

# **Terms of Reference for Study on Incorporation of Battery Energy Storage System for Reliable and Efficient Power Supply in Bangladesh Power Sector (S-14)**

## **1. Background**

The Government of Bangladesh (GoB) has prioritized the power sector right from the beginning of its previous tenure. GoB has undertaken immediate, short, medium and long-term plans and projects for generation, transmission and distribution. Along with strategic planning and enactment of conducive policy and legal framework, at present, the installed generation capacity of the country has been increased to 25,730 MW including captive and renewable energy. The per capita generation has increased to 608 kilowatt-hours (FY 2021-22). The power distribution line has also increased to 6,19,000 km and the number of consumers has increased to 43.6 million. The overall system loss has reduced to 10.41% on FY 2021-22 which was 18.43% on FY 2008-09. The GoB through Power Division has achieved 100% electrification.

As per SDG agenda, GoB is committed to provide reliable, quality and affordable power to all. The reliable grid and distribution system is a challenge. In this regard, incorporating the Battery Energy Storage Systems (BESS) into the grid and distribution system may act as a key technology for efficient transmission and distribution system, energy transition, reliability of service, efficient VRE integration, grid support and carbon emissions reductions. Bangladesh Power sector intends to use Energy Storage Technologies throughout the Bangladesh electricity grid and distribution networks. Furthermore, they can provide infrastructure support services across supply, transmission and distribution, and demand portions of the energy system. Broadly speaking, BESS can serve as valuable tools for operators in systems with supply and/or demand side variability for quality and reliable power flow. This will decrease concern in a transition to increased penetration of variable renewables in Bangladesh.

Therefore, the Government is intending to analyze the role of Energy Storage System in the Bangladesh Power System for ensuring quality and reliable power supply. In this process, Power Division, Ministry of Power, Energy and Mineral Resources under the TA for Bangladesh Power Sector Development and Capacity Building (BPSDCB) intends to appoint an International Consulting firm to conduct “Study on Incorporation of Battery Energy Storage System for Reliable and Efficient Power Supply in Bangladesh Power Sector”.

The project expenditure will be borne from the fund of the Asian Development Bank under the Bangladesh Power System Enhancement and Efficiency Improvement Project (Loan 3523-COL). Power Division will recruit the consulting firm in accordance with ADB Guidelines on the Use of Consultants (2013, and as amended from time to time) using a Quality and Cost-Based Selection (QCBS) method. A quality-cost ratio of 80:20 will be applied for the final selection of the consulting firm based on the Full Technical Proposals from the short-listed firms, and the

consulting firm will be engaged using an output-based lump-sum contract. The duration of the study is 8 months out of which 6 months for the study and 2 months for the piloting of Lithium-Ion Battery Storage piloting. It is to be mentioned that the closing date of Loan 3523-COL is December 2023. As such, consulting firm must complete the study along with piloting within December 2023. The required person-month for the project is 40 person-month out of which 30 person-month is for phase I and 10 person-months is for phase II. The pilot study will procure a consulting firm to study (with suitable software) to identify 3 locations to install 1 MW, 2 MW and 3 MW BESS each- from the pre-identified feeders. The firm will be responsible for supply and installation of one of the 1 MW, 2 MW and 3 MW BESS- based on the technical specification in request for proposal (RFP). The firm will be responsible for technology transfer and training the power utility staff taking over the pilot system. The RFP will have technical proposal and price proposals for the study and supply of 1 MW, 2 MW and 3 MW of BESS. Power Division will confirm one of the three optimal sizes from 1 MW, 2 MW and 3 MW which will fit with the budget.

## **2. Objectives**

The main objectives of this assignment are:

- Analyze the role of BESS for quality, reliable and efficient transmission and distribution network;
- Analyze the role of BESS in increasing the share of more efficient Variable Renewable Energy (VRE) penetration into the grid;
- Determine the optimum capacity of BESS systems for three different distribution areas with techno economic analysis; and
- Incorporation of BESS in the distribution network to improve the power quality and reliability.

## **3. 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:

### **Phase I (30 person-month)**

- 1) Prepare overview of recent electric energy storage technologies and offer best technological solutions for reliable, quality and efficient power system in Bangladesh.
- 2) analyze historical and present power load curves/ trends (monthly/seasonal) in the Bangladesh Power System at different temporal scales;
- 3) review present and planned network infrastructure and examine technical issues related to electric energy storage applications, peak-shaving and valley-filling, frequency regulation, voltage control, electric bill management, supply reserve capacity, tertiary balancing, grid support, transmission/distribution upgrade deferral and transmission & distribution congestion relief for improving efficient power system.
- 4) assess the financial and economic viability of proposed energy storage technologies comparing levelized cost of storage against prices for power

