



# **DIRECTORATE OF PLANNING & DEVELOPMENT**

**Lasbela University of Agriculture, Water and Marine Sciences Uthal,  
District Lasbela, Balochistan**

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## **TENDER DOCUMENT**

**FOR**

**DESIGN, SUPPLY, INSTALLATION, TESTING AND  
COMMISSIONING OF 1 MW ON GRID SOLAR PV PLANT AT  
LUAWMS BASED ON EPC MODEL**

**AT**

**MAIN CAMPUS OF LASBELA UNIVERSITY OF AGRICULTURE  
WATER AND MARINE SCIENCES, UTHAL LASBELA.**



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### Introduction

Lasbela University of Agriculture Water and Marine Sciences, Uthal Lasbela has given a new vision and a distinct meaning to education. At LUAWMS, we are a faculty of professionals dedicated to mentoring our students for their professional lives.

In order to optimally exploit the solar power potential and augment power generation capacity, LUAWMS management is entrusted with the responsibility of promotion and development of renewable energy to the main Campus.

LUAWMS hereby invites companies to participate in the bidding process for procurement of 1000KW Grid Connected Solar PV Power Plant to be installed at Main Campus at LUAWMS-Uthal. The responsibility of the successful bidder shall be to supply/install Solar Power Plant to the Purchaser as per the terms and conditions of this Tender Document.



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### Instructions to Bidder

#### Terms and Conditions

1. Sealed Envelope should clearly state "Name / Title of Tender."
2. Company should be registered with Taxation Department and should possess N.T.N and G.S.T Certificates.
3. Company should possess PEC Certificate in C3 category or above.
4. Location of the project is LUAWMS main campus at Uthal, Lasbela
5. Bidder is required to conduct site survey of the roof tops of all the buildings and parking areas for solar power plant along with power evacuation system up to nearest interconnection point before submission of their respective bids.
6. Procedure of bidding shall be a **single stage - two envelopes bidding pro: technical proposal and financial proposal**, procedure.
7. Both technical proposal and financial proposal are required to be submitted in a single package containing two separate sealed envelopes at the office of the Director Planning & Development at LUAWMS MAIN CAMPUS @ UTHAL, Lasbela Balochistan latest by **11:00AM on June 7<sup>th</sup>, 2022**.
8. The envelopes shall be marked as "TECHNICAL PROPOSAL" and "FINANCIAL PROPOSAL" in bold and legible letters to avoid confusion.
9. TECHNICAL PROPOSALS will be opened on the same day i.e on **June 7<sup>th</sup>, 2022 at 11:30AM** at Conference Room at Administration Block of LUAWMS MAIN CAMPUS AT UTHAL in the presence of bidders who desire to attend.
10. TECHNICAL PROPOSAL shall be retained in the custody of the procuring agency without being opened.
11. Bidder/s who fulfill technical criteria, will be entertained for the opening of the respective TECHNICAL PROPOSAL /S. Time, date and venue for the opening of TECHNICAL PROPOSAL will be communicated to bidders accordingly.
12. Tender/ TECHNICAL PROPOSAL, should be supported by earnest money of Rs.500,000/- (refundable) as bid security in the form of CDR/DD/Pay Order/Bank Guarantee/ Banker's Cheque in favor of the Director P&D LUAWMS. No offers will be entertained without bid security.
13. The bid security to un-successful bidders will be returned after award of contract to technically/financially qualified lowest/successful bidder.
14. Rates are to be quoted on TCA (Total Cost of Acquisition) basis, which shall be calculated including but not limited to Licensing (**where applicable**), Insurance charges, clearing charges, installation, commissioning, training, transportation & labor charges incurred up to final **LUAWMS MAIN CAMPUS AT UTHAL**, at the risk & cost of the Contractor / Business Firm.
15. Any Prices quoted in US cents will be exchanged on prevailing selling rate of NBP exchange rate list at the time of contract signing to equivalent Pakistani Rupees.
16. Country of origin & manufacture (separately), completion time, after-sales services &



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warranty conditions may be clearly specified under respective captions. Where completion time shall mean; time consumed in delivery till destination, time required for fixation, installation, training & commissioning of the delivered equipment.

