

VOLUME - IA

TECHNICAL CONDITIONS OF CONTRACT (TCC) FOR O&M AT 40MW SOLAR POWER PLANT OF NLC, NEYVELI, TN.

TCC No: HY/PE&SD/O&M/ Solar/65MW/NLC/01, Rev.00

BHARAT HEAVY ELECTRICALS LIMITED

PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Chapter-I. Project Details

1.0 Project Details			
M/s NLC Ltd is establishing 2 block of 65MW (AC) Grid Interactive Solar PV Plant on EPC basis at Neyveli, Cuddalore District, Tamil Nadu. BHEL has been awarded 1 block of 65 MW which is divided in two different site with each of 40 MW & 25 MW respectively.			
1	Customer	:	M/s Neyveli Lignite Corporation Limited.
2	Project Information	:	1x65 MW(AC) Grid Interactive Solar PV Power Plant Area of 65MW block is divided into two sub blocks of 40MW and 25MW. The distance between these blocks is around 8kM.
3	Location	:	At Neyveli, Cuddalore District, Tamil Nadu. The site is 200 KM from Chennai.
4	Address Detail	:	Neyveli, Cuddalore District, Tamil Nadu.
5	Nearest Railway Station	:	Neyveli,
6	Road Approach	:	State Highway connecting Vridhachalam-Cuddalore and is about 18 KMs East of Vridhachalam and about 43 KMs South West of Cuddalore on Eastern Coast.
7	Nearest Air Port	:	Chennai
11	Ambient Air Temperature (Average)	:	a) Maximum : 40.0 ⁰ C b) Minimum : 18.4 ⁰ C
12	Average Relative Humidity	:	28-96 %
13	Climatic Condition	:	Tropical Climate

Bidder is advised to visit the project site and appraise himself about the local conditions and infrastructure available in the area for fulfilling their commitments under the contract. BHEL will not admit any claims whatsoever on account of Contractor's non-familiarization of local conditions.

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Chapter-I. Project Details

1.1 INTRODUCTION:

1.1.1 Project outline of 65MWp solar photovoltaic power plant:

Bharat Heavy Electricals Limited (BHEL), PE&SD, Hyderabad has set up a 65MWp solar photovoltaic (SPV) power plant at Neyveli, TN for NLC. The plant has two locations one of 40 MW at NLCIL Town ship and the other of 25 MW located at Koliruppu village, 12 kms apart from each other in Neyveli of Cuddalore district.

An overview outline of the project is as follows:

(a) The SPV modules employed at the power plant generates DC electricity that in turn is inverted to 3-phase AC with ~ 350V. The voltage is further stepped up to 33kV using 2.7MVA transformers. Twenty six such transformers are employed to achieve 65MWp. In which 16 nos. transformers are associated with 40MW block and 10 nos. transformers are associated with 25 MW

(b) String monitoring boxes (SMBs, 549nos.) are employed to monitor the DC parameters of the strings of solar array. The DC power outputs from the SMBs are fed to 52 Nos of 1250kW grid-interactive power conditioning units (inverters) that are housed in a distributed manner among 11 PCSS rooms/inverter rooms and two PESS buildings/central control rooms. The PCSS room, each generating 5MWp, are placed at different locations of the power plant. Each such room is associated with a 33kV transformer yard, employing two oil-immersion transformers each of 2.7MVA, 33kV/350-350 V (one HV and two LV windings). Each LV winding voltage is expected to be in the range ~350V-380V.

The 33KV output of 2 Nos of 2.7MVA transformers are fed to 33KV Switch boards with (2 I/C & 1 O/G) vacuum circuit breaker (VCBs) indoor panels are also placed in each PCSS room. The 33kV outgoing feeder from each PCSS will feed the 33kV switchboard at PESS. From PESS power generated is exported through Metering yard, Gantry to Grid. Thus, 7 PCSS rooms & 1 PESS room put together will generate 40MW in 40MW block and 4 PCSS rooms & 1PESS room put together will generate 25MW in 25MW block.

(c) As per the above major equipment pertaining 40MW block and 25MW block are listed broadly below

For 40MW block

333 SMBs, 32 PCUs, 7 PCSS, 1 PESS building, 16 Nos 2.7 MVA Transformer and 1Metering yard (2bays) & gantry.

For 25MW block

216 SMBs, 20 Inverters, 4 Inverter rooms, 1 PESS building, 10 Nos 2.7 MVA Transformer and 1Metering yard (1bay) & gantry.

