IN WITNESS, WHEREOF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of …….
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Lead Partner (Party No.-1)
For and on behalf of M/s
……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Common Seal of …….
has been affixed in my/our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

Signature …….

For Party No.-2
For and on behalf of M/s……..

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Common Seal of …….
has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated …….

Name ……..

Designation …….

For Party No.-3
For and on behalf of M/s.
……..

Signature …….

(Signature of the authorized representative)

WITNESS :

I. ……

II. ……

Note:

1. For the purpose of executing the Joint Deed of Undertaking, the non-judicial stamp papers of appropriate value shall be purchased in the name of Consortium.

2. The Undertaking shall be signed on all the pages by the authorized representatives of each of the partners and should invariably be witnessed.

Form F-18A

FORMAT FOR POWER OF ATTORNEY OF CONSORTIUM AGREEMENT

(*To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Consortium***)**

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder ..... have formed a Consortium under the laws of ..... and having our Registered Office(s)/ Head Office(s) at ..... (hereinafter called the 'Consortium' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s ..... being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of .....…….... and having its Registered/ Head Office at ..... as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorised Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Consortium in regard to Tender No..... Package ..... the bids for which have been invited by Solar Energy Corporation of India Limited, D-3, 1st Floor, Wing-A, Prius Platinum Building, District Centre, Saket, New Delhi-110017 (hereinafter called the 'Employer') to undertake the following acts:

i) To submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Consortium".

ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Consortium".

iii) To do any other act or submit any document related to the above.

iv) To receive, accept and execute the Contract for and on behalf of the "Consortium".

It is clearly understood that the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/ Authorized Representatives/ Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Consortium by virtue of this Power of Attorney and the same shall bind the Consortium as if done by itself.

IN WITNESS, THEREOF the Partners Constituting the Consortium as aforesaid have executed these presents on this ..... day of ……..... under the Common Seal(s) of their Companies.

for and on behalf of the
Partners of Consortium

.....

.....

.....

The Common Seal of the above Partners of the Consortium:

The Common Seal has been affixed there unto in the presence of:

WITNESS

1. Signature.....

   Name .....

   Designation .....

   Occupation .....

2. Signature.....

   Name .....

   Designation .....

   Occupation .....

Note:

1. For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value shall be purchased in the name of Consortium.

2. The Agreement shall be signed on all the pages by the authorized representatives of each of the partners and should invariably be witnessed.

Form F-19

e-BANKING FORMAT

(To be submitted on the Letter Head of the Bidder)

1. Bidder/ Customer Name :

2. Bidder/ Customer Code :

3. Bidder/ Customer Address :

4. Bidder/ Customer E-mail ID :

5. Particulars of Bank Account
   a) Name of Bank :
   b) Name of Branch :
   c) Branch Code :
   d) Address :
   e) Telephone Number :
   f) Type of Account :
   g) Account Number :
   h) RTGS IFSC Code :
   i) NEFT IFSC Code :
   j) 9 digit MICR code :

I/ We hereby authorize Solar Energy Corporation of India Limited to release any amount due to me/ us in the bank account as mentioned above. I/ We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or lost because of incomplete or incorrect information, we would not hold the Solar Energy Corporation of India Limited responsible.

(Signature of Vendor/ Customer)

BANK CERTIFICATE

We certify that ---------- has an Account no. ---------- with us and we confirm that the details given above are correct as per our records.

Bank stamp

Date

(Signature of authorized officer of bank)

Form F-20

PROFORMA OF BANK GUARANTEE FOR ADVANCE PAYMENT

(*To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the issuing Bank***)**

Bank Guarantee No.: .....
Date: .....

NOA/ Contract No.....

……. *[Name of Contract]* …….

To:

Solar Energy Corporation of India Limited
(A Government of India Enterprise)
D - 3, 1st Floor, Wing - A, Prius Platinum Building
District Centre, Saket, New Delhi - 110 017

Dear Sir / Madam,

We refer to the Contract ("the Contract") signed on .....*(insert date of the Contract)* …..... between you and M/s ..... *(Name of Contractor)* .....,

(or)

vide notification of award issued on ……. *(insert date of the notification of award)* …. by you to M/s ..... *(Name of Contractor)* ..... having its Principal place of business at ……..... *(Address of Contractor)* ..... and Registered Office at ……..... *(Registered address of Contractor)* ..... ("the Contractor") concerning ……..... *(Indicate brief scope of work)* ..... for the complete execution of the …… *(insert name of Package alongwith name of the Project)* …….

Whereas, in accordance with the terms of the said Contract, the Owner has agreed to pay or cause to be paid to the Contractor an interest bearing Advance Payment against furnishing of an irrevocable bank guarantee for an amount of …… (*Amount in figures and words*) ……which is equal to 110% of the amount of Advance Payment.

By this letter, we, the undersigned, …… *(insert name & address of the issuing bank)* ……, a Bank (which expression shall include its successors, administrators, executors and assigns) organized under the laws of ..... and having its Registered/ Head Office at ……. *(insert address of registered office of the bank)* ……..... do hereby irrevocably guarantee repayment of ……. *(Amount of the bank guarantee in figures and words)* …… upon the first demand of the Employer without cavil

or argument in the event that the Contractor fails to commence or fulfill its obligations under the terms of the said Contract for reasons whatsoever.

Provided always that the Bank's obligation shall be limited to the amount of this Bank guarantee or an amount equal to the outstanding balance of the Advance Payment and the accrued interest on the Advance Payment, taking into account such amounts, which have been repaid by the Contractor from time to time in accordance with the terms of payment of the said Contract, as certified by you.

This Guarantee shall remain in full force from the date upon which the said Advance Payment is received by the Contractor up to sixty (60) days beyond the date on which the entire Advance Payment along with the accrued interest if any due thereon has been fully adjusted in terms of the Contract i.e., up to sixty (60) days beyond the date of Completion of the Facilities under the Contract. This Guarantee may be extended from time to time, as may be desired by M/s Solar Energy Corporation of India Limited on whose behalf this Guarantee has been issued.

Any claims to be made under this Guarantee must be received by the Bank during its period of validity, i.e. upto sixty (60) days beyond the date of Completion of the Facilities by the Employer i.e. upto and inclusive of ……. *(dd/mm/yy)*.

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed _____ (*value in figures*) _____ [_____ (*value in words*) _____].

2. This Bank Guarantee shall be valid upto _____ *(validity date)* _____.

3. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only & only if we receive a written claim or demand on or before _____ (*validity date*) _____.

For and on behalf of the Bank

[*Signature of the authorised signatory(ies)*]
Signature_____

Name_____

Designation_____

POA Number_____

Contact Number(s): Tel._____Mobile_____

Fax Number_____

email _____

Common Seal of the Bank_____
Witness:
Signature_____

Name_____

Address_____

Contact Number(s): Tel._____Mobile_____

email _____

Note:

1. For the purpose of executing the Bank Guarantee, the non-judicial stamp papers of appropriate value shall be purchased in the name of Bank who issues the 'Bank Guarantee'.

2. The Bank Guarantee shall be signed on all the pages by the Bank Authorities indicating their POA nos. and should invariably be witnessed.

