

**INVITATION FOR REQUEST FOR QUOTATION
DASU HYDROPOWER STAGE-I PROJECT
WATER AND POWER DEVELOPMENT AUTHORITY (WAPDA)**

**Design, Supply, Installation, Testing, and Commissioning of 25 kW Solar Power System for
Hostel Cat-2A at Project Colony, Choochang**

DASU-C&E-001/2024-25

(Credit Number 5498-PK, 5497-PK)

The Government of the Islamic Republic of Pakistan (The Borrower) has received a credit from the International Development Association (IDA), and the World Bank, towards the cost of the Dasu Hydropower Stage-I Project. It intends to apply part of the proceeds toward payments for Dasu-C&E-001/2024-25: Design, Supply, Installation, Testing, and Commissioning of 25 kW Solar Power System for Hostel Cat-2A at Project Colony, Choochang.

The Pakistan Water and Power Development Authority (WAPDA) (The Employer) intends to engage appropriate firms/contractors through Request for Quotations for Contract **Dasu-C&E-001/2024-25: Design, Supply, Installation, Testing, and Commissioning of 25 kW Solar Power System for Hostel Cat-2A at Project Colony, Choochang.**

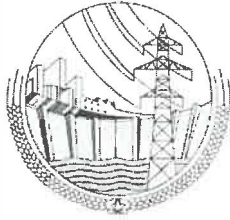
The procurement process will be conducted through the World Bank Shopping Procedure specified in the **"World Bank Procurement Regulations for IPF Borrowers" (July 2016, revised November 2020).** and is open to all applicants, as defined in the regulations.

Interested eligible applicants may obtain further information from and inspect the Request for Quotation Documents at the addresses given below from 0830 to 1630 hours. A complete set of these Request for Quotation Documents in English may be purchased or downloaded from (dasuhpp.com or wapda.gov.pk) by the interested eligible applicants from any of the following offices upon submission of a written application and upon payment of a non-refundable fee of PKR 3,000/- The method of payment will be through a bank pay order or demand draft in favor of General Manager/Project Director, Dasu Hydropower Project, WAPDA:

1. Office of the General Manager / Project Director, Dasu Hydropower Project - WAPDA, Choochang Colony Dasu, District Kohistan. Tel: 0944-220009 E-Mail: dasuhppsite@gmail.com
2. Camp Office Dasu Hydropower Project, Room #325, WAPDA House, Lahore. Tel: 042-99202676 E-mail: dasuhpp@yahoo.com

Applications should be submitted in sealed envelopes, clearly marked **"REQUEST FOR QUOTATION-Dasu-C&E-001/2024-25: Design, Supply, Installation, Testing, and Commissioning of 25 kW Solar Power System for Hostel Cat-2A at Project Colony, Choochang"** and delivered to the address given below by 21st November 2024 up to 1100 hours. Applications will be opened in the presence of the applicant's representatives who choose to attend at 1130 hours on 21st November 2024, at the same place.

**General Manager / Project Director
Dasu Hydropower Project
Water and Power Development Authority (WAPDA)
Choochang Colony Dasu, District Kohistan, Khyber Pakhtunkhwa
Tel: 0944-220009 E-Mail: dasuhppsite@gmail.com**



**PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY**

DASU HYDROPOWER PROJECT

REQUEST FOR QUOTATION

PROCUREMENT UNDER WORLD BANK SHOPPING PROCEDURE

DESIGN, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF SOLAR POWER SYSTEM AT HOSTEL CATEGORY 2A AT PROJECT COLONY

**GENERAL MANAGER/PROJECT DIRECTOR
DASU HYDROPOWER PROJECT
DASU, PAKISTAN**

REQUEST FOR QUOTATION

Main Contents

- (I) Instructions for Request for Quotation & Bidding Data
- (II) Forms of Bid
- (III) Standard Forms
- (IV) Technical Specifications
- (V) Drawings

SECTION-I INSTRUCTIONS FOR REQUEST FOR QUOTATION & BIDDING DATA

Instructions

1 Scope of Bid/Quotation

The Employer as defined in the Bidding Data (here in after called "the Employer") wishes to receive Bid/Quotation for the works as summarized in the Bidding Data (here in after referred to as "the Works").

2 Eligibility of Bidders

Documents evidencing eligibility are required to be submitted by the bidders (valid trade/registration certificate, registration with FBR/Provincial Tax Department and evidence of supplies/works completed of similar nature during last three (3) years).

3 Preparation of Bid/Quotation

Bidder shall complete the Schedule of Price as mentioned in Request for Quotation (RFQ).

Quotation shall be submitted entirely in Pakistani Rupees and all the duties, taxes and other levies payable by the Supplier under the contract shall be included in the total quoted price.

The rates quoted by the bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account.

Each Bidder can submit only one quotation.

4 Deadline for Submission of Bid / Quotation

Bid/Quotation must be received by the Employer at the address detailed in Bidding Data.

Bid/Quotation shall remain valid for forty-five (45) days after Bid/Quotation submission deadline date.

Each Bidder shall prepare Original and numbers of copies as Specified in the Bidding Data and shall clearly mark them "ORIGINAL", "COPY" and "ELECTRONIC COPY" as appropriate.

5 Evaluation of Bid / Quotations

The Project Manager will evaluate and compare the quotations determined to be:

- Substantially responsive;
- Properly signed and valid for minimum forty-five (45) days; and
- Conform to the terms and conditions, specifications and warranty period.

6 Award of Contract

The Employer will award the Contract to the Bidder whose Bid/Quotation has been determined to be substantially responsive and who has offered the most advantageous Bid/Quotation.

Notwithstanding the above, the Employer reserves the right to accept or reject any Bid/Quotation and to cancel the bidding process and reject all Bids/Quotations at any time prior to the Award of Contract.

The Bidder whose Bid/Quotation is accepted will be notified of the Award of Contract by the Employer prior to expiration of the Bid/Quotation validity period. The terms of the accepted offer shall be incorporated in the Work Order.

7 Bid Security

The Bidders shall furnish, along with their Bids/Quotations, a Bid Security at an amount not less than PKR 200,000/- in the form of unconditional Bank Guarantee/Call Deposit Receipt (CDR)/Pay Order in the name of GM/PD Dasu Hydropower Project issued by a scheduled Bank in Pakistan. In case of Foreign Bank, the guarantee shall be counter-guaranteed by a scheduled Bank in Pakistan. Guarantees from other financial institutions such as insurance, bonding or security companies shall not be permitted. The Bid Security shall be valid for fourteen (14) days beyond the original validity period of the Bid/Quotation. The Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the issuance of Work Order to the successful Bidder.

8 Performance Security

Within fourteen (14) days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the Performance Security in the form of unconditional Bank Guarantee from a Scheduled Bank in Pakistan/Call Deposit Receipt (CDR)/Pay Order at five (5%) of the cost of Contract. The Performance Security shall remain valid up to the expiry of the Defects Liability Period. In case of Foreign Bank, the guarantee shall be counter-guaranteed by a Scheduled Bank in Pakistan. Guarantees from other financial institutions such as insurance, bonding or security companies shall not be permitted.