17. Validity of the bid should be at-least 60 days from the date of financial bids opening.
18. Evaluation of the successful bidder from those who are technically qualified for their financial proposals, shall be made on the basis of quoting the lowest price against setting up of 1MW Solar Power Plant.
19. Solar system has to be commissioned within 6 months of signing of contract agreement.
20. Bidder shall provide the Gantt Chart of the Project.
21. Complete plant in running condition will be handed over to LUAWMS MAIN CAMPUS AT UTHAL within 6 months off the contract signing.
22. Payment terms to be finalized.
23. Contractor shall carry out Operation & Management (O&M) for six months after commissioning and ensure the production of KWh specified in the technical proposal.
24. Technically/financially qualified successful bidder shall be required to provide Performance Security in the shape of CDR/DD/Banker's Cheque/insurance in favor the Director Procurement LUAWMS, amounting to 10% of the Work Order/Contract Agreement value at the time of acceptance of Letter of Intent (L.o.I).
25. Performance Security may be retained for at-least 12 months from Commercial Operation Date (COD) of Plant.
26. All terms & conditions mentioned in the tender documents for technical/prequalification shall also apply.
27. No change after award of contract. If feasible changes can be agreed and charged separately will be communicated accordingly.



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### TECHNICAL QUALIFICATION CRITERIA:

1. The Bidder shall provide the energy simulation report and detailed losses diagram of offered solar PV system simulated through renowned industrial software. Moreover, the bidder shall also provide the single line diagram (SLD) of the offered solar PV system. (attach document/s)
2. The bidder or its sub-contractor must have AEDB V1 License under relevant category for installation and cumulative experience of commissioning solar PV plants of 2-5 MW. (attach document/s)
3. The bidder or its sub-contractor must have previous experience of installing single project of 1 MW at an educational institute (preferably) and upto 250Kw-500Kw single project at any other industry; having experience of installing a single project of more than 1Mw at any industry would earn extra points to the participating firm.
4. List of Solar Power Plants completed by the bidder or its sub-contractor with site address, and contact details with date of installation of Plants. (attach document/s)
5. The bidder must have minimum three graduate engineers having valid PEC registration in Electrical/mechanical/Energy engineering or equivalent disciplines and PEC registration Number and copy of valid membership Card. (attach document/s)
6. The bidder or its sub-contractor must be duly registered by the Pakistan Engineering Council (PEC) in category C3 or above of the Works and CE-01, CE-10, EE-03, EE-04, EE-05, EE-10m, ME06 & EE-11 which is the mandatory requirement for the participating bidders. (attach document/s)
7. List of similar projects completed / in hand in Pakistan / worldwide bidder or its sub-contractor . (attach document/s)
8. The Bidder shall give an undertaking that the information and documents submitted in the offer are correct and authentic. (attach document/s)
9. The Bidder shall provide an undertaking on stamp paper duly attested from the authority concerned that the "bidder has not been blacklisted."
10. The bidder or its sub-contractor must have ISO 9001, 14001 and 45001 certifications. (attach document/s)
11. Terms & conditions mentioned in Instructions to Bidders will follow.
12. bidder or its sub-contractor must be direct importer of Solar Modules and must have 100Kw Solar Modules in stock.

### FINANCIAL QUALIFICATION CRITERIA:

1. Company must be registered with Security Exchange Commission of Pakistan (SECP) for last three years. (attach document/s)
2. Company must provide audited financial statements along with audit report for last three financial years. (attach document/s)



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3. Company must provide prove of registration with Taxation Authorities for Income tax and Sales Tax purposes. (attach document/s)
4. Company must provide detail of its subscribers and directors. (attach document/s)
5. Terms & conditions mentioned in Instructions to Bidders will follow.

### **Approvals:**

The contractor shall be responsible for obtaining power generation license and all the related approvals from NEPRA/QESCO/KE for the permission of the project.

### **Net Metering / Wheeling:**

The contractor shall ensure that the system installed will technically conform to all requirements prerequisites for Wheeling/Net-metering as per DISCO/ PEPCO/NEPRA requirements. Bidder shall be responsible for net-metering and all related processes to get Net Metering License as per LUAWMS MAIN CAMPUS AT UTHAL request.

### **Term:**

The Contractor after successful commissioning of Solar Power Plant (SPP) shall become the Operator and shall be responsible for operation and maintenance of the solar power plant for a period of One (1) year from the date of commercial operation and shall be responsible to give guaranteed Net Minimum Guaranteed Generation (NMGG).