Form F-22

LIST OF BANKS

(*For Reference Purpose*)

SBI AND ASSOCIATES	OTHER PUBLIC SECTOR BANKS
1. State Bank of India	1. IDBI Bank Limited
2. State Bank of Indore	**FOREIGN BANKS**
	1. Bank of America NA
	2. Bank of Tokyo Mitsubishi UFJ Ltd.
	3. BNP Paribas
	4. Calyon Bank
	5. Citi Bank N.A.
NATIONALISED BANKS	6. Deutsche Bank A.G
1. Allahabad Bank	7. The HongKong and Shanghai Banking Corpn. (HSBC) Ltd.
2. Andhra Bank	8. Standard Chartered Bank
3. Bank of India	9. Societe Generale
4. Bank of Maharashtra	10. Barclays Bank
5. Canara Bank	11. Royal Bank of Scotland (RBS)
6. Central Bank of India	12. Bank of Nova Scotia
7. Corporation Bank	13. Development Bank of Singapore (DBS)
8. Dena Bank	14. Credit Agricole Corporate and Investment Bank
9. Indian Bank	**SCHEDULED PRIVATE BANKS**
10. Indian Overseas Bank	1. Federal Bank Limited
11. Oriental Bank of Commerce	2. Kotak Mahindra Bank Limited
12. Punjab National Bank	3. Axis Bank Limited
13. Punjab & Sind Bank	4. ICICI Bank Limited
14. Syndicate Bank	5. HDFC Bank Limited
15. Union Bank of India	6. Yes Bank Limited
16. United Bank of India	7. IDFC Bank Limited
17. UCO Bank	8. IndusInd Bank
18. Vijaya Bank	9. Karur Vysya Bank
19. Bank of Baroda	10. South Indian Bank
	11. RBL

Form F-23

SHAREHOLDING CERTIFICATE

(To be submitted on the Letter Head of the Bidder)

Name of the Equity Holder	Type and Number of Shares Owned	% of Equity Holding	Extent of Voting Rights

Yours faithfully

(Signature and Stamp of Authorized Signatory of Bidder)

Name: …….

Date: ……

Place: …….

(Signature and Stamp of Company Secretary/ Director/ Chartered Accountant)

Form F-24

POWER OF ATTORNEY FOR BIDDING COMPANY

(*To be stamped in accordance with Stamp Act, the Non-Judicial Stamp Paper of Appropriate Value should be in the name of the Bidder***)**

Know all men by these presents, We …… (name and address of the registered office of the Bidding Company as applicable) do hereby constitute, appoint and authorize Mr./Ms. …… (name & residential address) who is presently employed with us and holding the position of …… as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for …… (insert details of Tender) in response to the Tender No …… dated …….. issued by Solar Energy Corporation of India Limited (SECI), New Delhi including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which the SECI may require us to submit. The aforesaid Attorney is further authorized for making representations to the Solar Energy Corporation of India Limited, New Delhi and providing information/ responses to SECI, New Delhi representing us in all matters before SECI, New Delhi and generally dealing with SECI, New Delhi in all matters in connection with Bid till the completion of the bidding process as per the terms of the above mentioned Tender.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the Tender.

Signed by the within named

…….. (Insert the name of the executant company)

through the hand of

Mr. ……

duly authorized by the Board to issue such Power of Attorney

Dated this …… day of ……
Accepted

……..
Signature of Attorney
(Name, designation and address of the Attorney)

Attested
……
(Signature of the executant)

(Name, designation and address of the executant)

……
Signature and stamp of Notary of the place of execution

Common seal of …… has been affixed in my/ our presence pursuant to Board of Director's Resolution dated……

WITNESS

1. **……..**
(Signature)

Name……

Designation ……

2. **…….**
(Signature)

Name……

Designation ……

Notes:

The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

The person authorized under this Power of Attorney, in the case of the Bidding Company/ Lead Member being a public company, or a private company which is a subsidiary of a public company, in terms of the Companies Act, 1956, with a paid-up share capital of more than Indian Rupees Five Crores, should be the Managing Director/ Whole Time Director/ Manager appointed under section 269 of the Companies Act, 1956. In all other cases the person authorized should be a director duly authorized by a board resolution duly passed by the Company.

Also, wherever required, the executant(s) should submit for verification the extract of the chartered documents and documents such as a Board resolution/ power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

SECTION - VIII

SCHEDULE OF RATES (SOR)

1. **Bidders are required to quote for the Total Contract Price on Lumpsum basis in cognizance with the Tender Terms & Conditions.**

2. Bidder's quoted prices shall be strictly as per various Formats included under this Section [i.e. Section-VIII, Schedule of Rates (SOR)]. Bidder shall quote Lumpsum (LS) Price for the entire scope of work including Design, Engineering, Manufacture, Supply, Storage, Civil Work, Erection, Testing & Commissioning as per the Technical Specifications (TS) as defined under Section-VII.

3. All the Columns of quoted items in the Schedule of Rates including currency must be filled with required information, as applicable.

4. Bidder must quote the price in enclosed SOR formats only. The formats shall not be changed and/ or retyped.

5. Bidder to note that breakup of Lumpsum price is to be provided for assessment of Evaluated Bid Value (EBV), however total price payable under the Contract shall be restricted to the Lumpsum Price/ Contract Price only.

6. The Lumpsum Price shall be considered as Total Contract Price which Owner agrees to pay and the Contractor agrees to accept as full compensation for the Contractor's full performance of the Work in accordance with the provisions of the Contract Documents. Contract Price shall not be subjected to any adjustment except in case of Change Order or Statutory Variations in accordance with the provisions of the Contract.

7. The price quoted shall be Lumpsum price on Turnkey basis. Unless the basic parameter changes or additional/ extra requirements are made, total payments to be made to the contractor shall be limited to Lumpsum price indicated, irrespective of the progressive payments made during execution based on the split up of price.

8. Obligation of the Contractor is not limited to the quantities that the Contractor may either indicate in the Schedule of Breakup of Lumpsum Prices along with his bid or in further detailed break of Lumpsum prices furnished along with the bid or after award of work. Contractor shall carry entire scope of work/ supplies as detailed in various sections/ volumes of the Tender Document within the quoted Lumpsum Price (Contract Price).

9. Lumpsum Prices quoted by the Bidder shall include cost of any other supplies/ work(s) not specifically mentioned in the Bidding Document but necessary for the efficient, trouble free commissioning & operation of the Plant and to make this package job complete. Quoted price is FIRM and fixed till complete execution of the entire order. Also, variation on account of Foreign Exchange rate is not to be payable extra.

10. Spares for start-up/ commissioning and mandatory spares required are in Contractor's Scope and deemed included in the quoted Lumpsum Prices.

11. Bidder shall furnish following Forms of Schedule of Rates: -

a) SOR -1 is the Schedule and Breakup of Lump sum Price (Supply, Service and NPV of O&M) of the Tender. SOR -2 comprises of the yearly Breakup of the NPV of O&M price for 10 years period.

b) Details of Goods & Service Tax (GST) as included in SOR-1

c) Prices shall be considered for evaluation on NPV basis as per Evaluation Methodology Specified in Section III ITB of the Tender Document.

d) Bidder to mention the NPV of O&M amount for total 10 years in CELL NO I 39 of SOR-1 which should match with the NPV of O&M amount for total 10 years in CELL NO L 23 of SOR 2.

e) In case of any variation of the total NPV of O&M price, the NPV of O&M amount for total 10 years mentioned at CELL NO L 23 of SOR 2 will be considered for evaluation purpose.

12. INR = Indian Rupees

13. Bidder confirms that he has noted the contents of the Preamble to the Schedule of Rates, Schedule of Rate, Bid Document and quoted his Prices accordingly without any deviation.

