

# **Terms of Reference (ToR)**

## **on**

# **Appointment of Consulting Firm for Grid Reliability Study for Integration of Renewable Energy into the National Grid**

### **1. Project Background**

Electricity is an integral part for the socio-economic development of a country. In the recent years Bangladesh has experienced booming economic growth, rapid urbanization and increased industrialization. Hon'ble Prime Minister has announced the target of ensuring affordable and quality electricity supply for all by 2020. The Power Division has taken diversified fuel based short, medium and long term power generation plans in order to fulfill the target and commitment of the government. Besides, government has targeted to generate 10% of total generation from Renewable Energy (RE) resources.

In order to achieve the goal set by the government and attain the Sustainable Development Goals, Bangladesh needs to install large scale RE based grid-tied power plants to attain the said percentage along with keeping pace with development of conventional power generation. However, renewable energy, especially those of intermittent nature, would require special consideration in grid integration. Significant localized growth in RE can raise concerns such as voltage violations and reverse powerflow in low-voltage distribution systems. Various studies have shown that positive impacts (e.g., reduced line losses and avoided generation costs) can also result from distributed RE generation. Updating interconnection standards, procedures, and distribution planning methodologies to better reflect the characteristics of distributed RE can help realize these benefits and delay or even prevent the need for grid reinforcement.

A study to identify the maximum limit of RE integration and to conduct the required modeling, develop codes and standards (grid code elements) is required to establish a clear technical path for their connection and operation on the Bangladesh grid. Further, as a policy measure, a tariff methodology requires to be developed, considering possible technical and economic operational constraints and ancillary services required. For meeting above purposes, Power Division, Ministry of Power, Energy and Mineral Resources intends to appoint Consulting firm to conduct an assessment of impact of RE integration into grid and preparation of necessary interconnection standards, procedures, and distribution planning methodologies. The project expenditure will be borne from the fund of the Asian Development Bank.

### **2. Purpose of the Assignment**

The main objectives of this assignment are:

- a) Scaling up renewable energy generation into grid;
- b) Ensure safety & security of the National Grid
- c) Assess the amount of RE for integration into the Grid;
- d) Identification & solution of barriers to renewable deployment & integration challenges.
- e) Reduce environmental pollutions and meeting SDG targets;
- f) Increase the share of Variable Renewable Energy (VRE) into the grid;
- g) identification of correlation among VRE, Conventional Energy, Storage and other alternatives to ensure the stability of grid as well as to ensure maximum VRE integration.

### **3. Duration and Location of the Services**

The duration of the assignment is 04 (Four) months. The location of service will be in Bangladesh.

### **4. Scope of Services**

The scope of services includes the followings (including modifications proposed by the consultant, if any) in the scopes of work to meet the objectives of the assignments:

- The study would recommend the most prudent strategy for development of renewable energy, and recommend any changes to (i) codes and standards to ensure grid performance of the required quality, and (ii) tariff methodology and pricing of renewable energy.
- Review existing relevant documents including PSMP, RE based contract documents, Policies etc.
- Identification of maximum amount of RE integration including year wise recommendation up to the year 2041, considering potential RE technologies.
- Identified technical constraints for the integration of Renewable Energy (RE) into grid;
- Assessment of grid condition to integrate RE into national grid;
- Required grid integration measures for RE (i.e. enabling technologies), including an initial concept for dimensioning and implementation of the most relevant components. This also includes relevant grid support functions and range of operation (frequency, voltage, etc.) to be requested for RE power generators
- Examine the technical, economic and commercial impacts of the renewable energy development plan, by conducting the required steady state and dynamic simulations, dispatch, intermittency, and financial/ economic impact modeling;
- Preparation of required modeling, codes and standards (grid code elements) to establish a clear technical path for RE connection and operation on the Bangladesh grid.
- Further, as a policy measure, a tariff methodology requires to be developed, considering possible technical and economic operational constraints and ancillary services.
- Assess the present grid condition to integrate RE;
- Assess the present load capacity from RE being fed to the national grid;
- Recommend required modification to the national grid to integrate RE;
- Assess the impact of distributed RE vs. large RE in the national grid;
- Cost estimation to modify the national grid to integrate RE to the system;
- Assessment of frequency stability, voltage stability, transmission congestion and angular stability, demand response etc.
- Assess the present regulation/policies and recommend modification in the regulations and policies for RE grid integration;
- Qualitative assessment of suitability of existing grid codes for RE;
- System cost and cost benefit analysis.
- On the basis of the findings of the study, prepare a Renewable Energy Master plan in line with the existing PSMP 2016/Revisiting PSMP-2018.
- Analyze possibility of energy storage, technologies of energy storage and cost-benefit in details with clear and specific recommendations.
- Analyse the cost comparison of energy storage system with peak power generation using conventional fuel.
- Analyzing the present grid condition and recommendation about mitigation measure such as Static Var Compensator (SVC), Storage Device and other available technology for safe penetration of Variable Renewable Energy (VRE) into the grid;

- Asses the cost impacts of renewable energy both in terms of grid reinforcements necessary to maintain safe operation as well as on the Levelized Costs of Electricity (LCOE) considering fuel mix.
- Review the Grid frequency variation status precisely and way out to reduce the variation within the limit at least as defined by IEC 61727 which will ensure the proper integration of VRE into the grid network.
- Review the Grid Voltage variation for all grid substation as well as voltage variation of distribution level (0.4kV, 11kV and 33kV) and identification of a necessary solution to reduce the variation within -15% to +10% according to IEC 61727 for VRE integration.
- Analyze the standard IEC 61727, IEEE 1547 and similar utility interfacing standard for VRE and necessary recommendation for all types of VRE projects of Bangladesh.
- Assessment of regional VRE integration maximum capacity for all grid substation or district wise based on generation station of that region, the capacity of the transmission line, load pattern and relevant other factors. The suggestion will be for present grid status and probable grid status that will be achieved if the modification recommendation of this study has taken.
- Assessment of additional storage, reserve or other balancing systems to achieve the scope 1 and 2 (frequency and voltage) as mentioned above including cost-benefit analysis.
- Forecasting of VRE and suggestion of quick demand response for the Grid management system.
- Assess land requirement to implement the Renewable Energy Master Plan and its impact on agriculture.