### **Annexure - A**

### **QUALIFICATION CRITERIA**

NTN/ GST registered companies related to Solar Power Generation System / Authorized agent who fulfills the following criteria shall be eligible to apply:

- a) The bidder or its sub-contractor should have experience in design, manufacture, supply, Installation and commissioning of at least 1 MW at an educational institute (preferably) and upto 2 MW single project at any other industry in Pakistan on Turnkey basis as **a single Power Plant, but not aggregated; having experience of installing a single project of more than 2MW at any industry would earn extra point to the participating firm.**
- b) Bidders shall provide contact details for independent verification by LUAWMS MAIN CAMPUS AT UTHAL for such projects. LUAWMS MAIN CAMPUS AT UTHAL may visit installation sites for confirmation.
- c) The Bidder shall give an undertaking that the information & document submitted in the offer are correct & authentic (Annexure - B)
- d) The bidder must have ISO 9001, 14001 and 45001 certification (copy to be enclosed).



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- e) The bidder must provide valid PEC registration certificate for execution of such projects.
- f) Audited Financial Statements for last three financial years (2018-19, 2019-20, 2020-21)
- g) Organizational profile.
- h) Detail address indicating name of contact person for the service unit or regional office or manufacturing set up in Pakistan.
- i) Detail address of your clients and name of contact persons to verify about your projects and reliability for post services.
- j) Bank statement for financial stability.
- k) Bidder must provide the documentary evidence to all above points.
- l) The bidder or its sub-contractor must be AEBD (Alternate Energy Development Board) approved vendor in respective category.



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### **Annexure - B**

(To be submitted by bidders on official letter head)

Dated: .....

To,

Director (Procurement)LUAWMS, Uthal.

Subject: **Offer in Response to Tender Notice of May-June 2022 for Design, Manufacture, Supply, Installation, Erection, Testing and Commissioning of 1MW Solar Power Plant at LUAWMS MAIN CAMPUS AT UTHAL with Associated Power Evacuation System on Turnkey Basis at Project Locations Mentioned in the Tender Document.**

Sir,

We the undersigned bidder, having read and examined in details the specification, general terms & conditions and special terms & condition of the tender, do are hereby submitting our offer to executethe contract as per specification as set forth in your bid document. In this connection, we enclose thefollowing documents for your kind perusal.

- 1.
- 2.
- 3.

We also further declare:

The information & documents as enclosed herewith are correct & authentic and original documents are with us and same can be produced as and when required.

(Authorized Signatory)Name:

Designation:Seal:





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### Annexure - C

#### **SCOPE OF WORK**

The contractor will be responsible for Design, Supply, Installation, Commissioning and Maintenance of Solar Plant for the period of 1 Years. Operator shall provide all day to day, weekly and Monthly operation and maintenance procedures tasks. Operator shall perform the Work and supply all required spare parts in a prudent and efficient manner and in accordance with Manufacturers and systems designers' specifications, the Annual Operating Plan for the Plant and all operation and maintenance manuals.

#### **Operator shall use all reasonable and practical efforts**

- (1) To maximize plant capacity utilization,
- (2) To Reduce plant downtime,
- (3) To optimize the useful life of the equipment of the power plant.

**After taking over the activity of O&M for the power plant, the Operator shall be responsible for the operation and maintenance of the plant and shall perform all necessary services including applicable services listed below: -**

1. Provide all operations and maintenance services necessary and advisable to efficiently operate and maintain the plant, including all associated mechanical and electrical equipment's keeping in view the objectives set-forth herein above.
2. Maintain up-to-date operating logs, records and monthly reports regarding the operation and maintenance of the Plant, which shall include detail of power output, other operating data, repairs performed and status of equipment.
3. Regularly update and implement an equipment repair or replacement / overhaul and preventive maintenance program that meet the specifications of the equipment manufacturers and the recommendations of the manufacturers.
4. Perform the services required to provide all spare parts, or equipment's as required. Tools and equipment, required to operate and maintain the Plant in accordance with the recommendations of individual original equipment manufacturer.
5. Operate and maintain Plant fire protection and safety equipment.
6. The Contractor shall guarantee the installation for the following period from the date of issue of commissioning certificate.
  - Solar Modules: 12/25 Years
  - Inverter 15 Years



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- Mounting Structure 20 Years
- Other equipment 5 years

Any damage or defect, that may arise after or remain undiscovered at the time of issue of commissioning certificate, same shall be rectified or replaced by the Contractor at his own expenses. This guarantee shall be applicable for the quality of works executed as well as for the equipment/fittings supplied by the Contractor.