14. O & M Charges on YoY basis must be equal or in ascending order only.

SCHEDULE OF RATES [SOR-1]

Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 20 MW (AC) Solar PV Power Plant (50 MWp DC) with 20 MW / 50 MWh Battery Energy Storage System at Phyang, Leh, UT of Ladakh, India

Sl. No.	Description of Item	Quantity (Ls)	PRICES (INR)				
			Unit Ex works Price (Excluding GST)	Total Ex works Price (Excluding GST)	Total value of Applicable GST (in figures)	% of GST applied (Ex 5%, 18% etc)	Total Price including GST
1	2	3	4	5 = 3 * 4	6	7	8= 5 + 6
PART A : SCHEDULE OF RATES [SOR-1] - SOLAR PART (20 MWAC)							
1	Supply of PV Modules as specified in the Tender Documents	1		INR 0.00			INR 0.00
2	Supply of Inverters as specified in the Tender Documents	1		INR 0.00			INR 0.00
3	Supply of Inverter Transformer as specified in the Tender Documents	1		INR 0.00			INR 0.00
4	Supply of Panels & Switchgears as specified in the Tender Documents	1		INR 0.00			INR 0.00
5	Supply of Module Mounting Structure as specified in the Tender Documents	1		INR 0.00			INR 0.00
6	Spare Modules (As Mandatory Spares, 0.50% of total supply of solar modules)	1		INR 0.00			INR 0.00
7	Mandatory Spares excluding Modules	1		INR 0.00			INR 0.00
8	Cables (All DC, LT & HT)	1		INR 0.00			INR 0.00
9	Weather Monitoring Station	1		INR 0.00			INR 0.00
10	Manufacture & Supply of Balance of System including all Equipments, Materials, Spares, Accessories, Safety & Fire Fighting System etc. excluding in above Solar Part supply and any other Supplies specified in the Tender Documents	1		INR 0.00			INR 0.00
	Sub Total - A			INR 0.00	INR 0.00		INR 0.00
PART B : SCHEDULE OF RATES [SOR-1] - BESS PART (20 MW)							
11	Supply of Battery along with the Battery Management System (BMS) as specified in the Tender Documents	1		INR 0.00			INR 0.00
12	Supply of Bidirectional Inverter (PCS) as specified in the Tender Documents	1		INR 0.00			INR 0.00

SCHEDULE OF RATES [SOR-1]

Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 20 MW (AC) Solar PV Power Plant (50 MWp DC) with 20 MW / 50 MWh Battery Energy Storage System at Phyang, Leh, UT of Ladakh, India

Sl. No.	Description of Item	Quantity (Ls)	PRICES (INR)				
			Unit Ex works Price (Excluding GST)	Total Ex works Price (Excluding GST)	Total value of Applicable GST (in figures)	% of GST applied (Ex 5%, 18% etc)	Total Price including GST
1	2	3	4	5 = 3 * 4	6	7	8= 5 + 6
13	Supply of Step-up Transformer as specified in the Tender Documents	1		INR 0.00			INR 0.00
14	Supply of MV Switchgear/ RMU as specified in the Tender Documents	1		INR 0.00			INR 0.00
15	Manufacture & Supply of Balance of System including all Equipments, Materials, Spares, Accessories, Grounding, Lighting, Lightning, Safety & Fire Fighting System etc. excluding BESS part supply above and any other Supplies specified in the Tender Documents	1		INR 0.00			INR 0.00
	Sub Total - B			INR 0.00	INR 0.00		INR 0.00
	PART C : SERVICES FOR PART A , SOLAR PART (20 MWAC)						
16	Freight & Insurance including Loading, Unloading, Storage, Handling at Site	1		INR 0.00			INR 0.00
17	Design, Engineering, Installation, Erection, Testing and Commissioning including Performance Testing in respect of all the Equipments Supplied and any other Services Specified in the Tender Documents	1		INR 0.00			INR 0.00
18	Civil and allied works including construction of Trenches, Module Mounting Structure, foundations, etc of all the Equipments Supplied.	1		INR 0.00			INR 0.00
	Sub Total - C			INR 0.00	INR 0.00		INR 0.00
	PART D : SERVICES FOR PART B , BESS PART (20 MW)						
19	Freight & Insurance including Loading, Unloading, Storage, Handling at Site	1		INR 0.00			INR 0.00

SCHEDULE OF RATES [SOR-1]

Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 20 MW (AC) Solar PV Power Plant (50 MWp DC) with 20 MW / 50 MWh Battery Energy Storage System at Phyang, Leh, UT of Ladakh, India

Sl. No.	Description of Item	Quantity (Ls)	PRICES (INR)				
			Unit Ex works Price (Excluding GST)	Total Ex works Price (Excluding GST)	Total value of Applicable GST (in figures)	% of GST applied (Ex 5%, 18% etc)	Total Price including GST
1	2	3	4	5 = 3 * 4	6	7	8= 5 + 6
20	Design, Engineering, Installation, Erection, Testing and Commissioning including Performance Testing in respect of all the Equipments Supplied and any other Services Specified in the Tender Documents	1		INR 0.00			INR 0.00
21	Civil and allied works including construction of foundations, etc of the Equipments Supplied	1		INR 0.00			INR 0.00
	Sub Total - D			INR 0.00	INR 0.00		INR 0.00
PART E : OPERATION AND MAINTENANCE PART							
22	Bidder to mention here the NPV of O&M amount for total 10 years in **CELL NO I 39 only** which should match with the NPV of O&M amount for total 10 years in **CELL NO L 23 of SOR 2.** **In case of any variation the NPV of O&M amount for total 10 years mentioned at CELL NO I 23 of SOR 2 will be considered for evaluation purpose.**	1					INR 0.00
	Sub Total - E						INR 0.00
	TOTAL EVALUATED BID VALUE (TEBV) (A+B+C+D+E)						**INR 0.00**

NOTES

1 **O & M Charges on YoY basis must be in equal or in ascending order only.**

SCHEDULE OF RATES [SOR-2] [OPERATION AND MAINTENANCE]

Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and O&M of 20 MW (AC) Solar PV Power Plant (50 MWp DC) with 20 MW / 50 MWh Battery Energy Storage System at Phyang, Leh, UT of Ladakh, India

Sl. No.	Description of Item	Year	PRICES (INR)							
			Yearly O&M Price (Excluding GST)		Total O&M Price (INR) (Excluding GST) in figures	Total value of Applicable GST in absolute figures [GST to be calculated on absolute O&M Price	% (Percentage) of Goods & Service Tax (GST) considered	Yearly O&M Price including GST	Present Value Factor (PVF)	NPV of O&M Price
			Solar PV - Part-A	BESS - Part-B						
1	2	3	4	5	6=4+5	7	8	9=6+7	8.61%	10= 9* PVF
OPERATION & MAINTENANCE										
1	Operation and Maintenance of the Plant Facility **for FIRST YEAR**	1	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.921	INR 0.00
2	Operation and Maintenance of the Plant Facility **for SECOND YEAR**	2	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.848	INR 0.00
3	Operation and Maintenance of the Plant Facility **for THIRD YEAR**	3	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.781	INR 0.00
4	Operation and Maintenance of the Plant Facility **for FOURTH YEAR**	4	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.719	INR 0.00
5	Operation and Maintenance of the Plant Facility **for FIFTH YEAR**	5	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.662	INR 0.00
6	Operation and Maintenance of the Plant Facility **for SIXTH YEAR**	6	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.609	INR 0.00
7	Operation and Maintenance of the Plant Facility **for SEVENTH YEAR**	7	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.561	INR 0.00
8	Operation and Maintenance of the Plant Facility **for EIGHTH YEAR**	8	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.516	INR 0.00
9	Operation and Maintenance of the Plant Facility **for NINTH YEAR**	9	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.476	INR 0.00
10	Operation and Maintenance of the Plant Facility **for TENTH YEAR**	10	INR 0.00	INR 0.00	INR 0.00			INR 0.00	0.438	INR 0.00
	TOTAL NPV OF O&M FOR 10 YEARS (1+2+3+4+5+6+7+8+9+10)		INR 0.00	INR 0.00	INR 0.00			INR 0.00		INR 0.00

NOTES

1 Bidders are required to mention the GST amount (Column I) on the actual O&M cost of the yearly basis & not on the NPV of O&M cost.