**5. Detailed Outputs of the assignment (and applicable quality standards, where applicable)**

**5.1 Team Composition and Qualification Requirements for the Key Experts (and Any Other Requirements that Will Be Used for Evaluating the Key Experts under Data Sheet 21.1 of the ITC)**

Consulting services are solicited from consulting firms having experienced in carrying out grid integration studies for RE based power plant. Consulting firms should have experience to perform consultancy services, experience of similar assignments, experience in similar conditions, firm's capability and availability of appropriate skills among key staff, availability of resources, relevant transactional experience. The proposer is expected to engage the following categories of key experts for the Project and CVs shall be submitted accordingly:

- **Renewable Energy/ Technical Expert (Team Leader) (Position-1International, 4 person months):**The Team Leader must have a minimum Bachelor's degree in Engineering or Masters in Renewable Energy with minimum 20 years of experience including minimum 5 years of experience in the field of large scale RE based power projects. He/she should preferably have experience of carrying out feasibility study of minimum of 50 MW RE based power plant. Besides, he/she should have good understanding on power system planning and load dispatch system. He/she should have knowledge on govt. acts, rules, policies and tariff system for power sector.
- **Transmission Expert (Position-1International, 4 person months):** The Transmission Expert should have at least a Bachelor's degree in electrical or mechanical engineering and 15 years of experience in the power sector including in power generation, transmission/distribution network analysis and grid integration of renewable energy-based generation. He/she should have minimum 5 years of

experience in the field of high and medium voltage transmission system. He/she should have knowledge of integration of renewable energy with the national grid as well as stability of the national grid.

- **Renewable Energy Storage Expert (Position-1 International, 4 person months):** The Renewable Energy Storage Expert must have a minimum Bachelor degree in Engineering or any related subject. The expert must have at least 5 years of experience in the field of energy storage system. The expert's experience on renewable energy based energy storage system will be considered as an added qualification.
- **Policy Expert (Position-1 National, 4 person months):** The Policy Expert must have a minimum Masters degree in any subject or LLM from a recognized institute or B. Sc. in Engineering degree. The expert should have knowledge on law, rules and regulations of Bangladesh. He must have at least 5 years of experience on electricity related acts, policy, rules and regulation of Bangladesh relevant to power generation, transmission, distribution and renewable energy related issues.
- **Financial/Economic Analyst (Position-1 National, 4 person months):**The Financial/Economic Analyst must have a minimum Masters in Economics/Finance/Business Administration or any relevant subject with a minimum of 5 years of experience in financial/economic analysis. The specialist shall be able to provide the cost benefit analysis of the project including possible tariff model for transmission of RE based power through grid.

## ***5.2 Reporting Requirements and Time Schedule for Deliverables***

- Inception Report within 1 (one) month after signing of the contract
- Interim Report within 2 (two) months after signing of the contract with the analysis of grid condition, grid codes etc.
- Draft Feasibility Study Report within 03 (three) months after signing of the contract with the analysis of grid condition, dispatch, intermittency, codes and standards (grid code elements) and tariff methodology to establish a clear technical path for RE connection and operation on the Bangladesh grid.
- Hold Stakeholders Consultation Workshop on Draft Feasibility Study Report after submission of DFR;
- Finalization of Feasibility Study Report within 4 (four) months after signing of the contract.

**10(Ten) copies of each report has to be submitted along with a soft copy;**

**Person to receive the Report:** Project Director, Power Division

The consulting firm will report to Project Director, Power Division for billing and contract management. For work execution purposes, the consulting firm will work SREDA, PGCB, BPDB and other concerned utility.

***5.3 Relevant background information or materials for the assignment: Not applicable***

***5.4 Indication is downstream work is potentially considered:*** No downstream work is expected at the end of the feasibility study.

**5.5 Training and capacity building requirement:** Manpower training: To enrich experience of project personnel and official of Power Division and Power Cell, arrangement for a study tour of approximately 7 personnel to the outside of client county.

**5.6 Equipment procurement:** —Not applicable

**6. Client's Input and Counterpart Personnel**

**(a) Services, facilities and property to be made available to the Consultant by the Client:**

**Facilitation and Reporting**

Consultant will work in close association with Project Office, SREDA, Power Cell, PGCB, PDB and other relevant utilities. A coordination mechanism will be set up to review progress, provide guidance and advice. The designated personnel of the entities will interact with the Consultants and provide data, arrange discussions and assistance as required. The Consultant will work under the guidance of Project Director.

**Logistics Support**

Project Office will provide meeting room and logistic support for the communication with executing agencies when necessary. Office accommodation, site visits, secretarial service will have to be arranged by the consulting firm at their own costs.

**(b) Professional and support counterpart personnel will be assigned by Project Director to the Consultant's team**

**(c) Selection of sites and concerned Utility:** The concerned official under whose guidance the study will be carried out will be mentioned when RFP will be issued.

**7. Client will provide the following inputs, project data and reports to facilitate preparation of the Proposals:**

The consultant will have to collect relevant project data and reports from the relevant departments as required to successfully completing the study.