- i. Generated power from 40MW block will be exported through two-transmission line, each is sized for 40MW and Generated power from 25MW block will be exported through one transmission line. Each feeder line is supported by a 33kV metering yard comprising of

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Chapter-I. Project Details

- outdoor-mounted equipment viz. CTs, PTs, surge arrestors, GOS isolators, earth switches, support structures, ACSR conductors etc. Each feeder line is provided with three ABT meters (main, check and standby) that are housed in independent panels kept in PESS room.
- ii. The parameters (DC solar array, LT AC inverter level, HT 33kV transformer level) of solar power plant are monitored using SCADA system.
 - iii. Power plant is provided with underground earth mat grid system for various electrical installations such as Solar array structures, string monitoring boxes, Inverter/PESS room electrical panels, Transformer yards, Metering yard and other installations.
 - iv. 415V AC power for power plant auxiliaries is derived from 415V ACDBs located in PCSS room & PESS building. These ACDB will be further fed from 2x100% 350V/433V Auxiliary transformers. These Auxiliary transformers derive the power from output terminals of inverter.
 - v. 110V DC supply for various electrical equipment such as protection relays, indication lamps etc. is derived from set of battery banks of Battery charger in PESS and PCSS rooms. The power supply to Battery charger is fed from auxiliary ACDB distribution panels.
 - vi. 230V UPS power supply for various electrical equipment such as SCADA, PCUs, emergency lighting etc. is provided and are located in PESS and PCSS rooms. The power supply to UPS is fed from auxiliary ACDB distribution panels.
 - vii. The plant has several other infrastructural support systems such as bore wells (for water supply), underground water pipeline network system for cleaning of SPV modules, lighting system for illumination of plant, fire alarm system for the inverter / PESS rooms, Inergent gas fire protection system for SCADA, IP based telephone system, fire extinguishers, tools and instruments for operations and maintenance etc.

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Chapter-II Scope of Works

2.0 SCOPE OF WORK

Vendor scope includes:

2.1 Operations and maintenance of the complete plant for a period of (07) seven months for 40MW site Block.

2.2 Coordination / liaison activities (related to clearance / approval) with concerned state / central authorities such as CEIG/CEA etc. including renewal of CEIG license during O&M period.

2.3. Furnishing all labour, materials, supervision, equipment, supplies, transport, to and from the site, fuel, electricity, compressed air, water, transit and storage insurance and all other incidental items and temporary works not shown on specified but reasonably implied or necessary for the proper operation & maintenance and handling over the works, except in accordance with the stipulations laid down in the contract documents and additional stipulations as may be provided by the engineer during the course of works.

2.4 The scope of work will also include such other related works although they may not be specifically mentioned in the above paragraph and all such incidental items not specified but reasonably imply and necessary for completion of the job as a whole all as desired and as directed by the engineer.

2.5 Site office for vendor use:

Vendor shall necessarily establish Site Office for their own purpose.

2.6 Electrical power / water for construction, drinking water

Vendor shall organize, on their own, necessary electrical power supply such as DG sets, Service water, drinking water etc. required for Site office/staff/employees of vendor.

2.7 Furnishing samples of all materials required by the engineers for testing/inspection and approval for use in the works. The samples may be retained by the engineer for final incorporation in the works.

2.8 Furnishing test reports for the products used or intended to be used, if called for the specifications or if so desired by the engineer.

2.9 Giving all notices, paying all fees, taxes etc., in accordance with the general conditions of contract, that are required for all works including temporary works.

2.10 Arranging manufacturer's supervision for items of work done as per manufacturer's specifications when so specified.

2.11 Providing all incidental items not shown or specified but reasonably implied or necessary for the successful completion of the work in accordance with contract.

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Chapter-II Scope of Works

WORK BY OTHERS

No work under the specification will be provided by any agency other than the contractor unless specifically mentioned elsewhere in the contract.

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT TECHNICAL SPECIFICATIONS PROVIDED IN THE SUBSEQUENT CHAPTERS IN THE TCC

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Chapter – III: Facilities in the scope of Contractor

S. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	ESTABLISHMENT			
3.1.1	FOR CONSTRUCTION PURPOSE:			
a	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with customer(NLC)
b	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with customer(NLC)
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipments, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Firefighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	FOR LIVING PURPOSES OF THE BIDDER			
a	Open space for labour colony (as per availability)	Yes		Can be provided as per availability
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.0	ELECTRICITY			
3.2.1	Electricity For construction purposes		Yes	Electricity @ free of charge for construction purpose will be provided by BHEL at one point, further distribution is in the scope of vendor
3.2.2	Electricity for the office, stores, canteen etc. of the bidder		Yes	
3.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc		Yes	
3.3.0	WATER SUPPLY			
3.3.1	For construction purposes		Yes	
3.3.2	<u>Water supply for bidder's office, stores, canteen etc</u>		Yes	Water @ free of charge for