9 Forced Labour Performance and Forced Labour Declaration

The Bidder shall be required to fill and submit Annex-I [Forced Labour Performance Declaration] and Annex-II [Forced Labour Declaration] included in Section-II [Forms of Bid] with the Bid/Quotation. Annex-III [Strengthened Contract Clause on forced Labour], included in Section-II, shall be enforced with effect from the issuance of the Work Order and shall remain valid till expiry of the Defects Liability Period.

Bidding/Quotation Data

1 Name of Employer

The Employer is: Pakistan Water and Power Development Authority (WAPDA) represented by General Manager/Project Director, Dasu Hydropower Project, WAPDA, Dasu, District Kohistan, KPK, Pakistan or any other representative authorized by the Employer to represent the Employer from time to time.

2 Project Manager

The Project Manager is: Dasu Hydropower Consultants – (DHC), 1st Floor, WAPDA Project Office Building, WAPDA Colony Choochang, Tehsil Dasu, District Kohistan, KPK, Pakistan or any other representative authorized by the Project Manager to represent the Project Manager from time to time.

3 Brief Description of Works

The scope includes the Design, Supply, Installation, Testing and commissioning of off-Grid rooftop/Ground Mounted PV power plants for Hostel Cat-2A in WAPDA's project colony.

Design study, necessary civil work, Mounting of Module Structures, PV Module Installation, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arresters and Earthing System as per the standards, Testing of PV Power Plant and Commissioning complete in all respect.

This work also covers connection with backup system by batteries and generators.

One set of operation and maintenance manual in English and warranties as defined in the performance requirements/ specifications.

4 Contact Details

Employer's address:

Dasu Hydropower Project, WAPDA Project Office Building, WAPDA Colony, Choochang, Tehsil Dasu, District Upper Kohistan, KPK, Pakistan

Telephone:	0092- 0998 – 407007
Electronic mail address:	dasuhppsite@gmail.com

5 Number of Copies of the Bid to be Submitted

One (01) original plus three (03) copies along with one (01) electronic copy.

6 Deadline for Submission of Bids

11:00 AM on _____.

For Bid submission purposes only, the Employer's address is:

Address: Office of General Manager / Project Director, Dasu Hydropower Project, WAPDA Project Office Building, WAPDA Colony, Choochang, Tehsil Dasu, District Upper Kohistan, KPK, Pakistan Country: Islamic Republic of Pakistan

Telephone: 0092-0998-407007

Electronic mail Address: dasuhppsite@gmail.com

7 Bid Opening

11:30 AM on _____.

The bid opening shall take place at:

Address: Office of General Manager / Project Director, Dasu Hydropower Project, WAPDA Project Office Building, WAPDA Colony, Choochang, Tehsil Dasu, District Upper Kohistan, KPK, Country: Islamic Republic of Pakistan

SECTION-II FORMS OF BID

Request for Quotation (RFQ)

Subject: Request for Quotation (RFQ) for Design, Supply, Installation, Testing and Commissioning of Solar Power System for Hostels Cat-2A in Project Colony

You are invited to submit your most competitive quotation for the subject Works

Table-1: Bill of Quantities Summary

Sr. No	Description	Unit	Qty	Unit Rate	Total Amount
1	Design, Supply, installation, commissioning and testing of 25kW solar power system for Hostel Cat-2A as per specifications and drawings Complete in all respects.	System	1		
Grand Total (including GST, all other applicable Taxes and Profit)					

For the purpose of comparison and payment, the bidder/supplier shall provide the breakdown of the Price as per following components:

**Table-2
Breakdown for Hostel Cat-2A
Bill of Quantities**

Sr. No	Item Description	Unit	Qty	Unit Rate	Total
1)	<u>Solar PV Panels</u>	Lot	1		
	Crystalline solar panels with the rating not less than 550 watt for total output power not less than 25kW. The cell efficiency must not less than 20% in compliance with specifications				
2)	Three Phase high voltage Hybrid Inverter having minimum rating 25kW with battery voltage 500 Vdc. Solar Max, Haitai Solar, Huawei, Inverex, or equivalent	no's	1		

**Bidding Documents – Design, Supply, Installation, Testing and Commissioning of
Design, Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Cat-2A
Forms of Bid**

3)	Lithium Iron Phosphate batteries for Cumulative 90KWh backup system with BMS and Master Controller at 500Vdc including battery rack/ cabinet. Pylontech, Haitai Solar, Inverex, Solar Max or equivalent.	no's	1		
4)	<u>Mounting Structures</u> Mild Steel Galvanized Iron frames with mounting structures with nuts & bolts Suitable for installation of PV Panels at concrete floor to Protect against wind power.	Lot	1		
5)	<u>System Accessories</u> MC04 connector, DC cables, AC cables, AC SPDs, AC breakers, common bus bar/junction box, DC cable HDPE pipes, cables ties, PVC pipes ducting etc. as per requirement.	Lot	1		
6)	<u>Earthing System</u> Earthing system for solar power plant as per requirement mentioned in technical specification.	Lot	1		
7)	<u>Civil work</u> Complete civil work in all respect including design	Lot	1		
Grand Total					

Comparative Statement Bids/ Quotations

Comparative Statement Dated:

Procurement of: – Design, Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Category-2A.

Sr. No.	Respective Bidder	Items / Quantity	Total Price	Remarks
1				
2				
3				

The committee recommends M/s..... for award of Contract as lowest responsive Bidder.

Project Manager _____
(Signature)

Member 1 _____
(Signature)

Member 2 _____
(Signature)

Work Order

Ref. No

Dated_____

M/s.....

Address.....

Phone.....

Fax:.....

Subject: Design, Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Category 2A.

Please refer to your Quotation No. Ref: Dated:.....
and subsequent submission of Performance Security on _____. We are pleased to
inform that your quotation for the subject Works has been accepted for the Contract Price of
PKR _____ /- (Pak Rupees _____ Only) with the following Terms and Conditions:

Sr. No.	Item Description	Total Amount
1		
2		
3		

Terms and Condition

1. Time for Completion shall be Sixty (60) days from the date of receiving of Work Order by the Contractor/Supplier. In case of any delay the liquidated damages 0.05 percent per day of the Accepted Contract Price will be charged to the Contractor/Supplier. The maximum amount of Liquidated Damages shall be 10 % of the Accepted Contract Price.
2. Income tax, Khyber Pakhtunkhwa Sales Tax (KPST) and other applicable taxes will be deducted at source as per rules/ orders if applicable. Deduction of applicable taxes shall be done at the rates and as per procedures provided for in the relevant laws applicable at the time of each payment. Any tax exemption shall be subject to valid and verifiable substantiation by the Contractor/Supplier prior to request for payment.
3. **Terms of Payment:**
 - 1) No Advance Payment shall be made to the Contractor/Supplier.
 - 2) **For Item No. 1 to 6 of Table-2 [Breakdown for Hostel Cat-2A]:**
 - i) **Seventy percent (70%)** of the Payment of the Accepted Contract Amount shall be paid to the Contractor/Supplier when all the supply of materials/goods related to the works reached at site and verified by the Project Manager **or** in case of delivery in lots, payment shall be made on pro rata basis for each lot after delivery of each lot at site.
 - ii) **Twenty percent (20%)** of the payment shall be made to the Contractor/Supplier upon complete installation along with provision of Operation Instructions and Maintenance Manual and successful Testing and Commissioning after the issuance of the Completion Certificate and Testing and Commissioning Certificate.