2 O & M Charges on YoY basis must be in equal or in ascending order only.

SECTION - VII

A. SCOPE OF WORKS

TABLE OF CONTENTS

1 Project Particulars

Design and Engineering		
Proposed AC capacity (MW)	20	
Minimum DC Capacity (MWp)	N – S Orientation	25
	E – W Orientation	25
Cell / Module Technology	Bifacial Mono-crystalline	
Origin of manufacturer	Open	
Minimum Cumulative Inverter Capacity (MW)	N – S Orientation	20
	E – W Orientation	20
Minimum Cumulative Inverter Transformer Capacity (MVA)	N – S Orientation	20
	E – W Orientation	20
Power Transformer Capacity (MVA)	3 x 20	
BESS Power Rating (MW)	20	
Dispatchable BESS Energy Rating (MWh)	50	
O&M period	10 years	
Design life of PV Power plant	25 years	
Site Location and Land Details (Please refer SECTION – VII, C. Special Technical Conditions for details)		
Site coordinates	Refer Annexure – E: Project Location	
Village	Phyang	
District	Leh	
Union Territory	Ladakh	
Type of Land	Revenue Land	
Owner of Project	Solar Energy Corporation of India Limited (SECI)	
Owner of Land	LAHDC (Ladakh Autonomous Hill Development Council)	
Electrical Interconnection Details		
Substation	66 kV LILO substation tapping 66 kV line interconnecting with the 220 kV Phyang Substation, Leh	
Distance to connecting substation (approx.)	500 m	

Access	
Nearest Urban Area	Leh
Nearest Highway	Srinagar – Leh (NH 1)
Nearest Railway Station	Udhampur
Nearest Domestic Airport	Kushok Bakula Rimpochee Airport, Leh
Performance Parameters	
Performance Ratio (PR)	82%
Capacity Utilization Factor (CUF)	42.5%
BESS Availability	98%
Other Details	
Construction Water	To be arranged by the EPC Contractor
Construction Power	To be arranged by the EPC Contractor

2 Brief Scope of Work

Scope of Supply & Work includes all design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, multi – level inspections, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licences, installation and incidentals, insurance at all stages, erection, testing and commissioning of a total of 20 MW (AC) Grid Interactive Solar PV Power Plant with 20 MW / 50 MWh Battery Energy Storage System (BESS), and performance demonstration with associated equipment and materials on turnkey basis at Phyang, Leh, Union Territory of Ladakh along with 10 (Ten) years comprehensive operation and maintenance from the date of Operational Acceptance.

All works shall be executed as per Technical Specifications given in Section VII-B. Section VII-C lays down Special Technical Specifications with reference to site specific design requirements. However, in case of any conflict in requirements between Section VII-C and Section VII-B, Section VII-C shall have the precedence.

3 Design and Engineering

The Contractor shall prepare the detailed design basis report (DBR) along with relevant standards (with respective clause description), PERT Chart and MDL. The Contractor shall submit a copy to Employer for review and approval prior to detail engineering.

3.1 All documents and drawings shall be submitted to the Employer both in soft as well as hard copies (5 nos.) for review and approval. Every drawing shall also be submitted in '*.dwg' format. In case of design calculations done in spread sheet, editable (working)

3.2 soft copy of the spread sheet shall also be submitted along with 'pdf' copies during every submission. The Employer shall return, as suitable, either soft or hard copies to the Contractor with category of approval marked thereon. The drawings/documents shall be approved in any one of the following categories based on nature of the comments/ type of drawing or document.

- Category-I: Approved
- Category-II: Approved subject to incorporation of comments. Re-submit for approval after incorporation of comments
- Category-III: Not approved. Re-submit for approval after incorporation of comments
- Category-IV: Kept for record/ reference
- Category-IV (R): Re-submit for record/ reference after incorporation of comments

(Note: Approval of document neither relieves the Vendor/ Contractor of his contractual obligations and responsibilities for correctness of design, drawings, dimensions, quality & specifications of materials, weights, quantities, assembly fits, systems/ performance requirement and conformity of supplies with Technical Specifications, Indian statutory

3.3 laws as may be applicable, nor does it limit the Employer/ Purchaser's rights under the contract)

Submission of basic design data, design documents, drawings and engineering information including GTP and test reports to Employer or its authorized representative for review and approval in hard copy and soft copy from time to time as per project schedule. The documents typically include, but not limited to, the following:

- Solar insolation data and basis for generation
- Detailed technical specifications (GTP) of all the equipment
- General arrangement and assembly drawings of all major equipment
- Schematic diagram for entire electrical system (DC, AC and auxiliary systems)
- GTP & G.A. drawings for all types of structures/ components, 66 kV or 33 kV

switchgears (as applicable) & other interfacing panels

- Test reports (for type, routine and acceptance tests)
- Relay setting charts
- Design calculations and sheets (licenced software as well as design templates)
- Geo technical investigation data and Topographical survey report including topographical survey data in digital format (Excel file) and Contour plan of the area.
- GA drawings of the entire project including equipment rooms/ inverter control rooms, office cum control room, roads, storm water drainage, sewage networks, security gate, fire protection system, perimeter fencing, transformer yard fencing etc.
- Transmission line drawings and erection plans as per DISCOM/ STU guidelines
- Quality assurance plans for manufacturing (MQP), Standard Operating procedure (SOP) and field activities (FQP)
- Detailed site EHS plan, fire safety & evacuation plan and disaster management plan.
- Detailed risk assessment and mitigation plan.
- O&M Instruction's and maintenance manuals for major equipment
- As-built drawings / documents and deviation list from good for construction (GFC)

3.4 Estimation of the plant generation based on Solar Radiation and other climatic conditions prevailing at site.

3.5 Design of associated civil, structural, electrical & mechanical auxiliary systems includes preparation of single line diagrams and installation drawings, manuals, electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth- mat, Bus Bar & Spacers indoor and outdoor lighting/ illumination etc., GTP and GA drawings for the major equipment including transmission line, design basis & calculation sheets, and other relevant drawings and documents required for engineering of all facilities within the periphery to be provided under this contract.

3.6 All drawings shall be fully corrected to match with the actual "As – Built" site conditions and submitted to Employer after commissioning of the project for record purpose. All as-built drawings must include the Good for Construction deviation list.

4.1

4 Procurement & Supply

The equipment and materials for Grid Interactive Solar PV Power Plant with associated system (Typical) shall include but not limited to the transit insurance, receipt, unloading, storage, erection, testing and commissioning of all supplied material for the following:

4.1.1 Adequate capacity of Solar PV modules of suitable rating including module mounting

structures, fasteners, suitable MMS foundations and module interconnections.

4.1.2 Array Junction boxes, distribution boxes and Fuse boxes with string monitoring capabilities: MCBs/ isolators, Surge Arrestors and with proper lugs, glands, ferrules, terminations and mounting structures.

4.1.3 DC and AC cables of appropriate sizes with adequate safety and insulation

4.1.4 Power Conditioning Units (PCU) with SCADA compatibility, common AC power evacuation panel with bus bars and circuit breakers, LT & HT Power Interfacing Panels, Plant Monitoring Desk, AC & DC Distribution boards and UPS for emergency power supply along with required batteries

4.1.5 Step – up transformers (inverter duty) in relevance with state grid code and inverter manufacturer requirements.

4.1.6 Battery Energy Storage System (BESS) of required power and energy capacity including unit batteries, Battery Management System (BMS), Power Conditioning System (PCS), Step-up transformers, LT & HT switchgear panels, Auxiliary supply system, DC & AC power cables, control and communication cables, along with RTU and related accessories for communication, HVAC system, fire fighting system and other related accessories

4.1.7 Power Transformer in relevance with technical specifications provided in this document and state grid code requirements.