### **Daily Generation Report:**

During the O&M period, the operator shall keep the measured daily data and provides the same to LUAWMS MAIN CAMPUS AT UTHAL in electronic) form. These data shall be transferred to LUAWMS MAIN CAMPUS AT UTHAL in a suitable form on weekly basis.

### **Personnel:**

The Operator shall employ only such personnel who are adequately qualified and experienced for operating and maintaining the Solar Power Plant.

### **Net Minimum Guaranteed Generation (NMGG):**

The operator shall be responsible for achieving NMGG submitted in the technical proposal. For any shortfall in the net minimum guaranteed generation corresponding to the offer, the compensation shall be adjusted from the performance security – in case of a 10% deviation from committed power generation, the bidder shall re do the installation and ensure the numbers are met.

### **Insurance**

- (1) Operator shall maintain in force throughout the period of contract all the legally required insurance coverage.
- (2) Operator shall also provide insurance of solar power plant, which shall cover, fire, burglary, earthquake, and flood damage etc or as required. In case of failure/damage of any equipment, Contractor will repair/replace the same without waiting for insurance claim at his own cost.

### **Measurement of Energy and Metering Systems:**

1. The operator shall provide cloud monitoring software, weather stations and energy meter for monitoring performance of Solar system.
  2. LUAWMS MAIN CAMPUS AT UTHAL shall have the right to carry out surprise inspections of the Metering Systems from time to time to check their accuracy.
  3. All testing and metering equipment shall conform to the relevant QESCO/KE/ WAPDA standards and applicable codes.
  4. If either the Operator or the LUAWMS MAIN CAMPUS AT UTHAL find any inaccuracy in the
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Metering System, the operator or the LUAWMS, as the case may be, shall notify the other party in writing within 24 hours for a joint inspection and testing or other agreed agency.

5. The Metering System shall be sealed in the presence of both parties.
6. When the Metering System and/or any component thereof is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, it shall be repaired, recalibrated or replaced by the Operator at his cost as soon as possible or as per requirement of LUAWMS.
7. Meters shall be duly tested/ calibrated yearly by the Operator at his cost from KE/WAPDA/QESCO accredited testing agency.
8. Any meter seal shall be broken by the Contractor's representative only in the presence of LUAWMS MAIN CAMPUS AT UTHAL representative whenever the Metering System is to be inspected, tested, adjusted, repaired or replaced with due permission of LUAWMS.



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### Annexure - D

#### **APPLICATION FORM FOR DESIGN, SUPPLY, INSTALLATION AND COMMISSIONING OF 1 MW POWER ON GRID SOLAR PV PLANT AT LUAWMS MAIN CAMPUS AT UTHAL BASED ON EPC MODEL**

1. Name of company : \_\_\_\_\_
2. Complete Postal Address : \_\_\_\_\_  
\_\_\_\_\_
3. Tel No : \_\_\_\_\_ 4. Email address: \_\_\_\_\_
4. Fax No: \_\_\_\_\_ 6. Mobile No: \_\_\_\_\_
5. Authorized Representatives Name: \_\_\_\_\_
6. Authorized Representatives Designation: \_\_\_\_\_
7. Type of Business:  
(1) Sole Proprietorship  (2) Partnership   
(3) Corporation (Private Ltd)  (4) Corporation (Public Ltd)
8. National Tax Registration #: \_\_\_\_\_
9. Sales Tax Registration #: \_\_\_\_\_
10. Year of Establishment: \_\_\_\_\_
11. Similar work experience: (Please specify name of buyer & date of purchase. Attach Purchase Orders)  
a. \_\_\_\_\_  
b. \_\_\_\_\_  
c. \_\_\_\_\_
12. Certificates / Awards (if any, please attach)
13. Company Profile: (Please attach if any)