- iii) **Ten percent (10%)** payment shall be made to the Contractor/Supplier after completion of the Defects Liability Period which shall be six (06) months, after the date of issue of the Completion Certificate.
- 3) **For Item No. 7:** Civil Works: Payment shall be made upon complete installation after the issuance of the Completion Certificate by the Project Manager.
- 4. **Extension of Time for Completion:** The Project Manager shall determine and authorize any Extension of Time for delivery upon Contractor's/Supplier's request for a decision and submitting full supporting information. Request for Extension of Time shall be submitted prior to the expiry of Completion Time.

Signature

General Manager/Project Director
Dasu Hydropower Project, WAPDA

ANNEX I - Forced Labor Performance Declaration

[The following table shall be filled in by the Bidder, each Subcontractor/ supplier/ manufacturer providing solar panels and/or solar panel components proposed by the Bidder]

Bidder's Name: *[insert full name]*

Date: *[insert day, month, year]*

Subcontractor's/supplier's/manufacturer's Name: *[insert full name]*

RFB No. and title: *[insert RFB number and title]*

Page *[insert page number]* of *[insert total number]* pages

Forced Labor Performance Declaration in accordance with Section III, Evaluation and Qualification Criteria			
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We:

☐ (a) have not been suspended or terminated, and/or other contractual remedies applied including calling of performance security by an employer, for reasons of breach of forced labor obligations in the past five years. *[if (a) is declared, state N/A for (b) below]*

☐ (b) have been suspended or terminated, and/or other contractual remedies applied including calling of performance security by an employer, for reasons of breach of forced labor obligations in the past five years. Details are provided below:

Year	Contract identification including calling	Name of Employer	Reasons for suspension or, termination, and/or other contractual remedies applied performance security
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-	-	-	-
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☐ (c) *[If (b) above is applicable, attach evidence demonstrating that adequate capacity and commitment to comply with Forced Labor obligations.]*

We declare that all the information and statements made in this Form are true, and we accept that any misrepresentation contained in this Form may lead to our disqualification by the Employer and/or sanctions by the Bank.

Name of the Bidder/ Subcontractor/ supplier/ manufacturer _____

Name of the person duly authorized to sign on behalf of the Bidder/Subcontractor/ supplier/manufacturer _____

Title of the person signing on behalf of the Bidder/ Subcontractor/ supplier/ manufacturer _____

Signature of the person named above _____

Date signed _____ day of _____,

Countersignature of authorized representative of the Bidder (for forms submitted by Subcontractor/ supplier/ manufacturer):

Signature: _____

**Bidding Documents – Design, Supply, Installation, Testing and Commissioning of
Design, Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Cat-2A**
Forms of Bid

Date signed _____ day of _____,

ANNEX II - Forced Labor Declaration

Date: _____

RFB No.: _____

Contract Title: _____ -

To:

We, the undersigned, declare that, if awarded the Contract, we, including our Subcontractors and suppliers/ manufacturers, are required to comply with the contractual Forced Labor obligations. In this regard, we:

- (a) accept that there will be no Forced Labor among the staff, employees, workers and any other persons employed or engaged by us;
- (b) accept that staff, employees, workers and any other persons employed or engaged, will be hired under employment conditions that meet the contractual obligations set out in the Contract;
- (c) will include in our contracts with Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]* obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by the Subcontractor/ supplier/ manufacturer;
- (d) will include in our contracts with Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]*, that the Subcontractors/ suppliers/ manufacturers include an obligation to prevent Forced Labor in all contracts that they execute with their suppliers/ manufacturers of *[solar panel][solar panel components]*;
- (e) will monitor our Subcontractors/ suppliers/ manufacturers of *[solar panels][solar panel components]* on implementation of obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by them;
- (f) will require our Subcontractors to monitor their suppliers/ manufacturers of *[solar panels][solar panel components]* on implementation of obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by them;
- (g) will require our Subcontractors/ suppliers/ manufacturers to immediately notify us of any incidents of Forced Labor;
- (h) will immediately notify the Employer any incident of Forced labor on the site, or premises of Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]*;
- (i) will include in periodic progress reports submitted in accordance with the contract sufficient details on our, including our Subcontractors/ suppliers/ manufacturers , compliance with Forced Labor obligations; and we
- (j) confirm that the Subcontractors/ suppliers/ manufacturers for *[solar panels][solar panel components]* for this contract are (or likely to be):

[Provide each firm's name, address, primary contact, e-mail address, and the link to the firm's website]

OR

confirm that you have not yet finalized the Subcontractors/ suppliers/ manufacturers of solar panels/components, but when known the firm/s name(s), address(es), primary contact(s), e-mail address(es) and web site link(s) will be provided to the Employer, prior to signing the

contract, with documentation demonstrating compliance with forced labor obligations to the Employer for approval].

THEN

If (c) above is applicable, attach evidence of how these contract obligations are/will be made.

If (d) above is applicable, attach evidence of how these contract obligations are/will be made.

If (e) above is applicable, please attach evidence of how this monitoring/due diligence is/will be undertaken (such as your inspection protocols, use of inspection agents, frequency of inspections, examples of previous factory/labor inspection reports etc.).

If (f) above is applicable, please attach evidence of how this monitoring/due diligence is/will be undertaken by Subcontractors (such as their inspection protocols, use of inspection agents, frequency of inspections, examples of previous factory/labor inspection reports etc.).

We declare all the information and statements made in this Form are true, and we accept that any misrepresentation contained in this Form may lead to our disqualification by the Employer and/or sanctions by the Bank.

Name of the Bidder _____

Name of the person duly authorized to sign the Bid on behalf of the Bidder* _____

Title of the person signing the Bid _____

Signature of the person named above _____

Date signed _____ day of _____, _____

*: Person signing the Bid shall have the power of attorney given by the Bidder attached to the Bid

ANNEX III - Strengthened Contract Clause on Forced Labor

The Contractor/Supplier, including its Subcontractors/ suppliers/ manufacturers, shall not employ or engage forced labour. Forced labour consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

In this regard, the Contractor/Supplier shall:

- (a) include in contracts with Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]*, obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by the Subcontractor/ supplier/ manufacturer;
- (b) include in contracts with Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]*, that the Subcontractors/ suppliers/manufacturers include an obligation to prevent Forced Labor in all contracts that they execute with their suppliers/ manufacturers of *[solar panel] [solar panel components]*;
- (c) monitor Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]* on implementation of obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by them;
- (d) require Subcontractors to monitor their suppliers/manufacturers of *[solar panels] [solar panel components]* on implementation of obligations to prevent Forced Labor among the staff, employees, workers and any other person employed or engaged by them;
- (e) require its Subcontractors/ suppliers/ manufacturers to immediately notify the Contractor/Supplier of any incidents of Forced Labor;
- (f) immediately notify the Employer any incident of Forced labor on the site, or premises of Subcontractors/ suppliers/ manufacturers of *[solar panels] [solar panel components]*; and
- (g) include in periodic progress reports submitted in accordance with the contract sufficient details on its, including its Subcontractors/ suppliers/ manufacturers, compliance with Forced Labor obligations.