- 5) prepare financial analysis of the proposed energy storage technologies and identify the savings of investment and value addition to the power system by incorporation of energy storage system.
- 6) recommend on alignment of existing grid code, policy, act and regulation to accommodate energy storage into power system;
- 7) evaluate the application of energy storage at the best fit in Bangladesh Power Sector;
- 8) identify the transmission and distribution investment deferral due to the energy storage system.
- 9) For the design of the practical Demonstration of BESS in Phase II-  
The consultant shall identify at least three (3) feeders in three different locations in any one of the six distribution networks (BPDB/BREB/ DPDC/DESCO/WZPDCL/NESCO) for Phase II for possible demonstration of the proposed battery storage technologies, and provide detailed rationale of their selection The area of demonstration is to be chosen by the consulting firm by required technical analysis..
- 10) The consultant shall propose at least (but not limited to) three different capacities of BESS (such as 1 MW, 2 MW and 3 MW) in the identified feeders with design justifications of each;
- 11) The consultant shall prepare financial analysis of the proposed energy storage technologies in each of the three feeders for their proposes capacity (1 MW, 2MW, 3 MW or other) and identify the savings of investment and value addition to the power system by incorporation of energy storage system in each.
- 12) The consultant will suggest at least two options in terms of battery sizing (2hr or 4hr continuous discharge capacity per day with Lithium Ion batteries) for their recommended BESS (without solar PV) in any one of the six distribution networks (BPDB/BREB/ DPDC/DESCO/WZPDCL/NESCO) for Phase II.
- 13) If required, the consultant will prepare tender documents/specification for the purchase of the BESS equipment in Phase II;
- 14) Power Division will order the most optimum one of the three proposed sizes from 1 MW, 2 MW and 3 MW (or other) within available budget, after conducting techno-commercial due diligence of each of the three or more designs.
- 15) The consultant shall prepare a comprehensive draft tender document and specification for piloting of Lithium- Ion BESS. This document should be prepared such way so that client can utilize these documents for further tendering in future.

**Phase II (10 person-month)**

1. Install at least *1 MW-4 hour (or 2 hour) Lithium- Ion* battery energy storage (without solar PV), or other, as selected from the Phase I above, into suitable location of one of any distribution networks (BPDB/BREB/DPDC/DESCO/ WZPDCL/NESCO) for piloting to understand the performance of the technology. After installing the BESS and end of the contract period, the respective utility will take over the O&M of BESS.
2. The consultant will purchase the required equipment and machinery. Consulting firm itself will be liable for such purchase and installation within the loan time period

(December 2023). Alternatively, to save time, the firm may form JV with a system installer while submitting the RFQ; Therefore, Phase I and Phase II activities can run in parallel.

3. Phase II may be implemented based on the analysis of Phase I and installation and commissioning may be initiated in the middle of Phase I if the suitable location could be identified during analysis.

4. **Procurement of Equipment**

- a) The consultant will prepare a complete equipment list with all necessary accessories with cost estimate to make the BESS operational at a respective utility network which will be identified at Phase I by technical analysis (as explained in selection process above);
- b) Approve the specification and cost estimate from the EA for the selected design;
- c) Purchase the equipment by ensuring the quality as agreed in Phase I;
- d) Install, commission and test the equipment at the designated site;
- e) Train manpower in the use of the equipment;
- f) The consulting firm will submit detail equipment list with cost estimates in the financial offer of RFP for each of the three (or more) design types;
- g) The consultant will bear the cost related to shipping, unloading, transportation, installation, commissioning, and operation.

4. **Man Power Training**

To conduct a comprehensive training program which shall be developed and conducted by the consultant during phase I on the BESS for project officials (Power Division, Power Cell and relevant distribution utility) and hands on training during the study will be required to operate the BESS. To enrich experience of project personnel (Power Division, Power Cell and relevant distribution utility), arrangement for a study tour of approximately 10 personnel for minimum 7 days for each group (during phase I) has to be arranged to venues (foreign country) where implementation of such project is completed.

5. **Duration and Location of the Services**

The duration of the assignment will be 8 months (6 months for Phase I and 2 months for Phase II). The location of service will be in Bangladesh. It is required to mention that the closing date of Loan 3523-COL is December 2023. As such, consultant must complete the study and piloting within December 2023.

6. **Evaluation Criteria**

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

- a. Technical Competence
- b. Geographical Experience
- c. Management Competence

The shortlisted consultants will quote price for Phase-I and Phase-II in a single envelope.