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Chapter – III: Facilities in the scope of Contractor

S. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.3.3	<u>Water supply for Living Purpose</u>		Yes	construction purpose will be provided by BHEL at one point, further distribution is in the scope of vendor
3.4.0	LIGHTING			
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5.0	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER			
a	Téléphone, fax, internet, intranet, e-mail etc.		Yes	
3.6.0	COMPRESSED AIR wherever required for the work		Yes	
3.7.0	Demobilization of all the above facilities		Yes	
3.8.0	TRANSPORTATION			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

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Chapter – III: Facilities in the scope of Contractor

F. LIST OF TOOLS AND PLANT:

The following tools and equipment but not limited to, are required for the efficient execution of the civil works. The contractor shall make them available for construction purposes, including all consumables likely to be used at his own cost at the time of mobilization.

S.No.	Description	Minimum Quantity	Remarks
1.	Hydra	1	Need based
2.	JCB	1	Need based
3.	Tractor	1	Need based
4.	Cable unwinding Machines, rollers etc	1 No	
5.	MC4 connector tool kit containing (1) crimping plier MC4, (2) open end spanner set MC4, (3) stripping plier MC4, (4) socket wrench insert to tighten, (5) socket wrench insert to secure, inserts for both 4 sq-mm and 6-sqmm (of both pliers).	2 Set	
6.	Electrical measuring instruments		
	a) Megger- 1 Kv	1 No	
	b) HV tester- 10 Kv	1 No	
	c) Logic probe	1 No	
	d) Modbus communication check kits	1 No	
	e) Digital multi meter	3 No	
7.	Tong testers	3 No	
8.	Digital power meters	1 No	
9.	Phase sequence meter	1 No	
10.	OFC termination kit, Splicing kits	1 Set	
11.	Primary / Secondary injection kit	1 No each	Need based
12.	Transformer oil filtration unit	1 No	Need based
13.	Earth resistance measuring kit	1 No	
14.	Lugs, glands	1 set	Need based
15.	Transmission line stringing equipment	1 No	
16.	DG sets	1 No	
17.	Cable jointing kit and associated tools	2 Set	
18.	Welding equipment	1 No	
19.	Flood lights	5 No	
20.	Set of screw drivers	1 set	

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Chapter – III: Facilities in the scope of Contractor

21.	Set of Allen keys (mm & inch)	1 set	
22.	Small size hacksaw & fraksaw	1 set	
23.	Cutting pliers	2 no	
24.	Nose pliers	2 no	
25.	Insulation stripers	2 no	
26.	Dry cable jointer	1 no	
27.	Number punches	1 no	
28.	Alphabet punch	1 no	
29.	Embossing machine with cassettes (Numbers and alphabets)	1 no	
30.	Portable drilling machine up to 1-1/2"	1 set	
31.	Soldering gun	1 no	
32.	Soldering Iron	1 no	
33.	Continuity tester	5 no	
34.	Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18	2 nos each	
35.	Crimping tool with Dye range 50-400sqmm cable, mechanical gear power, hand operated	1 set	
36.	Crimping tool up to 6 sq-mm cable	1 set	
37.	Drilling machine AC, hand operated, with bit size up to 20 mm	1 set	
38.	Measuring Tape, 5m	2 no	
39.	Measuring Tape, 50 m	2 no	
40.	Adjustable spanner 2-inch size	1 no	
41.	Hammer	2 no	
42.	Rough file kit	1 set	
43.	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 no	
44.	Blowers for cleaning the panels	2 no	

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Chapter – V: T&Ps to be deployed by BHEL on sharing basis

BHEL will not provide any tool, plants or any testing facility/apparatus for the work. It will be contractor's responsibility to arrange all required tools, plants and other testing apparatus, etc. at their own cost. The prices quoted & finalized are inclusive of the charges towards providing such T&P. No extra payment will be entertained on account of this.

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Chapter-VI: Time Schedule

6.1 TIME SCHEDULE

6.1.1

The work of O&M for 40MW site Solar power plant is for a period of 07 months.

6.1.2

During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

6.1.3

The work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

6.2 COMMENCEMENT OF CONTRACT PERIOD

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer will be final.

6.3 MOBILISATION

6.3.1

The contractor should mobilize man power in order to complete the work of O&M of 40MW site Solar power plant for a period of 07 months

6.3.2

Requisite Material, men and machinery should be arranged in order to complete the O&M work within stipulated time period.

