advisory Team Leader should be a full time employee, staff member of the Lead Financial Advisor, with at least fifteen years of experience in financial advisory services for infrastructure and energy projects, including at least five years of experience in renewable energy projects, and non-recourse project finance. The Financial Advisory Team Leader will work closely with the Project Director during the Feasibility Study phase and will lead and manage the Financial Advisory team. The Financial Advisory Team Leader will represent the Lead Financial Advisor in its

interface with the client and the Government, and would be required to be in Bangladesh during all key meetings and consultations with client, and shall provide overall direction during the Financing phase of the Project. The Lead Financial Advisor should demonstrate experience of successfully leading at least three private sector financings in the power sector (generation projects, preferably solar) that have reached financial closure, using non-recourse project finance, within the last ten years, and outside their home country. Familiarity with World Bank instruments, Public-Private Partnerships and concessional /public finance should also be demonstrated.

- **Financial Analyst(s)/Financial Modeling Specialist(s):** At least a Master's Degree in Finance, Business or Economics together with at least five years of experience developing and analyzing financial models utilizing non-recourse financial structures for power generation facilities, together with tariff analysis. The Financial Analyst/s should demonstrate experience of having prepared financial models for at least three private sector financings in the power sector, using non-recourse project finance.

- **Project Financing and Structuring Specialist:**At least a Master's Degree in Business or Finance. The Project Financing and Structuring Specialist should have at least eight years of experience in financial advisory services for infrastructure and energy projects, including experience of at least three renewable energy projects utilizing non-recourse project finance and outside their home country. The Project Financing and Structuring Specialist will work closely with the Financial Advisory Team Leader and Financial Analyst to develop a bankable financial structure for the Project that optimizes the use of private capital and Government resources, with minimal impact to Government's balance sheet. The Project Finance and Structuring Specialist should have experience identifying and allocating project risks, as well as demonstrated experience designing and implementing a successful PPP bidding process.

- **Procurement Specialist:**At least a Master's Degree in Economics/Business/Finance or any relevant subject with experience of at least five years in procurement best practice and World Bank requirements for international project procurement. The Procurement Specialist shall provide guidance and support to the client to ensure compliance with applicable procurement requirements, and shall assist the Financial & Economic Specialist in designing and implementing a bidding and evaluation process that meets applicable standards of fairness and transparency.

- **Legal Advisor(s):**A Juris Doctorate, or Master's Degree in law, together with tem years of relevant legal background, legal skills and experience in the drafting and negotiating of project finance agreements, as well as experience advising on the legal documentation required for commercially financed infrastructure and energy transactions, as well as preparation of bidding documents and implementation of a fair and transparent bidding process. The Legal Advisor shall also have experience conducting legal due diligence that includes regulatory framework assessments and identification of licensing, permitting and other legal risks.

VI. EVALUATION CRITERIA

The evaluation of consulting firms will be done according to the categories mentioned below:

- Age of the firm
- Experience of the firm in Bangladesh Power Sector
- Experience of the firm in Renewable Energy Sector
- Qualification of Key Experts
- Work Methodology and Project Plan

VII. DURATION

18. The expected duration of the assignment is 9 (nine) months.