

## **Terms of Reference**

# **Consulting Services Design Verification and Engineering Supervision for Implementation of Grid-Connected solar PV systems for 23 Facilities in the Sindh Province**

### **Background:**

Sindh Energy Department (SED) under Government of Sindh (GoS) has obtained financing and technical support from the World Bank to expand solar power and increase access to electricity under the Sindh Solar Energy Project (SSEP)<sup>1</sup>. Component 2 of SSEP targets the first of these objectives and included in the first round the installation of 20 MW of distributed solar power on and around public buildings in Karachi and Hyderabad. The current round includes the installation of an additional at least 10 MW in the Sindh province.

Component 2 of SSEP finances the installation of distributed solar PV on rooftops and other available space on and around public sector buildings in Sindh plus energy efficiency retrofits and energy management systems. Distributed solar, such as solar photovoltaic (PV) installations on and around buildings in urban areas, offers the benefit of being close to load centers, removing the need for transmission infrastructure and making efficient use of already-developed land. The first round of procurement and installation included around 20 MW of grid solar PV systems.

Under the second round, the objective is to add at least 10 MW of solar power PV, in addition to the capacity installed in the first round, within key load centers, contributing to the growth of the distributed and rooftop solar market in Sindh and Pakistan, and contributing to the reduction of the ‘circular debt’ problem by reducing the overall electricity consumption of the GoS through self-generation and energy efficiency measures.

SED have short listed 23 public buildings for the assignment, throughout the Sindh province. A survey has been commissioned for this purpose resulting in comprehensive documentation and plans created in 2020-2021, which formed the basis for the tendering process of engaging the installation supplier, who are required to design, supply, and install the solar PV systems.

The services of a supervision engineering firm (the “Consultant”) are required to support the Client in the implementation of at least 10 MW of distributed grid-connected solar PV systems at 23 public buildings, which will be carried out by multiple suppliers operating in four lots.

The Consultant shall ensure that all installations are carried out to the highest national and international standards, as specified in the Request for Bids (RFB), and in accordance with the scope of work, and phased approached detailed in this document.

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<sup>1</sup> Refer to Project Appraisal Document for further details of SSEP: <http://projects.worldbank.org/P159712?lang=en>

### Objective of the Assignment:

The objective of this assignment is to ensure that the design, supply, and installations for the solar PV systems is carried out in accordance with the highest standards, and conforming to technical specification and contractual requirements, in a timely manner. Independent suppliers will perform activities for design, supply, and installation of the solar PV systems at the target facilities, where each lot includes either five or six facilities with a total of 23 facilities forming a cumulative solar PV capacity of at least 10 MW.

The following requirements shall apply to this assignment:

- i) The Consultant shall assist the Client and shall act under its directions;
- ii) The Consultant shall work closely with the Client to support them on design verification and supervision activities and adhere to communication frequency and reporting;
- iii) The consultant shall engage actively and coordinate with suppliers, facility management and other stakeholders to ensure that the implementation is facilitated in the most optimal forms.
- iv) The Consultant shall undertake their work with professionalism and integrity, representing the interests of the Client in ensuring value for money and high-quality installations that are fully compliant with all contractual requirements.

### Scope of Work:

There are four phases for the implementation of the solar PV system at each facility considered within the project life cycle. The Consultant is expected to carry out responsibilities as detailed in under each of the phases. It is possible that the implementation progress at different facilities may vary in pace, depending on the Supplier and other variables. The activities at each facility shall be carried out independently, while consolidating data and results where possible for different lots. The scope of work for each of the phase can be summarized as follows:

#### Phase 1: System Engineering and Planning

Upon awarding the contract for each implementation supplier; based on lots, they are expected to visit each of the sites and carry out planning and engineering activities. The supplier is then required to conduct system planning and engineering to each facility, upon conducting site visits. In conjunction, the Consultant is expected to carry out the following functions during this phase:

1. **Engineering Plans:** Review the electrical, mechanical, and civil engineering drawings and designs submitted by the supplier and ensure conformity to the international best practices and standards related to solar PV systems, detailed technical specification, contractual agreement, and local and national standards in Pakistan.
2. **System Sizing:** The consultant shall verify that the proposed solar PV system sizing by the supplier is consistent with the contractual agreement, based on the variables stated in the original technical requirements (*optimal yield, rooftop space, load limits, energy consumption, shading, existing network limitation, etc*), and shall conduct independent calculation, analysis and modeling to confirm when necessary.
3. **Equipment and Materials:** Review the data sheets and technical specification of the proposed products to ensure conformity to original technical specification and contractual agreement for all

equipment and material used in the project. The consultant shall review that all the relevant documentation for each product, and ensure that the product warranty and other commercial obligations are met and are according to standards set in the contractual agreements.