SECTION-III STANDARD FORMS

Form of Bid Security

(Bank Guarantee)

Beneficiary: _____

Request for Quotation No: _____

Date: _____

BID GUARANTEE No.: _____

Guarantor: _____

We have been informed that _____ (hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its bid (hereinafter called "the Bid") for the execution of _____ under Work Order No. _____ ("the IFB").

Furthermore, we understand that, according to the Beneficiary's conditions, bids must be supported by a bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating either that the Applicant/ Supplier:

- (a) has withdrawn its Bid during the period of bid validity specified by the Applicant in the Letter of Bid, or any extension thereto provided by the Applicant; or
- (b) having been notified of the acceptance of its Bid by the Beneficiary during the period of bid validity, (i) fails to execute the Contract Agreement or (ii) fails to furnish the performance security, in accordance with the Instructions of the Beneficiary's bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the contract agreement signed by the Applicant and the performance security issued to the Beneficiary upon the instruction of the Applicant/ Supplier; and (b) if the Applicant/ Supplier is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the bidding process; or (ii) fourteen (14) days after the Validity Period, which date shall be established by presentation to us of copies of the Letter of Bid/ Application for quotation and any extension(s) thereto, accompanied by the bidding document; or (c) three years after the date of issue of this guarantee.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

[signature(s)]

**FORM OF PERFORMANCE SECURITY
(Bank Guarantee)**

Guarantee No. _____
Executed on _____

(Letter by the Guarantor to the Employer)

Name of Guarantor (Scheduled Bank in Pakistan) with
address: _____

Name of Principal (Supplier) with
address: _____

Penal Sum of Security (express in words and
figures) _____

Work Order No. _____ Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Request For Quotation Documents and above said Work Order (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the _____ (hereinafter called the Employer) in the penal sum of the amount stated above, for the payment of which sum well and truly to be made to the said Employer, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal (Supplier) has accepted the Employer's above said Work Order for _____
_____ (Name of Contract) for the
_____ (Name of Project).

NOW THEREFORE, if the Principal (Supplier) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of the said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements for the issue of the Completion Certificate are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____ (the Guarantor), waiving all objections and defenses under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer without delay upon the Employer's first written demand without cavil or arguments and without requiring the Employer to prove or to show grounds or reasons for

such demand any sum or sums up to the amount stated above, against the Employer's written declaration that the Principal has refused or failed to perform the obligations under the Contract, for which payment will be effected by the Guarantor to Employer's designated Bank and Account Number.

PROVIDED ALSO THAT the Employer shall be the sole and final judge for deciding whether the Principal (Supplier) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above bounded Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed, and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Witness:

1. _____

Corporate Secretary (Seal)

2. _____

(Name, Title & Address)

Guarantor (Bank)

1. Signature _____

2. Name _____

3. Title _____

Corporate Guarantor (Seal)

SECTION-IV SPECIFICATIONS

Technical Specifications for Design Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Category-2A at Project Colony

1. Scope of Work

The scope includes the Design, Supply, Installation, Testing and commissioning of off-Grid rooftop/Ground Mounted PV power plants for Hostel Cat-2A in WAPDA's project colony.

Design study, necessary civil work, Mounting of Module Structures, PV Module Installation, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arresters and Earthing System as per the standards, Testing of PV Power Plant and Commissioning complete in all respect.

This work also covers connection with backup system by batteries and generators.

One set of operation and maintenance manual in English and warranties as defined in the performance requirements/ specifications.

2. Location

Shade-free Rooftops of Hostel Cat-2A with available space approx. 400m² at WAPDA project colony under construction located at 6 km north of Dasu town of Upper Kohistan District of Khyber Pakhtunkhwa (KPK) Province of Pakistan.

3. Definition

Standalone solar PV power plant comprises of C-Si (Crystalline Silicon)/Thin Film Solar PV modules with intelligent Inverter with MPPT charging technology which feeds uninterrupted quality AC power to electrical loads. Batteries will be charged from solar energy by charge controller integrated in the inverter or by an external charge controller with MPPT technology. Other than PV Modules and Inverter/Inverters, the system consists of Module Mounting Structures, appropriate DC and AC Cables, Array Junction Boxes (AJB) / String Combiner Boxes (SCB), AC and DC Distribution Box, Vertical DB for Load segregation, Lightning Arrester, Earthing Systems, etc.

4. Solar PV Module

- 4.1. The Company/Contractor/Supplier shall use only the PV modules that are easily available in market. The PV modules under various categories (c-Si Mono/Mono PERC) can be used. The PV modules rating shall not be less than 500W. However, the specifications for the PV Module are detailed below:
- 4.2. The PV modules must be PID compliant, salt, mist & ammonia resistant and should withstand weather conditions for the project life cycle.
- 4.3. The efficiency of the cell shall not be less than 20%.
- 4.4. The back sheet of PV module shall be minimum of three layers with outer layer (exposure to ambience) and shall be made of PVDF or PVF. The Back sheets for PV Module with 2 layered or 3 layered Polyester types or the back sheets with Polyester (PET type) at Air side material are not permitted for the empanelment; The minimum thickness of the core layers (without adhesive and inner EVA coated) must be 300 microns. The maximum allowed water vapor transmission rate shall be less than 2 g / m²/day and shall have a Partial Discharge > / = 1500V DC.

The front glass shall meet the following specifications:

- a. The facing glass must be Tempered, PV grade with Low iron and high transmission.
- b. The transmission shall be > 93%.
- c. Thickness shall be min 3.2 mm.