6.3.3

The contractor has to augment his resources in such a manner that approved major milestones of the project are achieved on specified schedules.

In order to meet the schedule in general, and any other intermediate targets set, to meet customer/project schedule requirements, contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL.

6.4 CONTRACT PERIOD

For the purpose of contract, the period shall be taken as 7 (Seven) Months for 40MW site Solar power plant.

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Chapter-VI: Time Schedule

6.5 PROTECTION OF WORK

The contractor shall have total responsibility for protecting his works till it is taken over by the Employer. No claim will be entertained by the Employer or the representative of the Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's Works occur because of other party not being under his supervision or control, the Contractor shall make his claim directly with the party concerned.

If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's Works the same shall be rectified. The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.

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Chapter-VII: Payment Terms

7.1

The progressive payment for the work on accepted price of contract value will be released on the basis of running account bills & other bills as per the provisions of relevant clauses of GCC and SCC.

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Chapter-VIII: Taxes, Duties & Levies

8.0 TAXES AND DUTIES

The quoted rates shall be exclusive of GST but inclusive of all other taxes, including any cess or surcharge or levy/tax by whatever name called, imposed under GST law or any other law at any time, for which input credit is not available to BHEL under any interpretation of the law.

GST at the applicable rates shall be payable extra. SAC code is 995424. However, the same shall not be paid if the input credit thereof is not available to BHEL due any reason attributable to the supplier/bidder.

TDS under GST as and when applicable, shall be deducted at prevailing rates.

GST as applicable on the LD/Penalty shall also be recoverable in addition to LD/Penalty applicable on delayed supplies.

Bidders have to comply with all requirements of the GST law as may be prescribed by the Government from time to time (including provisions related to E-way bills as and when prescribed). In the event of any non-compliance to any of the requirements of the GST law by the supplier/bidder, any consequential financial implication to BHEL, including interest on delayed discharge of BHEL's GST liability, denial of input credit of GST, etc., shall be recoverable from the supplier/bidder.

8.1 SUPPLY:

Bidders have to issue GST compliant invoices showing:

BHEL PE&SD R C Puram Hyderabad GSTIN No.36AAACB4146P1ZG under "Details of Receiver (Billed To)

BHEL's Customers details (mentioned in SCC/Dispatch Instructions) under "Details of Consignee (Shipped To)

State of Telangana as the "Place of Supply" irrespective of where the goods are shipped to, since these transactions fall under Section 10(1)(b) of the IGST Act in case of suppliers from outside Telangana.

Details of dispatch comprising of copies of GST Invoice, LR/Delivery challan, Packing list etc. have to be submitted to BHEL through email to the concerned purchase officer, prior to dispatch. BHEL shall issue GST invoice (on BHEL's customer) and forward the transporter's copy to the vendor for the movement of the goods. Thereafter, the vendor shall ensure immediate movement of goods under the same documentary details submitted to BHEL. In the event of any delay in movement of goods/submission of these documents to BHEL and/or any documentary discrepancies, any consequential financial implication to BHEL, including interest loss on discharge of BHEL's GST liability, denial of input credit of GST, etc., shall be recoverable from the supplier/bidder.

8.2 SERVICES (E&C, Supervision of E&C, Civil Works etc.):

Bidders have to issue GST compliant invoices showing: BHEL, State of _____ (State in which the project site is located) GSTIN of BHEL in such State (to be obtained by the bidders before raising any invoice) under "Details of Receiver (Billed To)

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Chapter-VIII: Taxes, Duties & Levies

BHEL's Customers details (mentioned in SCC/Dispatch Instructions) under "Details of Consignee (Shipped To) State in which the project is located, as the "Place of Supply".

The invoices shall be raised within the time limit prescribed under the GST law. In the event of any delay in submission of the invoice to BHEL, any consequential financial implication to BHEL, including interest loss on discharge of BHEL's GST liability, denial of input credit of GST, etc., shall be recoverable from the supplier/bidder.

8.3 PAYMENT OF GST:

The GST amount on gross value of each invoice shall be claimed by the bidders along with the first stage payment by submission of GST invoice as mentioned above. However, the amount of GST shall be paid only upon confirmation of the following:

The bidder declaring the invoice in his GSTR-1 and

Confirmation of payment of GST thereon by bidder on GSTN Portal.