4. **Implementation Plan Review:** Review the Project Implementation Plan for the supplier, including the timelines and Gantt charts, the methodology, and the proposed templates. Provide relevant feedback and adjustments to ensure implementation is consistent with the contractual agreement and standards.
5. **Electrical Integration:** Review the electrical integration Bill of Quantities submitted by the supplier, validate based on the market prices locally that shall be researched and identified by the Consultant. Ensure that the proposed electrical integration works are consistent with engineering requirements on-site to determine suitability and conformity to solar PV system optimal interconnection requirements.
6. **Commissioning Protocols:** Review the testing, commissioning and acceptance protocols and templates, providing feedback to the suppliers, and ensuring development of consistent approach for all suppliers responsible for different to follow. Develop alternative templates, protocols, and procedures when necessary.

The Consultant shall ensure the main functions are performed for each of the facilities for the first phase, while coordinating with the different suppliers responsible for all four lots accordingly. The Consultant shall coordinate with the building management to obtain site access, and shall provide weekly updates (or other agreed upon frequency) to the Client on the progress towards realizing the completion of the first phase for all facilities. The consultant would also be responsible to validating the completion of contractual deliverables for the suppliers, and communicate conformity to Client in a timely manner.

## **Phase 2: System Implementation Supervision**

Upon finalizing the first phase for each facility, the supplier would procure the equipment, and initiate the solar PV system implementation, including the minor civil works, mechanical, and electrical works. The Consultant shall be responsible throughout the implementation process to supervise the installation, ensure the consistency with the technical requirements detailed in the contractual agreement, as well as the national and international best-practices, standards and regulations relevant to the project.

The consultant shall supervise all system implementation activities, including the following:

- i) Completion of roof rehabilitation
- ii) Completion of civil works
- iii) Installation of the mounting system
- iv) Installation of solar PV system, including strings, cable management, and modules
- v) Installation of electrical circuitry protection, grounding, and lightning protection
- vi) Installation of Remote Monitoring System (RMS)
- vii) Installation of security and safety measures and equipment

During the implementation phase, the Consultant is expected to closely supervise the activities on site, identifying any deviation from the original contractual agreement and the technical specification, while ensuring correction mechanisms are adhered to. The Consultant is responsible for identifying and documenting all the challenges, lessons learned, and developments taking place in each of the sites. The consultant would be representing the Client on site, and would be coordinating and communicating weekly updates and progress by the various suppliers, and ensuring a synthesized reporting is submitted to client in a timely manner.

The consultant would be responsible to quantifying, measuring and documenting the contractual deliverables for the suppliers during the second phase, and shall communicate conformity or deviations to the client. Furthermore, the consultant shall carry pre-commissioning inspections, and shall produce punch-list for the suppliers to address, should there be any installation corrections needed. Completing the works detailed, and addressing any potential punch-list items would signal conclusion of the second phase, and would permit the initiation of the third phase for testing, commissioning and acceptance.

### **Phase 3: Testing, Commissioning and Acceptance Supervision**

The Consultant shall directly supervise the testing and commissioning phase, in accordance with agreed upon methodology and protocols between the Consultant and the supplier. All activities for the testing and commissioning shall conform to all technical requirements stated in the contractual agreement between the supplier and the client, and adhere to international best practices.

The processes shall follow the templates formulated in the first phase, and shall be consistent for all facilities in all four lots. The Consultant shall ensure availability of all documentation requirements, including product certifications, warranties, manufacturer documentation, amongst other documents prior to completing this phase. During the testing phase, the consultant shall also conduct randomized sampling and testing of equipment procured under the project, including through field-based or central laboratories as required by Client.

Furthermore, the consultant shall verify and coordinate with the supplier all necessary steps required by the electrical utility (distribution) company and other relevant stakeholder before fully '*energizing the system*' and completing the interconnection with the grid and the network at the facility. The main milestone that is achieved at completion of this phase would be identified as a '*substantial completion*' which would permit the fourth phase to be initiated.

### **Phase 4: Operations and Maintenance (O&M) Supervision**

Upon initiating the O&M phase, the Consultant is expected to engage in a form that requires less time commitment compared to the initial three phases that relate to implementation. The Consultant would be assisting the client in verification of the monthly production in each of the facilities and that the O&M functions are performed adequately. Furthermore, the consultant shall ensure that the production is within the acceptable and expected range, and that system operations are optimal at each facility.

The Consultant shall assist the client in verification of the quarterly invoices from the suppliers (based on system production), and shall review the system overall performance in specific on a monthly basis for a period of 24 months from '*substantial completion*' milestone.