4.1.8 Auxiliary transformer (s) along with cables and accessories for plant internal consumption.

4.1.9 Relay and protection system along with battery system.

4.1.10 LT Power and Control Cables including end terminations and other required accessories for both AC & DC power

4.1.11 Internal 415V interconnection & Indoor feeder panels to cater auxiliary needs of plant

4.1.12 Indoor panels / outdoor structures having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and Bus coupler having Main and transfer Bus. Each bay shall consist of VCB, CT, Isolators with earth switch, LAs and PT's etc.

4.1.13 Installation, Testing and Commissioning of ABT meters with AMR facility and all necessary metering rated CTs and PTs as per CEA Metering Regulation 2006 as amended time to time and state metering code.

4.1.14 Providing necessary communication and Data Acquisition System to transfer real time data to SLDC/RLDC as per the specifications of SLDC/RLDC wing and as per grid connectivity approving authority.

4.1.15 Lightning arrestors for entire plant area.

4.1.16 HDPE pipes, cable conduits, cable trays and accessories/trenches.

4.1.17 Earthing of the entire plant as per relevant standards.

4.1.18 Control room equipment

4.1.19 Testing instruments for maintenance and monitoring of equipment.

4.1.20 Mandatory spares as per Annexure-D for each package

4.1.21 CCTV cameras for plant surveillance

4.1.22 Fire protection system in buildings and fire extinguishers.

4.1.23 Weather monitoring station shall include but not be limited to the following:

- Pyranometers – for Irradiation in horizontal and tilted plane and Albedo
- Ultrasonic Anemometer (wind speed and direction)
- Temperature Sensor – Ambient and module surface
- Power source to the all sensors
- Data Logger

4.1.24 Construction of suitable structures for termination of transmission line for taking off from plant end and receipt of lines at Substation end.

4.1.25 Design & construction of LILO Transmission line/ cable at required voltage level from plant take off point to the designated substation including right of way (ROW) and construction of bay at designated substation as per Leh PDD/CTU requirements/procedures.

4.1.26 Any re-arrangement/ replacement of substation equipment/ materials, including bay construction, if required, at the evacuating substation necessary for evacuation of power from the Plant.

4.1.27 All safety equipment including PPE, mats etc. for safe working environment

4.1.28 Materials and accessories, which are required for satisfactory and trouble-free operation and maintenance of the above equipment like module cleaning system, supply of spares for all equipment, supply of tools and tackles etc.,

5.1 4.1.29 Any other equipment / material, not mentioned but required to complete the Solar Power Plant facilities in all respect.

5 Construction and Erection Works

The items of civil design and construction work shall include all works required for solar PV project and should be performed specifically with respect to following but not limited to:

5.1.1 Conducting geotechnical investigation and topographical survey of the given area.

5.1.2 Earthwork for site grading, cutting, filling, levelling & compaction of land.

5.1.3 Construction and erection of boundary wall/fence and main/ security gate(s).

5.1.4 Construction of foundation for mounting structures for SPV panels.

5.1.5 Civil foundation work of transformers, switchgears, equipment, Water tank etc.

5.1.6 Construction of internal roads with WBM base.

5.1.7 Construction of Equipment room with necessary illumination system and finishing as required.

5.1.8 Office cum stores cum control room building with Supervisor room, pantry, wash room, conference room etc. along with requisite furniture, workstations, air conditioning, internal and external illumination, other equipment as per the specifications.

5.1.9 Suitable arrangement of water shall be ensured to cater to day-to-day requirement of drinking water and permanent water supply for module cleaning and other needs of SPV power plant during entire O&M period.

5.1.10 Suitable Communication System for telemetry, SCADA with remote monitoring capabilities and internet facility.

5.1.11 Construction of Storm water drainage to its nearest outfall point & sewage network including rain water harvesting mechanism.

5.1.12 Erection of Perimeter lighting along with all accessories and cabling

5.1.13 Laying of underground / over ground cables (all types, as applicable) with proper arrangements along with appropriate sized ferrules, lugs, glands and terminal blocks. Laying of cables inside the building trench and other locations as required shall be over GI cable trays with proper support and accessories.

5.1.14 Construction of transmission line including Design, route survey, foundation, erection stringing, commissioning as per PDD/PGCIL procedure from take-off point at plant end/ substation to the delivery point at the evacuation substation as per Project Particulars provided above.

5.1.15 Suitable earthing for plant along with earth pits as per standards

5.1.16 All approvals, for equipment, items and works, which are not otherwise specifically mentioned in this document but are required for successful completion of the work in all aspects, including construction, commissioning, O&M of Solar PV Power Plant and guaranteed performance are deemed to be included in the scope of the contractor.

6 Statutory Approvals

Obtaining statutory approvals /clearances/ compliances on behalf of the Employer from various Government Departments, not limited to, the following: -

- Pollution control board clearance, if required
- Mining Department, if required
- Forest Department, if required
- All other approval as and when, as necessary for setting up of the solar power plant including CEIG/ CEA, power evacuation, etc. as per the suggested guidelines. Grid connectivity approval will be in the Scope of the Owner.

6.1

6.1.1 All statutory approvals/permissions and/or No Objection Certificates (NoC) etc. from CTU/PDD for obtaining connectivity at the substation as per Project Particulars provided above.

6.1.2 All other statutory approvals and permissions and their respective compliances, not mentioned specifically but are required to carry out hassle free Construction and O&M of the plant.

6.1.3 Adequate and seamless insurance coverage during EPC and O&M period to mitigate all risks related to construction and O&M of the plant to indemnify the Employer.

6.2 The Contractor shall comply with the provision of all relevant acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guidelines or any modification thereof or any other law relating whereto and rules made there under or amended from time to time.

7.1

7 Operation and Maintenance

7.2 Total Operation & Maintenance of the SPV Plant shall be with the Contractor, after operational acceptance of the plant till culmination of the O&M period and shall include deployment of engineering personnel, technicians and security personnel.

7.3 To provide a detailed training plan for all O&M procedures to Employer's nominated staff, which shall have prior approval from the Employer.

Employ and coordinate the training of contractors' personnel who will be qualified and experienced to operate and monitor the facility and to coordinate operations of the facility with the grid system.

Discharge obligations relating to retirement/ Superannuating benefits to employees or any other benefit accruing to them in the nature of compensation, profit in lieu / in addition to salary, etc. for the period of service with the contractor, irrespective continuance of employees with the project as employees of Contractor, after conclusion of O&M period.

7.4 To maintain accurate and up-to-date operating logs, records and monthly Operation & Maintenance reports at the facility. Contractor shall keep the measured daily data at regular intervals and provide the same to Employer in electronic form, compatible in CSV

7.5 format. The right to use the data shall remain with the Employer.

The Contractor shall establish forecasting tools for submitting schedule and comply with JERC (for UT of Jammu and Kashmir and UT of Ladakh) Regulations on Forecasting,

7.6 Scheduling and Deviation settlement of solar and wind generation. The scope under this Clause shall also include establishing and maintaining forecasting tools and appointment of QCA/Aggregator, if required. % Error (Deviation) shall be calculated as per the said regulations and DSM Charges in case of deviation beyond the permissible limits shall be borne by the Contractor.

7.7 Procurement of spare parts, overhaul parts, tools & tackles, equipment, consumables, etc. required for smooth operation and maintenance of the plant as per prudent/ standard utility practices, OEM recommendations and warranty clauses for the entire O&M period

7.8 To upkeep all administrative offices, roads, tool room, stores room, equipment in clean,

7.9 green and workable conditions.

To carry out periodic overhauls or maintenance required as per the recommendations of

7.10 the original equipment manufacturer (OEM) and to furnish all such periodic maintenance schedules at the time of plant commissioning/ start of O&M contract.