However, BHEL, at its discretion, may release the GST amount based on undertaking by the bidders in the prescribed format(Ann. I), Pending the above confirmation, and in such cases, if any discrepancy is found on subsequent verification as per data available from GSTIN Portal, the entire financial implication thereof on BHEL shall be recovered from the bidder

8.4 PENALTY:

In addition to the Penalty determined as per clause in GCC, GST on penalty is also recoverable.

8.5 BUILDING & OTHER CONSTRUCTION WORKERS (REGULATION OF EMPLOYMENT AND CONDITIONS OF SERVICE) ACT, 1996 (BOCW Act) AND RULES OF 1998 READ WITH BUILDING & OTHER CONSTRUCTION WORKERS CESS Act, 1996 & CESS RULES, 1998.

In case any portion of work involves execution through building or construction workers, then compliance to the above titled Acts shall be ensured by the contractor and contractor shall obtain license and deposit the cess under the Act. In the circumstances it may be ensured as under:-

- i. It shall be the sole responsibility of the contractor in the capacity of employer to forthwith (within a period of 15 days from the award of work) apply for a license to the Competent Authority under the BOCW Act and obtain proper certificate thereof by specifying the scope of its work. It shall also be responsibility of the contractor to furnish a copy of such certificate of license / permission to BHEL within a period of one month from the date of award of contract.
- ii. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under these act and rules including that of payment / deposit of 1% cess on the extant of work involving building or construction workers engaged by the contractor within a period of one month from the receipt of payment.
- iii. It shall be the responsibility of the sub-contractor to furnish the receipts / challans towards deposit of the cess together with the number, name and other details of beneficiaries (building workers) engaged by the sub-contractor during the preceding month.

It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act, 1923. (building/Inter-state Migrant workmen) engaged by the sub-contractor during the preceding month.

It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act, 1923.

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Chapter-I General

1.1

The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship for construction, engineering and construction management. The Bidder should ensure timely completion of work. The Bidder must have adequate quantity of tools, construction aids, equipment's etc., in his possession. He must also have on his rolls adequate, trained, qualified and experienced supervisory staff and skilled personnel.

1.2

The work shall be executed under the usual conditions affecting industrial construction and in conjunction with numerous other operations at site. The Bidder and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.3

All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the Bidder.

1.4

The Bidder shall at his cost perform any services, tests etc, although not specified but nevertheless required for the completion of work.

1.5

Contractor shall execute the work as per sequence prescribed by BHEL at site. The sequence of activities, methodology will be decided by the BHEL engineers depending upon the availability of material, drawings, work fronts etc. No claims for extra payment from the Contractor will be entertained on the grounds of deviation from the methods and sequence of construction advised and agreed by BHEL engineer or for any reasons whatsoever.

1.6

All the necessary certificates and licenses required to carry out this work are to be arranged by the Contractor expeditiously at his cost.

1.7

The work to be carried out under the scope of these specifications covers ,temporary storing of contractor's own construction material, using the same in the work, carrying out all other activities, as defined in the scope of work enumerated in chapter-2, Part-I of TCC document, Bill of Quantities and elsewhere till handing over of the entire work. The work shall conform to dimensions and tolerances specified in the various drawings, documents etc. That will be provided during the course of construction. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the Contractor shall dismantle and re-do the work duly replacing the defective materials at his cost failing which the work will be got done by BHEL at the cost and risk of the contractor.

1.8

The terminal points as decided by BHEL shall be final and binding on the Contractor.

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Chapter-I General

1.9

During the course of execution of this work, certain rework/ modification/ rectification/ repairs/ fabrication/dismantling/reconcreting etc. will be necessary on account of feedback from customer/BHEL on account of design discrepancies and manufacturing defects and site operation/maintenance requirements. Contractor shall carryout such rework/ modification/rectification/fabrication/repairs etc., promptly and expeditiously. Claims of contractor, if any, for such works will be dealt as per relevant clauses of General Conditions of Contract.

1.10

Daily log sheets indicating the details of work carried out, man-hours, consumables used etc, shall be maintained by the Contractor and got signed by BHEL engineer every day.

1.11

All tools and tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables etc. required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause.

1.12

The contractor shall make adequate security arrangements including employment of security personnel and ensure protection from theft, fire, pilferage, damage and loss of materials/equipments issued to him for the work. Special care will have to be taken to guard against pilferage / theft of cement, steel and/or other materials.

1.13

Contractor shall ensure proper housekeeping and remove all scrap materials periodically from various work area covered in the scope and deposit the same at the place earmarked for this purpose. In case of contractor's failure to do the same, BHEL reserves the right to remove scrap at contractor's cost and risk.

1.14

Access to site for inspection by BHEL and customer engineers shall be made available by the contractor at all times.