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Annexure – E

### DETAIL OF SIMILAR PROJECTS EXECUTED / UNDER EXECUTION

Sr. No	Description	Client / Location	Cost	Mode	Status



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### Annexure - F

### FINANCIAL CAPABILITY

Name of Applicant or Partner of JV	
<b>BANK DETAILS</b>	Name:
	Address:
	Contact Name:
	Tel:

Financial Information in PKR Equivalent	Actual: Previous Three Years			Projected: Next Two Years	
	1	2	3	4	5
Total Assets					
Current Assets					
Total Liabilities					
Profit Before Taxes					
Profit after Taxes					

Source of Financing	Amount(PKR)

Attach audited financial statements for the last two years (for individual applicant or each partner of JV.(Also attach bank statement)



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### Annexure - G

### LITIGATION HISTORY

Name of Applicant or Partner of JV

Year	Award for or Against Applicant	Name of Client, cause of litigation & matter in dispute	Disputed Amount (PKR)



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### Annexure - H

#### FINANCIAL OFFER

(The format should be on the letter head of the Bidding Company/Lead Member of the Bidding Consortium)

Date: .....

From ----- (Insert name and address of Bidding Company)

Tel:..... Cell:..... Email: .....

Website: .....

**To.**

**Subject:** \_\_\_\_\_

Dear Sir,

We submit our financial bid in response to Tender Document reference # -----dated-----

S#	Description
	1 MW solar system with high efficiency i.e __Million units(KWh) with less than 2% degradation for the 1 <sup>st</sup> year and not more than 0.55% degradation for subsequent 25 years.

1. Contract will be finalized with the firm quoting the lowest per unit charges/total project cost of solar Electricity provided to LUAWMS MAIN CAMPUS AT UTHAL after meeting criteria as prescribed in tender documents shall be deemed successful lowest evaluated bidder
2. Complete plant in running condition will be handed over to LUAWMS MAIN CAMPUS AT 6 months of issuance of PO. However, the bidder will operate and maintain the system for 1 year after commissioning.
3. LUAWMS MAIN CAMPUS AT UTHAL reserve the right to either purchase equipment against above mentioned offers or continue services without purchasing

Thank You

Yours faithfully,

(Signature, name and Designation of person authorized by bidder)





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### Annexure - I

(To be Printed On Company's Letterhead)(To be attached with Technical Offer)

1. Bid Bond PO/DD No. : \_\_\_\_\_
2. Bid Bond PO/DD dated : \_\_\_\_\_
3. Bid Bond PO/DD issued by  
(Bank Name) : \_\_\_\_\_
4. GST and NTN certificate (Attached) : \_\_\_\_\_  YES  NO
5. Complete Technical specifications : \_\_\_\_\_  YES &  NO catalog attached  
Project Time Line : \_\_\_\_\_
- Validity of Acceptance : \_\_\_\_\_
- Country of Origin : \_\_\_\_\_
- Performance Bond to be provided : \_\_\_\_\_  YES  NO
- Company profile / capability for  
completion of such projects. (Attached) : \_\_\_\_\_  YES  NO
- Company full address : \_\_\_\_\_
- Contact Person : \_\_\_\_\_
- Cell # : \_\_\_\_\_
- E-mail : \_\_\_\_\_
6. Acceptance of terms & conditions : \_\_\_\_\_  YES  NO of tender without any  
condition.

### **Sign & Seal**



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### Annexure - I

#### **SOLAR PV PLANT SPECIFICATIONS**

Grid Connected Solar PV system without Energy Storage of quoted MWp (DC Capacity at STC) on EPC Basis to be installed at LUAWMS MAIN CAMPUS AT UTHAL with Roof mounted PV modules installations. Inverters design should be compatible with solar PV strings. A schematic electrical Single Line Diagram (SLD) of the entire System layout from the modules to the grid-connection, identifying and listing all of the following DC and AC components, must be provided by the Bidder. The system must be complete with protection devices (earthling, DC Isolators, manual switch, Lightning arrestors, surge protection and weather sensors etc.), solar mounting structure, all civil work including, concrete pads, car parking structure, AC Power distribution Cabinet etc. AC switchgear must have all the AC contactors, AC disconnects, Busbars, manual switch, fuses and energy meter, Voltage, Current and Power factor meters etc. System must be capable of remote monitoring of energy parameters on LAPTOP and PCs. System must be complete with all components and accessories. Electrical equipment, breakers, transformers, switch yard protective equipment, CTs/PTs and other panels must conform to the specifications and standards of Current Pakistan/NEPRA Grid Code.