## 7. Key Expert

Consulting services are solicited from consulting firms having experience in carrying out feasibility studies of energy storage systems. 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:

- 1. Power System Expert (Team leader) (position - 1, international, 8 person-months (during phase I: 6 person-months and during phase II: 2 person-months):** The consultant must have at least a Bachelor degree in electrical/ mechanical/ energy engineering; Shall have over all 15 years experience in electric energy storage/ power system planning/ grid tied renewable energy harvesting area out of which minimum 5 years of experience in electric energy storage; Shall have capability as team leader to drive the project; preferably with good oral and written interpersonal communication skills in English.
- 2. BESS specialist (position - 1, international, 8 person-months (during phase I: 6 person-months and during phase II: 2 person-months):** The consultant must have at least a Bachelor degree in electrical/ mechanical/ energy engineering or renewable or relevant fields; Shall have over all 12 years experience out of which minimum 5 years of experience in electric energy storage/ renewable energy harvesting area including; preferably with good oral and written interpersonal communication skills in English.
- 3. Power distribution specialist (position - 1, international, 8 person-months (during phase I: 6 person-months and during phase II: 2 person-months):** The specialist will have a Bachelor degree in electrical engineering or mechanical or related field; a minimum 12 years' professional experience in power distribution system, distribution operation and power system modeling; preferably with good oral and written interpersonal communication skills in English.
- 4. Power sector specialist/ Deputy team leader (position - 1, national, 8 person-months (during phase I: 6 person-months and during phase II: 2 person-months):** The consultant must have a Bachelor's degree in electrical or mechanical engineering and minimum 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 a minimum 5 years of experience in the field of high and medium voltage transmission systems. He/she should have knowledge of integration of renewable energy with the national grid as well as stability of the national grid.

5. **Power distribution expert (position - 1, national, 4 person-months (during phase I: 2 person-months and during phase II: 2 person-months):** The consultant must have a Bachelor's degree in electrical or mechanical engineering and minimum 15 years of experience in the power sector including in power distribution network analysis and grid integration of renewable energy-based generation. He/she should have knowledge of integration of renewable energy.
6. **Policy expert (position - 1, national, 2 person-months (during phase I: 2 person-months):** The consultant must have at least a bachelor or above degree in engineering, science, economics, business, legal or similar areas; Minimum 10 years of experience for Policy expert; and familiarity with power/ energy/ industrial system will get advantage.
7. **Economist (position - 1, national, 2 person-months (during phase I: 2 person-months):** The consultant must have at least a bachelor or above degree in economics or finance or energy economics or similar areas; Minimum 10 years of experience in economic and financial analysis of project and familiarity with power/ energy/ industrial system will get advantage.

**Consulting Firm may propose additional Key Expert mentioning person months and qualifications and experiences for conducting such study.**

## **8. Reporting Requirements and Time Schedule for Deliverables**

### **Phase I:**

- **Inception Report** within 15 days after signing of the contract.
- **Interim Report** within 3 months after signing of the contract.
- **Draft Final Report** within 5 months after signing of the contract with. Hold Stakeholders Consultation Workshop on Draft Final Report after 15 days of submission of Draft Final Report ;
- **Finalization of Final Report** within 6 months after signing of the contract. Final Report should contain the detailed analysis and detailed specification of BESS. The report must contain draft tender document and specification for further piloting of BESS. This document should be prepared such way so that client can utilize these documents for further tendering in future.
- 10 (Ten) copies of each report has to be submitted along with a soft copy;

### **Phase II:**

- Installing, commissioning and operation of BESS
- Preparation of material requirement, tender document and specification for material procurement for implementation of BESS.
- Submit a **report** during phase II which should **contain manual for standard operation and maintenance of BESS, material requirement, tender document and specification for further scale up of the project.** The relevant documents should be provided in both

digital and hard copy. 10(Ten) copies of each report has to be submitted along with soft copy.

**9. Person to receive the Report:**

Project Director, BPSDCB Project, Power Division. The consulting firm will report to Project Director, BPSDCB Project, Power Division for billing and contract management. For work execution purposes, the consulting firm will work with Power Division, Power Cell, BPDB, BREB, PGCB and other concerned utilities.

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

- 1) **Services, facilities and property to be made available to the Consultant by the Client:** Facilitation and Reporting Consultant will work in close association with BPSDCB Project Office, BERC, SREDA, Power Cell, BPDB, BREB, PGCB 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, BPSDCB Project.
- 2) **Logistics Support:** BPSDCB 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.
- 3) Professional and support counterpart personnel will be assigned by Project Director, BPSDCB Project to the Consultant's team
- 4) The consultant will have to collect relevant project data and reports from the relevant departments as required to successfully completing the study.
- 5) Equipment procurement: —Not applicable

**11. This is provisional Terms of Reference (ToR) for the assignment. The consulting firms may give their comments/suggestions on the provisional ToR. After incorporation of valid comments/suggestions, the ToR will be finalized, if required. The final ToR of the study will be incorporated in the RFP document.**