1.15

Site Inspection : The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

1.16

BHEL will not supply any materials unless otherwise specified.

1.17

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Chapter-I General

Makes of supply of cement, steel and painting materials shall be as per approved material list by NLC/BHEL.

1.18

The Contractor shall carry the work as per the Field Quality Plan issued by BHEL/NLC.

1.19

Lab has to be established at site for carrying out testing as per Field Quality Plan, like Cube testing machine, cube mounds etc.

1.20

Weigh batcher with printing facility should be available as per the deployment of parallel gangs.

1.21

Calibration of equipment's should be done by NABL/NPL accredited laboratories.

1.22

Welding procedure to be followed as per Field Quality plan. (Welding procedure and prequalification of welder required to be produced)(If required).

1.23

Indicative Field Quality Plan attached with the NIT.

1.24

Contractor should submit the royalty certificates for quantity of Coarse and fine aggregates used at site.

1.25

Field Quality Assurance Formats: It is the responsibility of the contractor to collect and fill up the relevant concrete pour card/FQA Log sheets and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL / Customer in token of their acceptance. Monthly Running Bill Payment to the contractor will be linked with the submission of these Log sheets.

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Chapter-II GENERAL TECHNICAL SPECIFICATION

2.0 SCOPE

Vendor scope includes:

Operations and maintenance of the complete 40MW site SPV plant for a period of 07 months

Coordination / liaison activities (related to clearance / approval) with concerned state / central authorities such as CEIG/CEA etc, including renewal of CEIG license every year as applicable.

2.1 DETAILED SPECIFICATION

Operation and maintenance of complete 40MW site SPV plant for a period of 07 months.

2.3 OPERATIONS AND MAINTENANCE:

2.3.1 DATE OF COMMENCEMENT OF OPERATIONS AND MAINTENANCE

Zero date for O&M shall be the actual date on which the successful trial run on the power plant is completed after commissioning of the 65MWp solar photovoltaic power plant with synchronization / export of power to the grid. (Note: Trial run is considered as an event with trouble-free operation for a cumulative period of 24 generation hours). Already completed.

2.3.2 O&M PERSONNEL:

1) Vendor shall deploy following minimum personnel:

- Technical / administrative / office personnel
 - One technical-cum-administrative in-charge having graduation in electrical / electronics engineering and experience with overall responsibility for complete plant operations. The in-charge shall have competence to deftly handle technical and operational / crisis problems.
 - Six working level staff with ITI / diploma level qualifications in engineering with competence for operating electrical / electronics / mechanical equipment, taking measurements, data logging / maintaining registers, preparation of reports in computer.
 - Six unskilled persons for regular house-keeping (cleaning / mopping etc) and water cleaning of SPV modules.
 - **Note:** At least one among the technical personnel shall essentially be a certified /licensed person for HT operations (33kV minimum). This is a mandatory requirement.
- The maintenance personnel shall be in a position to check and test all the equipment regularly, so that, preventive maintenance, could be taken well in advance to save

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any equipment from damage. Abnormal behavior of any equipment shall be brought to the notice of NLC not later than 2 hours for taking appropriate action.

2 Security personnel

Security of Solar Power Plant and PESS will rest solely on vendor till the O&M period (i.e 5 years from the date of successful trial run) of the power plant. Deployment of security guards during O&M period shall be in scope of vendor.

- 3 All repairing & replacement works are to be completed by the Contractor within reasonable time from the time of occurrence of fault or defect. If it is not possible to set right the equipment within reasonable time, the Contractor shall notify NLC indicating nature of fault & cause of damage etc. within 12 hours from the time of occurrence of the fault.
- 4 During operation and maintenance, if there is any loss or damage to any component of the power plant due to miss-management/ miss-handling or due to any other reasons, what so ever, the Contractor shall be responsible for immediate replacement / rectification of the same. The damaged component may be repaired, if it is understood after examination that after repairing performance of the components shall not be degraded, otherwise the defective components shall have to be replaced by new one without any extra cost to NLC.

The scope of maintenance work shall include the following:

1. Regular operation and maintenance of the Solar PV Power Plant and including water supply system and submission of daily performance data of the power plant. The Contractor shall maintain log book in this respect to clearly record the date of checking & comments for action taken etc.
2. The scope of operation and maintenance includes equipment up to Solar Power Plant. Proper records of operation of Power Plant System are to be kept as per direction of NLC.
3. Cleaning of the Power Plant including array yard on regular basis.
4. Normal and preventive maintenance of the Power Plant such as cleaning of module surface, tightening of all electrical connections, Line accessories, Transformers and associated Switchgear.
5. Keeping & recording daily log sheet as per approved format for the Power Plant to be Supplied after commissioning of the Power Plant.
6. Under no circumstances, the operator shall run the power plant damaging the substation or Grid.