- d. Textured to trap more light
 - e. The glass shall have an Anti-reflective coating for the better transmission and light absorption.
 - f. Tempered glass to meet the external load conditions.
- 4.5. The encapsulant used for the PV modules should be UV resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The sealant used for edge sealing of PV modules shall have excellent moisture ingress Protection with good electrical insulation and with good adhesion strength. Edge tapes for sealing are not allowed.
- 4.6. Anodized Aluminium module frames of sufficient thickness shall be used which are electrically & chemically compatible with the structural material used for mounting the modules having provision for earthing.
- 4.7. UV resistant junction boxes with minimum three numbers of bypass diodes and two numbers of MC4 connectors or equivalent with appropriate length of 6 sq.mm Cu cable shall be provided. IP67 degree of protection shall be used to avoid degradation during Life.
- 4.8. Shading correction/ bypass diode for optimizing PV out to be incorporated in each solar module or panel level.
- 4.9. Other relevant information on traceability of solar cells and module as per ISO 9000 series.
- The following details should be provided on the module.
- a. Name of the manufacture.
 - b. Month and year of manufacture.
 - c. Rated Power at STC.
 - d. Pmax, Vmp, Imp, Voc, Isc, NOCT.
- 4.10. The PV modules must qualify (enclose Test Reports/Certificates from IEC/NABL accredited laboratory) as per relevant IEC standard. The Performance of PV Modules at STC conditions must be tested and approved by one of the IEC/NABL Accredited Testing Laboratories.
- 4.11. PV modules used in solar power plant/ systems must be warranted for 10 years for their material, manufacturing defects, workmanship. The output peak watt capacity which should not be less than 90% at the end of 10 years and 80% at the end of 25 years
- 4.12. Original Equipment Manufacturers (OEM) Warrantee of the PV Modules shall be submitted when the materials delivered at site.
- 4.13. The PV modules shall conform to the following standards:
- a. IEC 61215 / IEC 61646: c-Si (IEC 61215): Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval Thin Film (IEC 61646): Design, Qualification & Type Approval.
 - b. IEC 61730-1: Photovoltaic Module safety qualification- Part 1: Requirements for construction.
 - c. IEC 61730-2: Photovoltaic Module safety qualification- Part 2: Requirements for testing.
 - d. IEC 61701: Salt mist corrosion testing of photovoltaic modules.
 - e. IEC 62716: Test Sequences useful to determine the resistance of PV.

5. Solar Power Inverter

Solar inverter comprises of charge controller with MPPT technology that is either integrated with the inverter or as a separate unit. However, the specifications for the OFFGrid inverter are detailed below:

5.1. General Specifications:

All the Inverters should contain the following clear and indelible Marking Label & Warning Label. The equipment shall, as a minimum, be permanently marked with:

- ii. i. The name or trademark of the manufacturer or supplier.
- iii. A model number, name or other means to identify the equipment.
- iv. A serial number, code or other markings allowing identification of manufacturing location and the manufacturing batch or date.
- v. Input voltage, type of voltage (A.C. or D.C.), frequency, and maximum continuous current for each input.
- vi. Output voltage, type of voltage (A.C. or D.C.), frequency, maximum continuous current, and for A.C. outputs, either the power or power factor for each output.
- vii. The Ingress Protection (IP) rating.

5.2. Off- Grid Inverter 25kW or above shall be considered.

5.3. The control system should continuously adjust the voltage of the generator to optimize the power available. The power conditioner must automatically re-enter standby mode when input power reduces below the standby mode threshold. Front Panel display should provide the status and fault indication (if any).

5.4. The inverter should have IGBT/MOSFET based controlling elements and current regulated systems

5.5. Operational Voltage Range: Suitable System Voltage according to the battery bank and panel array.

5.6. The inverter must have MPPT power electronics for the maximum extraction of PV power.

5.7. Auto resetting electronic over current protection.

5.8. The inverter shall conform to IEC 61683 for efficiency measurement, and IEC 600682 (1,2,14,30) or equivalent British standard for environmental testing.

5.9. Output voltage: Output voltage 230V/415V.

5.10. Output frequency; 50 Hz.

5.11. THD: Less than (<) 5%.

5.12. Efficiency: 90% or above at full load.

5.13. Ambient temperature: -5° to 55°C.

5.14. Protections:

- a. Short circuit (circuit breaker & electronic protection against sustained fault).
- b. Over-load protection.
- c. Over-temperature protection.
- d. Under voltage & Over-voltage of Battery.
- e. Auto/Manual re-connect provision.
- f. Reverse polarity protection both for the PV array and Battery bank (DC).
- g. Ingress Protections: IP20/ IP 21 or above.

5.15. Other Features:

- a. Surge Protection: 150% of the rated capacity for a period of 10 seconds.
- b. Acoustic Noise Level ≤ 50 dB.

5.16. Recommended Indicators / Displays / Alarms

- a. Digital Display(s) of input DC SPV voltage & current.

- b. Digital Display (s) AC output voltage, frequency, power and current.
- c. Overload Alarm / cut-off.
- d. System Cut-off Indicator.
- e. System Reset Button.
- f. Battery voltage and current.
- g. SPV charging.
- h. Battery Charge Level LED Indicator (s) – Low, Medium, High, Full.
- i. Battery Low indicator and Alarm/ cut-off.

6. Battery Bank

6.1. The battery bank shall be Lithium Iron Phosphate. The Contractor/Supplier shall use only the Batteries as per required backup. However the specifications for the Batteries are detailed below:

6.2. Technical Requirements

Sr. No.	Parameter
1.	Nominal Capacity shall be rated @0.5C
2.	Minimum Nominal Cell voltage (V): 3.2V
3.	Self-discharge (less than 3% per month at 30°C)
4.	A 6 hour backup of each hostel requirement is estimated as 90kWh
5.	Minimum life span shall be 2000 cycles.

6.3. General Specifications:

- a. Test certificate submitted should qualify the minimum requirements as per above standards for capacity test, ampere-hour efficiency test, watt-hour efficiency test, self-discharge test.
- b. Lithium Iron Phosphate Battery shall have a warrantee of minimum 5 years.
- c. Battery capacity is rated C/2 at 27°C
- d. Original Equipment Manufacturers (OEM) Warrantee of Battery shall be submitted.
- e. There should be a separate Battery Management System for Lithium Iron Phosphate Battery used for the PV Power Plant.
- f. The battery shall be manufactured in accordance with the IEC 62133: 2012, IEC 62133-2: 2017 and IEC 62620: 2014 standards.

7. Module Mounting Structure

- Photovoltaic arrays must be mounted on a stable, durable structure that can support the array and withstand wind, rain, and other adverse conditions. The modules will be fixed on structures with fixed arrangement.
- The module mounting structures shall have adequate strength and appropriate design suitable to the locations, which can withstand the load and high wind velocities. Stationary structures shall support PV modules at a given orientation, absorb and transfer the mechanical loads to the surface properly.
- Each structure with fixed tilt should have a tilt angle as per the site conditions to take maximum insolation which will be approximately equal to the latitude of the location facing true South with a North – South orientation. The tilt angle can vary from 0 degree to 30 degree based on the location.
- The PV module mounting structure shall have a capacity to withstand a wind velocity of at 40m/s.

- Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed. The PV array structure design shall be appropriate with a factor of safety of min 1.5.
- The materials used for structures shall be 14 SWG Hot dip Galvanized Mild Steel conformed or aluminium of suitable grade minimum alloy 6063 or better.
- The minimum thickness of galvanization for hot dip Galvanized Mild Steel should be at least 80 microns as per WAPDA standard.
- The Bolts, Nuts, fasteners, and clamps used for panel mounting shall be of Stainless Steel SS 304.
- No Welding is allowed on the mounting structure
- Aluminium structures used shall be protected against rusting either by coating or anodization.
- Aluminium frames should be avoided for installations in coastal areas.
- The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years. And shall be free from corrosion while installation.
- Screw fasteners shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frames.
- The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m².
- Minimum distance between the lower level of PV Module and the ground shall be 0.6m from the ground level.
- The PV Panel area shall be accessible for cleaning and for any repair work.
- Sufficient gap need to be provided between the rows to avoid falling of shadow of one row on the next row. Seismic factors for the site will be considered while making the design of the foundation.
- Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance.
- Installation of structure for solar PV mounting should not tamper with the water proofing of the roofs.