Handover the system to maintain an inventory of spare parts, tools, equipment, consumables and supplies for the facility's operation along-with required details of recommended spares list with all associated information regarding replacement records,

7.11 supplier details, tentative cost, storage details, specifications on the basis of replacement frequency and mean time between failures and mean time to restore at the culmination

7.12 of penultimate year under O&M period.

Availability of vehicles for Employer staff during construction and O&M period as per requirement may be ensured, failing which Employer shall have full right for alternate arrangement at the risk & cost of the contractor.

The contractor shall be responsible for all the required activities for the successful running, committed energy generation & maintenance of the Solar Photovoltaic Power

Plant covering:

- Deputation of qualified and experienced engineers and technicians at the facility.
- Deputation of Security personnel for the complete security of plant.
- Successful running of Solar Power Plant for committed energy generation.
- Co-ordination with PDD/CTU/other statutory organizations as per the requirement on behalf of Employer for Joint Metering Report (JMR), furnishing generations schedules as per requirement, revising schedules as necessary and complying with grid requirements.
- Monitoring, controlling, troubleshooting maintaining of logs & records, registers.
- Furnishing generation data monthly to Employer/Owner by 1st week of every month for the previous month to enable Employer raise commercial bills on consumers.
- Periodic cleaning of solar modules as approved by the Employer and water quality as per the recommendations of OEM
- Replacement of Modules, Invertors/PCU's and other equipment as and when required during the O&M period without additional cost to Employer

7.13 Continuous monitoring the performance of the Solar Power Plant and regular maintenance of the whole system including Modules, PCU's, transformers, overhead line, outdoor/indoor panels/ kiosks etc. are necessary for extracting and maintaining the maximum energy output from the Solar Power Plant.

7.14 Preventive and corrective O&M of the Solar Photovoltaic Power Plant including supply of spares, consumables, wear and tear, overhauling, replacement of damaged modules, invertors, PCU's and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary and others) as required.

7.15 The period of Operation and Maintenance will be deemed to commence from the date of completion of performance demonstration/Operational acceptance and successively the complete Solar Photovoltaic Power Plant to be handed over to the O&M contractor for operation and maintenance of the same. O&M contract shall further be extended on the mutually agreed terms and conditions for the mutually agreed period.

7.16 All the equipment required for Testing, Commissioning and O&M for the healthy operation of the Plant must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

7.17 The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or Employer's Workmen. This will include

procurement of all safety gadgets during Construction and O&M period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and suitable shoes etc.

8 Operation and Performance Monitoring

Operation part consists of deputing necessary manpower necessary to operate the Solar Photovoltaic Power Plant at the full capacity. Operation procedures such as preparation to starting, running, routine operations with safety precautions, monitoring etc., shall be

8.1 carried out as per the manufacturer's instructions to have trouble free operation of the complete system.

Daily work of the operation and maintenance in the Solar Photovoltaic Power Plant involves periodic cleaning of Modules including periodic tilt angle change as and when

8.2 required, logging the voltage, current, power factor, power and energy output of the Plant at different levels. The operator shall also note down time/ failures, interruption in supply and tripping of different relays, reason for such tripping, duration of such interruption etc. The other task of the operators is to check battery voltage-specific gravity and temperature. The operator shall record monthly energy output, down time, etc.

8.3 Earth resistance of Plant as well as individual earth pit is to be measured and recorded every month. If the earth resistance is high (compared to standards) suitable action is to be taken to bring down the same.

8.4 A maintenance record is to be maintained by the operator/ O&M-in-charge to record the regular maintenance work carried out as well as any breakdown maintenance along with the reasons for the breakdowns and steps taken to attend the breakdown, duration of

8.5 the breakdown etc.

The Preventive Maintenance Schedules will be drawn such that some of the jobs other than breakdown, which may require comparatively long stoppage of the Power Plant,

8.6 shall be carried out preferably during the non-sunny days or evenings. Prior information shall be provided to the Employer for such preventive maintenance prior to start.

The Contractor will attend to any breakdown jobs immediately for repair/ replacement/

8.7 adjustments and complete at the earliest working round the clock. During breakdowns (not attributable to normal wear and tear) in O&M period, the Contractor shall immediately report the accidents, if any, to the Employer showing the circumstances under which it happened and the extent of damage and/or injury caused.

The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

If negligence / mal operation of the contractor's operator results in failure of equipment, such equipment should be repaired/replaced by the contractor free of cost.

9 Security Services

8.8 The contractor has to arrange proper security system including deputation of security personnel at his own cost for the check vigil for the Solar Power Plant for the complete scope of works including comprehensive O&M period.

9.1 The security staff may be organized to work on suitable shift system; proper checking & recording of all incoming & outgoing materials vehicles shall be maintained. Any occurrence of unlawful activities shall be informed to Employer immediately. A monthly report shall be sent to Employer on the security aspects.

9.2 Any other activities required for completion of project, but not specified in the above shall be in the scope of contractor. The Contractor must provide the BOM of the plant as per the design during the time of submission of design basis report. The detailed technical specifications of major equipment to be followed strictly and are described in the technical specification section.

9.3

SECTION - VII

B. TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

DISCLAMIER:

1. Though adequate care has been taken while preparing the Bidding documents, the Bidders/Applicants shall satisfy themselves that the document is complete in all respects. Intimation of any discrepancy shall be given to this office immediately. If no intimation is received from any Bidder within twenty (20) days from the date of notification of NIT/ Issue of the NIT documents, it shall be considered that the NIT documents are complete in all respects has been received by the Bidder.
2. Solar Energy Corporation of India Limited (SECI), the Employer, reserves the right to modify, amend or supplement this NIT documents including all formats and Annexures.
3. While this bidding documents have been prepared in good faith, neither Employer or its authorized representatives nor their employees or advisors make any representation or warranty, express or implied, or accept any responsibility or liability, whatsoever, in respect of any statements or omissions herein, or the accuracy, completeness or reliability of information, and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this bidding documents, even if any loss or damage is caused by any act or omission on their part.
4. The specifications mentioned for all the equipment which include Solar modules, PCU, combiner boxes, DC cables, module mounting structures, transformer, CT, PT, LT/ HT cables, interfacing panels, switch gears & other associated equipment etc., to complete the power generation and evacuation to the designated substation, in the present bidding documents are for the **reference** only. It is subject to revise/ alter as per the design/ planning/ good engineering practices etc., to be carried out by the selected bidder, to the satisfaction of the Employer or its authorized representatives. It is advised that the bidders must satisfy himself with the prevailing site conditions before design/ plan. The design must be optimized as per the site conditions and directed to achieve the maximum output from the installed capacity at all times. Moreover, the components not separately mentioned, but are required to complete the plant for operation is also included in the scope of bidder and shall be vetted by the Employer or its authorised representatives.

Place:

Date:

(Signature)
Name and Designation of bidder

A Design Philosophy

1 The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. In order to achieve this, the following principles shall be adopted while designing the system.

1.1 Adequate capacity of SPV modules, PCUs, Junction boxes etc. to ensure generation of power as per design estimates. This will be done by applying liberal de-rating factors for the array and recognizing the efficiency parameters of PCUs, transformers, conductor losses, system losses, site conditions etc.

1.2 Use of equipment and systems with proven design and performance that have high availability track records under similar service conditions.

1.3 Selection of the equipment and adoption of a plant layout to ensure ease of maintenance.

1.4 Strict compliance with approved and proven quality assurance (QA) systems and procedures during different stages of the project, starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning.

1.5 Proper monitoring of synchronization and recording, to ensure availability of power to the grid.

1.6 The plant instrumentation and control system should be designed to ensure high availability and reliability of the plant to assist the operators in the safe and efficient operation of the plant with minimum effort.