*Therefore, the consultant shall engage in the following order upon activation of O&M:*

- **Quarterly Review:** Review of O&M reports and production reports based on a quarterly basis, upon supplier's issuance of invoice, in order to consolidate and identify issues in production.
- **Semi-Annual Site Visits (every 6 months):** Conduct semi-annual site visits with the O&M supplier to review any issues that may jeopardize the longevity of the system, or issues related to mismanagement of the O&M functions on site, detailing a list of corrective action if needed or relevant. Document and report site visit to the client, while providing longevity and system operations reviews and recommendations.
- For the first six months upon commissioning, investigation of any complaints or issues logged with Client by building occupants.

### Reporting Requirements & Time Schedule for Deliverables:

The selected Consultant shall report to the Client and shall work closely with the designated focal points to provide the specified technical services and support as required.

The assignment is expected to begin in August 2022 and continue until around May 2022 (*prior to initiation of O&M*). Upon award of the contract, a detailed timeline and reporting schedule shall be determined between the Consultant and Client. Summary and timeline of deliverables:

Deliverables	Submission schedule
1. Submission of Inception Report	1 weeks after the award of the contract
2. Revision of Inception Report and Periodic Updates	Monthly following approval of initial Work Plan

After submission of deliverables in a report/presentation format, the Consultant shall allow two weeks for review by the Client. All deliverables must be reviewed and accepted by the Client to be accepted as complete.

- **Access to data:** The Consultant shall organize progress pictures, and reporting, and up-to-date database in a cloud-accessible filing system for the /Client, and in a format to be approved by the Client. The system shall be protected, and access restricted to Client and Consultant only.
- **Weekly updates:** The Consultant shall provide at weekly updates about implementation progress, including at the sub-phase level (e.g percentage of completion for electrical, mechanical, and civil work at the facility level). The weekly updates format shall be approved by the Client.
- **Monthly reports:** The Consultant shall prepare comprehensive monthly reports to be submitted to the Client, detailing progress, challenges, lessons learned, and other parameters to be agreed upon between the Client and the Consultant.
- **Update Meetings:** The Consultant shall be available to de-brief the Client focal points at a set frequency determined, providing a progress overview and general updates on implementation.

## Qualification Criteria:

- **Organizational:**
  - The Consultant is required to be registered in Pakistan in the relevant legal authorities that permits it to carry out the functions stated in the scope of work.
- **Experience:**
  - The consultant shall have successfully completed at least 5 projects for rooftop solar PV systems performing similar functions detailed in the scope of work, and at least 10 projects of general engineering and project management (*including electrical, mechanical, and civil constructions projects*) with relevant functions.
- **Staffing:**
  - The consultants must have the ability to assign full-time engineering staff with relevant experiences in electrical, mechanical, and civil engineering projects. In particular, the requirement for the project include:

Key Staff	Requirement
Project Manager	<p>A relevant degree in engineering with experience in leading similar projects for at least ten years, with technical engineering background (at least a bachelor in engineering).</p> <p>Experience must include supervising installation of solar PV systems, including all electrical, mechanical, and civil works.</p>
Electrical Engineer	<p>A relevant degree in engineering with experience in designing, planning and supervision implementation of solar PV systems for at least eight years.</p> <p>The Consultant may propose multiple electrical engineer to be assigned on the project, given the nature of the assignment which requires high electrical engineering capacity and human resources, compared to other engineering disciplines.</p>
Mechanical Engineer	<p>A relevant degree in engineering with experience in mechanical design and simulation, with a minimum experience of seven years in project engineering and design, particularly in roof-top solar PV systems.</p> <p>Experience and competence in the design and simulation of mechanical mounting system would be preferred.</p>
Civil Engineer	<p>A relevant degree in engineering with experience in structural design and civil engineering for a minimum of seven years. Experience to include conducting engineering activities, developing BOQ, and supervising project engineering contracts for mechanical and electrical works.</p>

Social and Environment Expert	At least five years of experience of conducting social and environment assessments and implementation. Desirable to have experience in the power sector;
Contract Management Specialist	At least 15 years of experience in contract management of DSI/goods/works/supply and install procurement in relevant sectors with a strong preference for experience in renewable energy projects and preferably with experience also in grid-connected rooftop solar PV.

### **Non-Key Staff**

To include but not limited to the following:

- Accounts Officer
- Administrative Staff
- Reporting Staff

### **Selection Method:**

The Consultant will be selected through Qualification and Cost based Selection method (“QCBS”) in accordance with the procedures set out in the World Bank Procurement Regulations for Borrowers, 2016 (revised November 2017 and August 2018)