8. Earthing

The Solar PV Plant should be earthed with earthing system of building. The Earthing for array and LT power shall be made as per the provisions of IEEE/IEC standards.

- 8.1. Earthing System shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV module mounting structures in one long run. The earth strips should not be bolted. Earthing GI strips shall be interconnected by proper welding.
- 8.2. The earthing conductor should be rated for 1.56 times the maximum short circuit current of the PV array. The factor 1.56 considers 25 percent as a safety factor and 25 percent as albedo factor to protect from any unaccounted external reflection onto the PV modules increasing its current.
- 8.3. In any case, the cross-section area of the earthing conductor for PV equipment should not be less than 6 mm² if copper, 10 mm² if aluminium or 70 mm² if hot-dipped galvanized iron. For the earthing of lightning arrestor, cross-section of the earthing conductor should not be less than 16 mm² of copper or 70 mm² if hot-dipped galvanized iron. The complete Earthing system shall be mechanically & electrically connected to the existing earthing system of building provide return to earth.

- 8.4. Body earthing shall be provided in inverter, each panel frame, module mounting structure, kiosk and in any other item as required.
- 8.5. All non-current carrying metal parts shall be Earthing with two separate and distinct earth continuity conductors to an efficient earth electrode.
- 8.6. The equipment grounding wire shall be connected to earth strip by proper fixing arrangement. Each strip shall be continued up to at least 500mm from the equipment.

9. Lightning Protection

The SPV power plant should be provided with lightning and over voltage protection. The source of over voltage can be lightning or other atmospheric disturbance. The lightning conductors shall be made as per applicable IEC Standards in order to protect the entire array yard from lightning stroke. The design and specification shall conform to IEC 62305, "Protection against lightning" govern all lightning protection-related practices of a PV system.

- 9.1. The entire space occupying SPV array shall be suitably protected against lightning by deploying required number of lightning arresters. Lightning protection should be provided as per IEC 62305.
- 9.2. Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.
- 9.3. The protection against induced high voltages shall be provided by the use of surge protection devices (SPDs) and the earthing terminal of the SPD shall be connected to the earth through the earthing system.
- 9.4. The Contractor/Supplier shall submit the drawings and detailed specifications of the PV array lightning protection equipment to Employer for approval before installation of system.

10. Array Junction Box (AJB)/ String Combiner Box (SCB)

AJB shall be provided as per the design requirement of the Inverter, if required. AJB comprises of an enclosure, copper busbars, Fuses, Surge Protection Device (SPD) and Isolator. DC generated by the solar modules is transmitted through the appropriate cables from Array Yard to Control facility. AJB bus & panel shall be provided for the incoming DC supply from array yard.

AJB, if required, should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, protection relays, fuses, etc.

AJB, if required, shall have sheet from enclosure of dust and vermin proof, the bus bar / cables are to be made of copper of desired size.

The Array Junction Boxes are to be provided in the PV array for termination of connecting cables.

The Array Junction Boxes shall be made of GRP/FRP/with full dust, water& vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.

- 10.1. Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- 10.2. Copper bus bars/ terminal blocks housed in the junction box with suitable termination threads conforming to IP 65 standard to prevent water entry, Single/ double compression cable glands, provision of earthing. It should be placed at a height suitable for ease of accessibility.
- 10.3. Each Junction Box shall have high quality Suitable capacity Metal Oxide Varistors (MOVs)/ SPDs. The Surge Protective Device shall be of Type 2 as per IEC 603645-53.
- 10.4. The junction Boxes shall have suitable arrangement for the followings (typical):- Combine groups of modules into independent charging sub-arrays that will be wired into the controller. The Junction Boxes shall have arrangements for disconnection for each groups and attest point for sub-group for fault location.

- 10.5. The current carrying ratings of the string combiner box/ junction box shall be suitable with adequate safety factor, to inter connect the Solar PV array.
- 10.6. All fuses shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP65 enclosures with transparent covers.
- 10.7. Fuse for both positive and negative inputs of each string, Isolator of MCB, SPD of type 2 shall be provided.
- 10.8. The surge arresters shall be type 2 (with reference to IEC 61643-1) rated at a continuous operating voltage of at least 125 percent of the open-circuit voltage of the PV string, and a flash current of more than 5A.
- 10.9. Not more than two strings can be connected in parallel to a single input of SCB/AJB. One spare input terminal along with connector shall be provided for each SCB/AJB.
- 10.10. DC switch/ dis connector of suitable rating shall be provided at AJB/SCB output to disconnect both positive and negative side simultaneously.

11. AC Distribution Board

AC Distribution Board (ACDB) shall control the AC power from inverter and should have necessary surge arrestors and circuit breakers.

- 11.1. The AC DB enclosure shall be of good protection and suitable for mounting on the trenches / on wall.
- 11.2. All the 415 V AC or 230 V AC devices/equipment like bus support insulators, circuit breakers, SFU isolators (if applicable), SPD, etc. mounted inside the switch gear shall be suitable for continuous operation.
- 11.3. Switches/ circuit breakers/ connectors meeting general requirements and safety measurements as per IS 60947 Part I, II, III and IEC 60947 part I, II and III.
- 11.4. Junction boxes, enclosures, panels for inverters/ Controllers shall meet IP 54 (for indoor)/ IP 65 (for outdoor) as per IEC 529.

12. AC/DC Cabling

Cabling is required for wiring from AC output of inverter/PCU to the AC distribution board to AC bus bar. It includes the DC cabling from Solar Array to AJB & from AJB to inverter input and Inverter to Battery Bank.

- 12.1. All cables of appropriate size to be used in the system shall have the following characteristic:
 - a. Shall conform to IEC 60227 & IEC 60502 standards.
 - b. Temperature Range: -5 degree Celsius to +90 degree Celsius
 - c. Voltage rating: 660/1000V
 - d. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
 - e. Flexible
- 12.2. Sizes of cables between any array interconnections, array to junction boxes, junction boxes to inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- 12.3. For the DC cabling, XLPE/XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used; Multi-core cables shall not be used.
- 12.4. For the AC cabling, PVC or XLPE insulated and PVC sheathed single or, multi-core flexible copper cables shall be used. However, for above 25kWp systems, XLPE insulated Aluminium cable of suitable area of cross section can be used in the AC side subject to a minimum area of cross section of 10 sq.mm. Outdoor AC cables shall have a UV –stabilized outer sheath IEC 69947.
- 12.5. The total voltage drop on the cable segments from the solar PV modules to the inverter shall not exceed 2.0%

- 12.6. The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.
- 12.7. The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.
- 12.8. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- 12.9. All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with 16 hermes-plastic clamps at intervals not exceeding 50cm; the minimum DC cables size shall be 4.0mm² copper; the minimum AC cable size shall be 4.0mm² copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.
- 12.10. Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified. The following colour code shall be used for cable wires.
 - a. DC positive: red (the outer PVC sheath can be black with a red line marking).
 - b. DC negative: black
 - c. AC single phase: Phase: red; Neutral: black
 - d. AC three phase: phases: red, yellow, blue; neutral: black
 - e. Earth wires: green
- 12.11. Cables and conduits that have to pass through walls or ceilings shall be taken through PVC pipe sleeve.
- 12.12. Cable conductors shall be terminated with tinned copper end ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.
- 12.13. All cables and connectors used for installation of solar field must be of solar grade which can withstand harsh environment conditions including high temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall solar grade copper (Cu) with XLPO insulation and rated for 1.1 kV as per relevant standards only.
- 12.14. Bending radii for cables shall be as per manufactures recommendations.
- 12.15. For laying/termination of cables latest IEC Codes/ standards shall be followed.