1.7 It should also provide the analysis of the historical data and help in the plant maintenance people to take up the plant and equipment on predictive maintenance.

1.8 System design shall have intelligent protection mechanism which may include very fast responsive microprocessor-based relays etc., so that any disturbance from the grid will not cause any damage to the equipment of the Solar Power Plant.

2 The basic and detailed engineering of the plant shall aim at achieving high standards of operational performance especially considering following:

2.1 SPV power plant should be designed to operate satisfactorily in synchronization with the grid within permissible limits of high voltage and frequency fluctuation conditions. It is also extremely important to safeguard the system during major disturbances, internal and external surge conditions while ensuring safe operation of the plant.

2.2 The Module Mounting Structures shall be designed for such that SPV arrays produce

maximum energy during the period of respective tilt.

2.3 Shadow free plant layout to ensure minimum losses in generation during the day time.

2.4 Higher system voltage and lower current options to be followed to minimise ohmic losses.

2.5 Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.

2.6 Careful logging of operational data / historical information from the Data Monitoring Systems, and periodical analysis of the same to identify any abnormal or slowly deteriorating conditions.

2.7 The designed array capacity at STC shall be suitably determined to meet the proposed guaranteed generation output at the point of interconnection by the contractor in his bid. The contractor shall take care of first year degradation also by installing additional DC capacity as the CUF calculations will not factor the first-year degradation of the modules.

2.8 Each component offered by the bidder shall be of established reliability. The minimum target reliability of each equipment shall be established by the bidder considering its mean time between failures and mean time to restore, such that the availability of complete system is assured. Bidder's recommendation of the spares shall be on the basis of established reliability.

2.9 Bidder shall design the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.

2.10 The work execution planning for supply, erection, commissioning and all other allied works for SPV Power Plant shall be such that it is completed within stipulated time from the date of order/ LOI/ NTP, whichever is later.

3 The specifications provided with this bid document are functional ones; any design provided in this document is only meant as an example. The Contractor must submit a detailed design philosophy document for the project to meet the functional requirements based upon their own design in-line with the above. The bidders are advised to visit the site and satisfy themselves before bidding.

B Electrical System

1 Photovoltaic Modules

1.1 Standards and Codes

Photovoltaic Modules shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61215-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements
IEC 61215-1-1:2016 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
IEC 61215-1-2 Ed.1	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules
IEC 61730-1:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction
IEC 61730-2:2016 Ed.2	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing
IEC 61701:2011 Ed.2	Salt mist corrosion testing of photovoltaic (PV) modules (Applicable for coastal and marine environment)
IEC 62716:2013 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing (if applicable)
IEC TS 62804-1:2015 Ed.1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon (under conditions of 85^{o}C/85% RH for minimum 192 hours)
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, PV Modules used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards. Further, PV Modules should have been included in the ALMM list as per MNRE Approved Models and Manufacturers of Solar Photovoltaic Modules (Requirements for Compulsory Registration) Order, 2019.	

1.2 Technical Requirements

Parameter	Specification
Cell/ Module Technology	Mono-crystalline and Bifacial
Origin	Modules shall be domestically manufactured
Module Efficiency (Frontside)	≥ 19.5%
Bifacialitiy Factor, ø (P_{mp} Back / P_{mp} Front at STC)	0.7 ± 0.05

Rated power at STC	No negative tolerance is allowed
Temperature co-efficient of power	Not less than -0.40%/°C
Application Class as per IEC 61730	Class A

Note: Bifaciality shall be verified in accordance with IEC TS 60904-1-2:2019 – Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices. Refer Annexure – A.

1.3 Supplier Qualification Criteria

1.3.1 The PV Modules Supplier should have supplied minimum 5 GW capacity globally or 500 MW in India in the past 5 years (as on last date of Bid submission). The PV Module supplier shall be Class-I local supplier as per MNRE Order dated 23rd Sep, 2020 on Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Renewable Energy (RE) Sector.

1.4 Component Specifications

1.4.1 The PV Modules glass panel shall be:

(i) Glass-glass Modules, with minimum of 2 mm glass thickness on each side. It shall be laminated using a laminator with symmetrical structure, i.e. heating plates on both sides.

(ii) The glass used shall have transmittance of above 90%.

1.4.2 Void

1.4.3 The encapsulant used for the PV modules should be polyolefin based, UV resistant and PID resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. The encapsulant shall have the following properties.

Parameter	**Value**
Gel content	> 75%
Volume resistivity	> 1×10^{14} Ω.cm
Peeling strength with glass	> 40 N/cm

1.4.4 The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength. Edge tapes for sealing are not allowed.

1.4.5 The module frame shall be made of anodized Aluminium, which shall be electrically & chemically compatible with the structural material used for mounting the modules. It is required to have provision for earthing to connect it to the earthing grid. The anodization thickness shall not be less than 15 micron.

1.4.6 The material used for junction box shall be UV resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP67. Minimum three number of bypass diodes and two number of IEC 62852/EN 50521 certified MC4 compatible connectors with appropriate length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. The cable length shall be in accordance with the PV Module wiring strategy and adequate to ensure that the cable bending radius standard is not exceeded.

1.4.7 Each PV Module shall be provided a bar code which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The bar code data base shall contain the following information. Bar code scanner and database of all the modules containing the following information shall also be provided.

(i) Name of the manufacturer of PV Module
(ii) Name of the Manufacturer of Solar cells
(iii) Type of cell: Mono / Multi
(iv) Month and year of the manufacture (separately for solar cells and module)
(v) Country of origin (separately for solar cells and module)
(vi) I-V curve for the module
(vii) Peak Wattage, I_m, V_m and FF for the module
(viii) Unique Serial No. and Model No. of the module.
(ix) Date and year of obtaining IEC PV module qualification certificate
(x) Name of the test lab issuing IEC certificate
(xi) Other relevant information on traceability of solar cells and modules as per ISO 9000 series.

1.5 Warranty

1.5.1 PV modules must be warranted with linear degradation rate of power output except for first year (maximum 3% including LID) and shall guarantee 80% of the initial rated power output at the end of 25 years.

1.5.2 The modules shall be warranted for minimum of 10 years against all material/ manufacturing defects and workmanship.

1.4.3 The above warranties shall be backed by third party insurance.

1.6 Approval

1.6.1 The Contractor shall provide Guaranteed Technical Particular (GTP) datasheet and Bill of Materials (BOM) of the module that is submitted for approval along with the

datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above.

1.6.2 The Contractor shall also provide test certificates corresponding to the standards mentioned above along with complete test reports for the proposed module. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC/IECEE member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted.

1.6.3 The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports.

1.6.4 The Contractor shall submit a detailed Manufacturing Quality Plan (MQP) for the PV Module with list of checks/tests performed during incoming material inspection, production, pre-dispatch and package.

1.6.5 The Contractor shall obtain the approval of the proposed module make & model prior to manufacturing/ inspection call.

1.7 Manufacturing and Inspection

1.7.1 The Contractor shall inform the module manufacturing schedule to the Employer at least 7 (seven) working days before the start of proposed schedule.

1.7.2 The Employer shall perform material inspection at the Manufacturer's factory before the start of proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification.

1.7.3 The Manufacturing shall start only after the clearance by the Employer after the material inspection.

1.7.4 The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of top surface etc. Only Class A solar cell shall be used.

1.7.5 The modules shall be uniformly laminated without any lamination defects.

1.7.6 Current binning of modules shall be employed to limit current mismatch of modules. Different colour codes shall be provided on the modules as well as pallet for identification of different bins. Maximum three nos. of bins will be allowed for each module rating.

1.7.7 Pre-dispatch inspection of modules shall be performed as per the inspection protocol

attached in Annexure – A.