#### **SOLAR PV SYSTEM COMPONENTS**

##### **Solar PV Modules:**

- Solar PV modules should be Tier-1 type as per latest Bloomberg List.
- Number of Cells and Type= 72 Cells or more Mono
- Bus bars = Not less than 09
- Each PV module size must be more than 535 Wp with positive power tolerance only
- The modules must have efficiency more than 20%.
- Fill Factor (FF) more than 78%.
- Modules must be as per IEC standard 61215 and 61730.
- Modules should be free of PID and must include PID free certificate.
- Minimum 12 years replacement warranty and 25 years performance warranty
- String configuration must be compatible with Inverters and vice versa.
- Size of total PV modules: As per quoted size at STC.
- Flash Test report and Module Test report as per standards 61215 and 61730 should be provided at the time of supply.
- Outdoor cable connectors should be ingress protected by IP 66 or above.
- Must be supplied with connected cables and MC4 connectors.



- Flash report of the PV modules must be submitted at the time of supply.
- Pre-shipment Inspection Report must be submitted.
- Certificate of Conformance (COC) must be attached.
- Dynamic and loading capacity may be 2400 Pa or better'
- Each PV module in any Solar PV plant must have bar code or QR codes. The following information must be mentioned in the Bar Code or QR Codes used in each module (This can be inside or outside the Laminate but must be able to withstand harsh environmental conditions (Thunder storm, hailstorm, hurricanes and wind storm).
- Name of manufacturer of PV Module
- name of manufacturer of PV Cells
- Month and year of manufacturing (separately for solar PV module and solar cells)
- Country of origin (Sedately for solar Cells and PV modules)
- Name of Test Lab issuing IEC certificate / EN certification.
- All tests as per latest version of IEC standards / EN certification

### **Solar On-Grid Inverters / PV Conditioning Equipment:**

- Type of Inverters = Grid Tied String Inverters.
- Number of MPPT inputs = 5 or More than 5.
- Output AC Voltage: 400V, Three Phase
- Make: USA / EUROPE / CHINA OR EQUIVALENT
- Size of each Inverter: As per string design but not less than 50KVA
- Total Inverter Size: As per PV string. PV to Inverter ratio may be set to optimum
- Maximum Efficiency: not less than 98%.
- Total Harmonic Distortion: THD < 3%
- Standards compliance: UL 1741, IEC 62109-1 / 2, IEC 62116, IEC 61683 for safety, grid connectivity and parallel operation.
- Degree of protection: Minimum IP 65 or above.
- Type-2 or better DC and AC SPDs.
- Built with data logger, communication interfaces protections and remote monitoring capability.

### **Module Mounting Structure: (Fixed/Single Axis/Double Axis)**

- a. The structure design shall be appropriate and innovative. It must follow the existing roof and parking areas profile.
- b. The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements.
- c. Design drawings with material selected and their standards shall be shared with LUAWMS Management before commissioning.
- d. The support structure design & foundation shall be designed with reference to the existing roofstructure and parking areas conditions in order to withstand wind speed applicable for the zone(Site Location), using relevant Pakistani wind load codes. The structures and foundations shall also conform to the seismic conditions pertaining to the zone using relevant Standards and codes.



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- e. The structure must be designed with considering appropriate factor of safety. The bidder must provide the detail design and calculation for the structure design.
- f. The structure shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation & tilt, absorb and transfer the mechanical loads to the roof structure or parking areas properly.
- g. The string structure may preferably be made of hot dipped galvanized steel of suitable size. The thickness of galvanization should be as per the relevant standards for galvanization but minimum of 80 microns. It is to ensure that before galvanization the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such foreign material as are likely to interfere with the galvanization process.
- h. The string structure shall be so designed that it will occupy minimum space without sacrificing
- i. the output from SPV panels at the same time.
- j. Nut & bolts, supporting structures including Module Mounting Structures shall have to be adequately protected from atmosphere and weather prevailing in the area.
- k. The string structure shall be grounded properly using maintenance free earthing.
- l. The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- m. For multiple module mounting structures located in a single row, the alignment of all modules shall be within minimum error limit.
- n. Cable should pass from Pipes and Cable-ties shall be used to hold and guide the Pipes (cables/wires) from the modules to inverters or junction boxes. All the cables should be aesthetically tied to module mounting structure.
- o. Bidder must submit all the quality test documents and test certificates complying with the requirement of the structure.
- p. Every major Component of the Plant should be suitably named / tagged numbered for easy traceability, identification and maintenance

### **Combiner Boxes:**

Must be manufactured with GI material with 99% copper strips in it for termination of PV strings and must comply with IP 65.