13. Civil Works

Existing shade-free roof-top space shall be used to install Solar PV array. While installing solar power plants on rooftops, the physical condition of the rooftop, chances of shading, chances water level rise in the rooftop during raining due improper drainage in the rooftop should be taken in to consideration. The solar PV array should be installed in a way that the existing structure does not damage. In case the damage to structure is unavoidable, the Contractor/Supplier shall reinstate and make good with the same or appropriate material at its own cost. The cost of repair shall deemed to have been inclusive in the rate quoted in the Supplementary BOQ.

- 13.1. PV array shall be installed in the terrace space free from any obstruction and/or shadow and to minimize effects of shadows due to adjacent PV panel rows.
- 13.2. There should not be any damage what so ever to the rooftop due to setting up of the solar power plant so that on a later day there is leakage of rainwater, etc. from the rooftop.
- 13.3. Some civil works are inevitable for erecting the footings for the module mounting structure as discussed in Module Mounting Structure section. The roof top may be given

- a suitable grading plaster with suitable leak proof compound so as to render the roof entirely leak proof.
- 13.4. Ample clearance shall be provided in the layout of the inverter and DC/AC distribution boxes for adequate cooling and ease of maintenance.
- 13.5. While cabling the array, care must be taken such that no loose cables lie on the rooftops.
- 13.6. Neatness, tidiness and aesthetics must be observed while installing the systems.
- 13.7. RCC Works – All RCC works shall be as per approved design and the materials used viz. Cement reinforcement; steel etc. shall be as per relevant ASTM standards.
- 13.8. Brick Works (If any) – All brick works shall be using 1st class bricks of approved quality.
- 13.9. Plastering – Plastering in cement mortar 1:3 shall be applied to all.
- 13.10. Display of mandatory items- Single Line Diagram and layout diagram of modules and interconnection at installation site shall be provided near the inverter for greater than 10 kWp systems.
- 13.11. For painting on concrete, masonry and plastered surface the relevant standard shall be followed.
- 13.12. All Civil works required for the installation of the PV Plant and other civil wherever necessary shall be within the scope of the Contractor/Supplier.
- 13.13. The layout of Inverter accommodation shall be designed to enable adequate heat dissipation and availability. Mount within the existing infrastructure available in consultation with the Site in charge.
- 13.14. The Inverter and Battery should be placed as near as possible in the near vicinity of PV array to avoid voltage drop.
- 13.15. There shall be enough ventilation for the battery room.

14. Warranty

- 14.1. 5 years system warranty should be provided by the Contractor/Supplier for the equipment and the components installed.
- 14.2. The successful Contractor/Supplier should submit the copies of the Warrantee Certificates for the on-site warrantee provided by the OEM for the important components like PV Modules, Inverters and Batteries etc. as follow:
- a. PV modules used in solar power plant/ systems must be warranted for 10 years for their material, manufacturing defects, workmanship. The output peak watt capacity which should not be less than 90% at the end of 10 years and 80% at the end of 25 years
 - b. The Solar inverter shall have a warrantee of minimum 05 years.
 - c. Lithium Iron Phosphate Battery shall have a warrantee of minimum 05 years.

15. Operation Manual

An Operation, Instruction and Maintenance Manual, should be provided with the system. The following minimum details must be provided in the manual:

- About solar power plant – its components and expected performance.
- DO's and DON'T's
- Cleaning of Solar PV Modules in regular intervals
- Clear instructions on regular maintenance and troubleshooting of solar power plant.
- As built drawings for the installation
- Five Year System Warrantee/CMC Certificate

- OEM Warrantee Certificates of Inverters, PV Modules, Batteries etc.
- Specification of PV Power Plant
- Data Sheets of Major Equipment like PV Module/Inverter etc.
- Name and address of the Contractor/Supplier and the contract person in case of non-functionality of the solar power plant.

16. Site Inspection

Once Empaneled and when a project is awarded the Contractor/Supplier should visit site / sites for the checking the feasibility before proceeding. The load proposed to be segregated and connected to the Off-Grid PV Plant should match with the connected load.

17. Drawings and Documents

Once Empaneled and when a project is awarded, the Contractor/Supplier must submit drawings/documents required by statutory authorities and obtain the approval before the installation.

- i) Schematic drawing showing the PV panels, Power conditioning Unit(s)/Inverter, Array Junction Boxes (AJBs)/String Combiner Boxes (SJB), AC and DC Distribution Box, Battery bank etc
- ii) Layout of solar PV Array.
- iii) Single Line Diagram (SLD) with specification of all components.
- iv) Design document for Module Mounting Structure (MMS) including calculations/report showing wind speed withstanding capacity of the structure.
- v) Module Mounting Structure (MMS) drawing along with foundation details for the structure.
- vi) Sizes and specification of cables for PV Module interconnections, PV Array to Array Junction Boxes, Array Junction Boxes to Inverter, and Inverter to AC DB etc. shall be furnished.
- vii) Voltage drop calculations for the cables from PV module to inverter and inverter to DB's.

All PV plant design should contain the following details which should be approved by the concerned officer before installation.

- i) Design of string including the number of PV modules in series and number strings. ii) AC Protection (Circuit Breaker, Switches, Fuses, SPD).
- iii) DC Protection (Switches, Fuses, SPD).
- iv) AJB/ Junction Box details.
- v) DC Cable size and length from point to point.
- vi) AC Cable size and length from point to point.
- iv) Lightning protection details/specification.
- v) Earthing system details.