1.8 Transportation, Handling, Storage and Installation

1.8.1 Transportation, handling, storage and installation of modules shall be in accordance with the manufacturer manual so as not to breach warranty conditions. The Standard Operating Procedure (SOP) for the same shall be shared by the Contractor prior to dispatch.

1.8.2 It is required to construct a temporary platform (graded) while keeping the modules at least above the highest flood level. If the contractor scheduled/ planned to mount the modules immediately after the receipt at site, then the module shall be kept in common storage area with proper arrangement.

1.8.3 Modules shall be dispatched in line with the Construction schedule. If Modules are dispatched ahead of schedule, following measures shall be undertaken:

Modules shall be covered with tarpaulin sheet. Alternatively, the Modules, properly stacked as per OEM recommendations, shall be stores under a temporary shed. Further, the temporary platform for keeping the modules shall be treated with anti-termite treatment.

2 String Monitoring Unit

2.1 Standards and Codes

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60269	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

2.2 Construction

2.2.1 SMU enclosure shall be made of UV resistant, fire retardant, thermoplastic material. Enclosure degree of protection shall be at least IP65 and mechanical impact resistance shall be at least IK08.

2.2.2 Not more than two strings can be connected in parallel to a single input of SMU. One spare input terminal along with connector shall be provided for each SMU.

2.2.3 Every SMU input shall be provided with fuses on both positive and negative side. In case of negative grounded system, fuse at positive side only is acceptable. The rating

of the fuses shall be selected such that it protects the modules from reverse current overload. The fuses shall be 'gPV' type conforming to IEC 60269-6.

2.2.4 DC switch disconnector of suitable rating shall be provided at SMU output to disconnect both positive and negative side simultaneously.

2.2.5 Type-II surge protective device (SPD) conforming to IEC 61643-11/IEC 61643-31/ EN 50539-11 shall be connected between positive/negative bus and earth.

2.2.6 Resistance Temperature Detector (RTD) type or semiconductor type temperature sensor shall be provided to monitor the cabinet temperature.

2.2.7 MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SMU input. Cable gland (double compression metallic) of suitable size for DC cables shall be provided at the SMU output.

2.2.8 UV resistant printed cable ferrules for solar cables & communication cables and punched/ embossed aluminium tags for DC cables shall be provided at cable termination points for identification.

2.2.9 Suitable communication interface shall be provided to communicate the data to SCADA. The following parameters shall be measured/ monitored and made available at SCADA.

(i) String current
(ii) Bus voltage
(iii) Output current
(iv) Cabinet temperature
(v) DC disconnector switch ON/OFF status
(vi) SPD operating status

2.3 Warranty

The SMU unit shall be warranted against all material/ manufacturing defects and workmanship for minimum of 2 (two) years from the date of supply.

2.4 Tests

Routine tests and acceptance tests for the assembled unit shall be as per the Quality Assurance Plan (QAP) approved by the Employer.

3 Solar and DC Cables

3.1 Standards and Codes

Cable	From	To	Conductor/ Insulation	Voltage Rating	Applicable Standard

Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC/ 1.5 kV DC	IEC 62930/ EN 50618/
DC Cable	SMU	PCU	Copper or Aluminium/ XLPE	1.1 kV DC/ 1.5 kV DC	IS 7098 Part I for 1.1 kV DC IS 7098 Part II for 1.5 kV DC
* Cable used for module interconnection shall also be referred as solar cable.					

3.2 Solar cable outer sheath shall be flame retardant, UV resistant and black in colour. Solar cable with positive polarity should have marking of red line on black outer sheath.

3.3 DC cables shall be single core, armoured, Flame Retardant Low smoke (FRLS), PVC outer sheath conforming to IS 7098-I /IS 7098-II. DC cable with positive polarity should have marking of red line on black outer sheath.

3.4 In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.

(i) Cable size and voltage grade

(ii) Word 'FRNC/ FRLS' (as applicable) at every metre

(iii) Sequential marking of length of the cable in metres at every metre

3.5 Cables shall be sized based on the following considerations:

(i) Rated current of module

(ii) In case of central inverters, average voltage drop in the cables (from PV Modules to PCU) shall be limited to 1.5 % of the rated voltage. In case of string Inverters, average voltage drop (from PV module to string inverter) shall be limited to 0.5% of the rated voltage drop. The Contractor shall provide voltage drop calculations in excel sheet.

(iii) Short circuit withstand capability

(iv) De-rating factors according to laying pattern

3.6 Warranty

The cables (Solar and DC) shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply.

3.7 Tests

Type test, routine test and acceptance tests requirements shall be as per IEC 62930/EN 50618 for solar cables and IS 7098-1 for DC cables.

3.8 Installation

3.8.1 Cable installation shall be as per IS 1255.

3.8.2 Only terminal cable joints shall be accepted. No cable joint to join two cable ends

shall be accepted.

3.8.3 Solar cables shall be provided with UV resistant printed ferrules and DC cables shall be provided with punched/ embossed aluminium tags. The marking shall be done with good quality letter and numbers of proper size so that the cables can be identified easily.

3.8.4 Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry & exit point of the cubicles. Bimetallic lugs shall be used for connecting Cu bus bar and Al cables or vice-versa.

3.8.5 Solar cables, wherever exposed to direct sunlight and buried underground, shall be laid through Double Wall Corrugated (DWC) HDPE conduits. The size of the conduit or pipe shall be selected on the basis of 40% fill criteria.

3.8.6 Solar cables shall be aesthetically tied to Module Mounting Structure using UV resistant cable-ties suitable for outdoor application.

3.8.7 A.C and D.C cables shall be kept in separate trenches. The horizontal and vertical clearances between power and communication cable shall not be less than 300mm.

4 Power Conditioning Unit

4.1 Standards and Codes

Power Conditioning Unit (PCU) shall comply with the specified edition of the following standards and codes.

Standard	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
IEC 62116 Ed. 2	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold

IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 and 2019 Amendment	
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Inverters used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.	

4.2 Supplier Qualification Criteria

4.2.1 The Inverter Supplier should have supplied minimum 5 GW capacity globally or 1 GW in India in the past 5 years (as on last date of the bid submission). The solar inverter supplier shall be Class-I local supplier as per MNRE Order dated 23rd Sep, 2020 on Public Procurement (Preference to Make in India) to provide for Purchase Preference (linked with local content) in respect of Renewable Energy (RE) Sector.

4.3 Technical Requirements

Parameter	**Specification**
Type (String/Central)	String
Rated AC power	As per design
Maximum input voltage	1000 V / 1500 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power
Total Harmonic Distortion	Less than 3% at 100% load
Degree of protection	IP 20 (Indoor)/IP 54 (Outdoor)

4.3.1 The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 50°C.

4.3.2 Maximum power point tracker (MPPT) shall be integrated in the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.

4.3.3 The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient enough to accommodate the allowable grid voltage and frequency variations.

4.4 Construction

4.4.1 Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.

4.4.2 Every DC input terminal of PCU shall be provided with fuse of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system. One spare DC input terminal shall be provided for each PCU.

4.4.3 Type-II surge protective device (SPD) conforming to IEC 61643-11/IEC 61643-31/ EN 50539-11 shall be connected between positive/ negative bus and earth.

4.4.4 In case external auxiliary power supply is required, UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.

4.4.5 Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.

4.4.6 The PCU shall be tropicalized and the design shall be compatible with conditions prevailing at site. Suitable number of exhaust fan with proper ducting shall be provided for cooling keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve desired performance and life expectancy.

4.4.7 All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductor of appropriate size. DC negative terminal shall be grounded. In case DC negative grounding is not possible, appropriate anti-PID device shall be provided.

4.4.8 Dedicated communication interface shall be provided to monitor the PCU from SCADA.

4.4.9 PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not limited to, the following parameters.