### **MC4 Connectors:**

Qty: As per design

Current rating: As per design Ingress protection: IP 65 or above

Standard Compliance: EN 50521:2008

### **Remote Monitoring:**

System must have capability for remote monitoring / remote string monitoring complete with communication interfaces, data logging and software. The contractor will have to configure the whole system and show monitoring on Laptop or PC the parameters like Load watts, PV watts, DC energy and AC energy generation.



## **Civil and Mechanical Work:**

The bidder shall have the sole responsibility for the whole civil and mechanical works for rooftop based solar mounting structures.

## **Manuals:**

The successful bidder will supply all the service and maintenance manuals in hard and soft copy of each component of the system after the signing of contract.

## **System Protections:**

System must be complete with all protections including DC and AC Disconnects, Surge protection, Lightning arresters, Grounding, weather sensors etc.

### **a. Surge Protection:**

- (1) Surge protection shall be provided on the DC side and the AC side of the DG facility.
- (2) The DC surge protection devices (SPDs) shall be installed in the DC distribution box adjacent to the solar grid inverter and generator.
- (3) The AC SPDs shall be installed in the AC distribution Cabinet adjacent to the DG facility.
- (4) The SPDs earthing terminal shall be connected to earth through the above mentioned dedicated earthing system.
- (5) The Lightning Arresters need to be provided for the buildings which are of more than 15 meters height only.

### **b. Earthing Protection:**

Three separate dedicated and interconnected earth electrodes must be used for the earthing of the

solar PV system support structure with a total earth resistance not exceeding 5 ohms as below:

- (1) Equipment earth (DC) &
- (2) System earth (AC)
- (3) LA

## **Metering:**

Solar system must be equipped with necessary metering for measurement of DC and AC Power and Energy, Power factor, Voltage, Current and Frequency.

## **PV DC Cables:**

- 99.9% copper cables with conductor withstanding at temperature of 120 Degree.
- Cables must be double insulated suitable for 1000V DC transmission.



- Weather resistant, UV resistant, Ozone corrosion resistant, halogen free and flame resistant.
- Temperature range from -10 degree C to 120 Degree C.
- Test reports namely Conductor resistance test, Insulation resistance test, Pressure test and spark test must be provided.
- Outer insulation must be UV resistant.
- Preferably CU/PVC/XLPE

### **AC Power Distribution Cabinet:**

AC Power Distribution cabinet must contain AC circuit breakers, contactors, bus bars, energy meter and main switch with monitoring of Voltage, current, Power, Energy and power factor. The components must be of high quality complying with national standards of switchgears.

### **Electric Substation and Transmission:**

Electric sub-station is available at locations and if needed as per bidder's design, the bidder has to build substation and include costs of building substation and transmission system for connectivity with the Grid and must account for in its tariff.

### **MV Switchgear Cubicle**

If Needed, contractor shall supply the MV panel with VCB including CTs/PTs, all protection / monitoring and interlocking devices and accessories of appropriate rating. The component must be of high quality complying with national standard (Make: Schneider Electric / ABB / Siemens or equivalent).

### **Step Up Transformer**

If Needed as per contractor's design, the contractor shall supply step up transformers with appropriate MV ratings along with all protection and monitoring devices. The component must be of high-quality complying with national standard (Make: PEL Electric / Siemens or Equivalent).

### **Medium / Low Voltage Cable**

The contractor shall supply the required Low Voltage and medium voltage cables as per the design submitted. The component must be of high-quality complying with national standard (Make: Pakistan Cables, FAST Cables or equivalent).

### **Asset Performance Management**

The contractor must ensure that asset performance management team maximizes solar asset energy production throughout the plant life cycle through cloud based real time portfolio remote monitoring, maintenance strategy tools, network operating Centre and dedicated onsite maintenance and operation team.