**Bidding Documents – Design, Supply, Installation, Testing and Commissioning of
Design, Supply, Installation, Testing and Commissioning of Solar Power System at Hostel Cat-2A
Specifications**

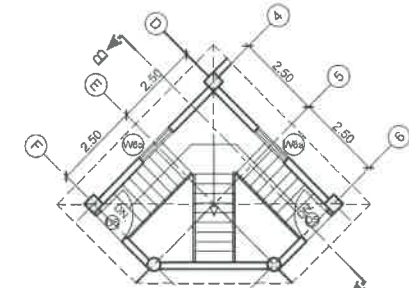
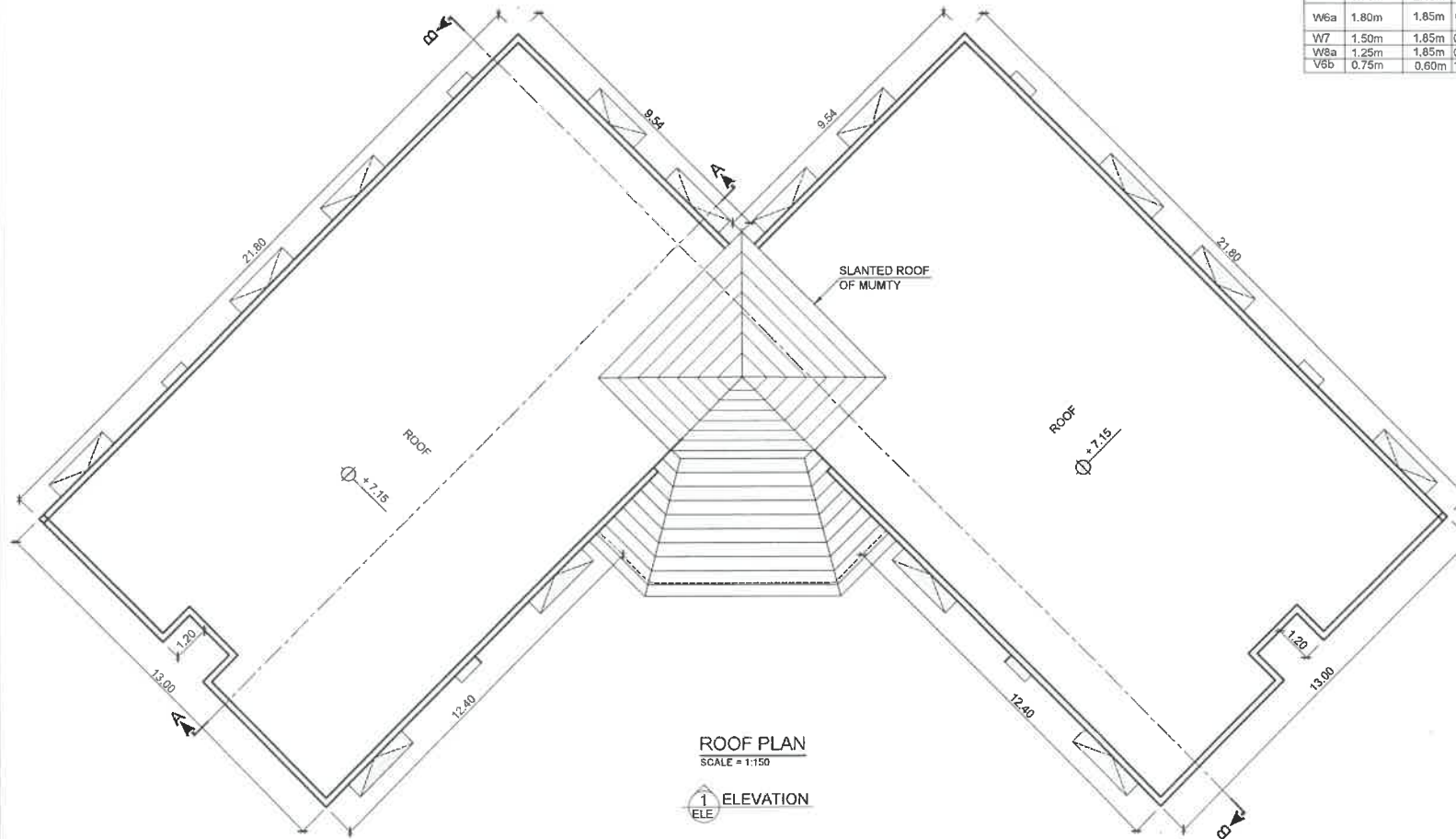
Sr. Officers Hostel - Catagory II

Sr #	Description	Quantity (No)	Unit Load (W)	Cumulative Load C.L (W)	Diversity Factor (DF)	Load(W)
1	Hanging (Ceiling) Lights	66	12	792	0.9	712.8
2	Bracket Lights	96	12	1152	0.8	921.6
3	Wall Bracket Lights	18	12	216	0.8	172.8
4	Tube Lights	68	40	2720	0.9	2448
5	Chandelier	3	100	300	0.6	180
6	Exhaust Fan	21	80	1680	0.8	1344
7	56" Ceiling Fan	30	80	2400	0.9	2160
8	3 - pin socket (5A)	30	300	9000	0.8	7200
9	3 - pin socket (15A)	0	0	0	0	0
10	T.V point	24	150	3600	0.6	2160
	Total			21860		17299.2

SECTION-V DRAWINGS

SCHEDULE OF DOORS & WINDOWS

TYPE	WIDTH	HEIGHT	SILL	DESCRIPTION	MATERIAL
D3	1.50m	2.15m	-	DOUBLE LEAF PANELLED DOOR	SOLID WOODEN DOOR
D4	1.25m	2.15m	-	DOUBLE LEAF DOOR /GLAZED	∕
D5	1.05m	2.15m	-	SINGLE LEAF PANELLED DOOR	∕
D6a	0.90m	2.15m	-	DOUBLE SIDED SINGLE LEAF PANELLED DOOR	∕
D7	0.75m	2.15m	-	SINGLE LEAF PANELLED DOOR	∕
W6a	1.80m	1.85m	0.30m	SLIDING OPENABLE WINDOW	ALUMINUM FRAME GLAZED + WIRE GUAZE
W7	1.50m	1.85m	0.30m	∕	∕
W8a	1.25m	1.85m	0.30m	∕	∕
V6b	0.75m	0.60m	1.55m	OPENABLE VENTILATOR	∕



ROOF MUMTY PLAN
SCALE = 1:150

ROOF PLAN
SCALE = 1:150

ELEVATION

COVERED AREAS:-

GROUND FLOOR	= 587.65 Sq m
FIRST FLOOR	= 587.65 Sq m
STAIR CASE LOFTS	= 72.00 Sq m
TOTAL (COVERED)	= 1247.30 Sq m

NOTES:-

All dimensions are in meters unless otherwise mentioned
Adjacent Road Level assumed ± 0.00

Rev. No.	DATE	REVISION	Appr.
Prepared		Reviewed	Approved
Name: Sobia Nazir		Name: M. Haneef	Name: Mr. Molohiko Iijima

DASU HYDROPOWER PROJECT



PAKISTAN WATER AND POWER
DEVELOPMENT AUTHORITY- WAPDA

CONSTRUCTION DRAWING FOR No. DASU-PCI-01R Project Colony & Infrastructure

DRAWING TITLE:
OFFICER'S HOSTEL CATEGORY-2
ROOF PLAN

DASU HYDROPOWER CONSULTANTS

JOINT VENTURE OF
NIPPON KOGYO CO. LTD. and
DOL SAF ENGINEERING LIMITED

IN ASSOCIATION WITH
DEVELOPMENT & MANAGEMENT CONSULTANTS
NATIONAL DEVELOPMENT CONSULTANTS LTD. and
PAKISTAN ENGINEERING SERVICES LTD.

DATE
28/OCT/2019

DRAWING No.
251-068