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7. The Contractor shall submit monthly Performance report of Solar PV Power Plant indicating cumulative energy export data as per approved format within three days of the following month. The reporting shall also include any mismatch or abnormality in the performance of the power plant based on SCADA details review. Day to day coordination with TANGEDCO /RRVPL authorities (as the case may be) and sending details required by them are also under the scope of the O & M contract
8. The Contractor shall preserve all recorded data in either manual or through computer format and shall submit to NLC every month.
9. The Contractor shall develop & maintain the garden, which will be developed by the Contractor himself as per landscaping including daily watering and manuring as and when necessary and on regular basis.
10. During operation and maintenance period, the Contractor shall refill the fire extinguishers as per manufacturer's recommendation before expiry.
11. Vendor shall provide uniforms for the O&M staff.
12. Similarly, O&M personnel shall be provided with raincoats, toolsets, earthing rods, safety gloves, safety goggles, gumboots, helmets and all other personal protective equipment (PPE) that will be relevant to ensure human safety
13. Maintenance personnel shall be in position to check and test all the equipment regularly, so that, preventive maintenance could be taken well in advance to save any equipment from damage. Abnormal behaviour of any equipment shall be brought to the notice of BHEL/ NLC not later than 2 hours for taking appropriate action.
14. Names, qualification, work responsibility of personnel shall be listed on a display board within control room.
15. Attendance register shall be maintained for both the teams.
16. Vendor shall ensure statutory requirements such as ESI, PF and labour license for their O&M personnel posted at site.
17. BHEL / NLC shall have right to disallow any O&M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on vendor who shall replace the person.
18. O&M personnel at site shall conform to general regulations in force at site and to any special instructions from local NLC administration.
19. O&M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of NLC land & works from time to time and BHEL / NLC shall not be responsible for any injury to personnel arising there from.

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20. Training to O&M personnel

It is the absolute responsibility of vendor to ensure imparting of necessary training to their O&M personnel to get them acquainted with the operations of various electrical and mechanical equipment of the power plant. For this purpose, vendor shall identify the O&M personnel well in advance and involve them during installation and commissioning stages so that they become well versed with various functional aspects of the power plant.

21. Availability of O&M personnel at power plant

- (a) Vendor shall ensure that operating staff are present in the power plant during 7:30 AM – 6:30 PM every day.
- (b) Vendor shall ensure that certain minimum operating staffs are present at the power plant even on festivals, public holidays and any other unique occasions so that the plant is run under competent supervision on all days.

22. O&M personnel shall, strictly, not use any part of the power plant for their personal / residential purposes. Their presence at the plant shall, strictly, be meant only for the purpose of operation and maintenance of plant.

SCOPE OF CIVIL MAINTENANCE:

1. Cleaning of surface drain, sewerage line, drainage outfall, down pipes, soil pipes, water pipe lines.
2. Repairing or replacement, whatever necessary, and cleaning of all joineries in the Pre Engineered Building of PCSS as and when necessary.
3. Repairing or replacement, whatever necessary, of doors, window fixtures, toilet accessories, etc in PESS and other buildings as and when necessary.
4. Cleaning & maintaining of power plant area clearing all weeds, leaves and other wood Rejects.
5. Painting of iron parts of array structures posts once in a year.
6. Painting of PCSS, PESS, Security room, compound wall, fencing, gates, etc once in two years.
7. All minor repair maintenance in case of buildings and all other structures as and when required as per the instructions of Project Manager.

Tools & Tackles , Measuring Instruments :

Tools and Tackles are not supply items. Tools and Tackles which are required for O & M are to be supplied by the Contractor for use during the O & M period and the same can be taken back by the Contractor after completion of O & M period. The contractor shall maintain all regular operation and maintenance tools apart from the tools and tackles listed below.

Sl.No.	Item Description	Unit	Quantity
1.	Insulation tester 500V (Megger)	No.	1

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2.	Insulation tester 5000V (Megger)	No.	1
3.	Earth tester	No.	1
4.	Digital Tong tester	No.	1
5.	Digital Multi-meter with Graphic display	No.	1
6.	Tool box with D / Ring spanner sets, socket wrench with sockets, insulated cutting & nose pliers, insulated screw drivers, pipe wrenches, Allen key wrench set, MS files, hammer, crowbar, steel tape, etc.	No.	1
7.	Crimping tool (2.5 to 240sq mm)	Set	1
8.	Insulation stripper	Set	1
9.	Analog multi meter	No.	1
10.	Analog tong tester (AC/DC)	No.	1
11.	Relay Tools Kit	Set	1
12.	Electronic Relay Testing Kit	No.	1
13.	Torque Wrench	Nos.	2
14.	Breaker lifting / handling truck of each type	No.	1
15.	Fuse pullers of each type	No.	5
16.	PV Array Tester	No.	2
17.	IR Hand-held Temperature Scanner	No.	1
18.	Temperature Indicator	No.	1
19.	Solar Module Cleaning Kit	No.	4
20.	Rheostat	No.	1
21.	C.R.O	No.	1
22.	Function Generator	No.	1
23.	Inverter Testing Kit	No.	1

The contractor shall maintain all regular operation and maintenance tools apart from the tools and tackles listed above. Such special tools and tackles used by the contractor during operation and maintenance period shall be handed over to NLC at free of cost, to ensure smooth takeover of the plant by NLC from the contractor at the end of five years O& M period.

Bidder shall provide all details of onsite testing instruments / equipment. Details of equipment / instrument, make, numbers, range, accuracy, etc. shall be furnished to NLC.

Responsibility of vendor during PG test

Vendor shall, in addition to the O&M activities (as per this specification), carry out the Performance Guarantee test (PG test) that commences on a date (as mutually decided by BHEL/NLC) after successful completion of trial run. PG test is the final acceptance test to prove the performance of the power plant in respect of energy generation as contractually guaranteed by BHEL to NLC.

Vendor shall carry out the following activities during this period:

1. O&M activities as per this specification

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2. Monitoring of power plant parameters as per SCADA reports
3. Reporting power plant parameters to BHEL/NLC on daily basis

O&M operations – daily basis

- (1) Water cleaning of SPV modules
- (2) Inverter room / PESS room cleaning – dry sweeping, wet mopping
- (3) Water wash cleaning of toilets, urinals
- (4) Gardening of landscaping areas: watering of plants, trimming of plants as applicable and necessary.
- (5) Logging of DC, AC, grid parameters (current, voltage, power, energy) at PCUs & VCB panels, transformer temperatures, equipment tripping/ breakdown, grid outage etc as per BHEL formats.
- (6) SCADA data station / PC operations for daily monitoring of weather parameters, trend graphs and urgent reporting to BHEL/NLC in case of any problems / anomalies observed with any of the parameters.
- (7) Drinking water to be arranged for O&M personnel at site.

O&M activities – weekly basis

- (1) Removal of garbage from solar array field, switchyard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge.
- (2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats

O&M activities – monthly basis

- (1) Inspection of fire extinguishers (weight, pressure indication, physical status etc.) followed by refilling actions, if necessary, based on indications. Report to be submitted as per BHEL approved recording formats.
- (2) Earthing resistance measurements for solar array structures, control room equipment, switchyard equipment, and lightning arrestors: measured values shall be recorded in registers and reported to BHEL as per BHEL approved recording formats.
- (3) Submission of values / status of plant parameters and events for the corresponding month, as below, as per BHEL approved formats:
 - a. Daily values of solar array strings (SMB parameters)
 - b. Daily values of weather parameters (solar energy, wind speed, ambient temperature)
 - c. Daily energy generation
 - d. Events (with date, time) of faults / tripping / breakdown of equipment
 - e. Events (with date, time) of grid outage
 - f. Events (with date, time) of equipment damages, accidents and thefts
 - g. Activities of module cleaning
- (4) Monthly reports shall be submitted to BHEL for all the above data.
- (5) The month wise net energy export calculation for first five years shall be furnished by the by the vendor in the following format.

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Guaranteed Month-wise Energy Export of the project at 33 KV outgoing feeders in metering stations of NLC take off point as per below

Sl.No.	Month	Average Global Radiation on horizontal surface Considered (kWh /M ₂ / Day) Month wise.	1 st Year (kWh)	2 nd Year (kWh)	3 rd Year (kWh)	4 th Year (kWh)	5 th Year (kWh)
1.	January						
2.	February						
3.	March						
4.	April						
5.	May						
6.	June						
7.	July						
8.	August						
9.	September						
10.	October						
11.	November						
12.	December						
	Annual						

Note:

1. The basis and reference standards used for arriving at these data shall be furnished.
2. PV System Design Report with simulation parameters / variants, shading diagrams, production charts, loss diagrams, etc. shall be furnished correlating with the above month wise energy export data.
3. For each 33KV outgoing feeder, the above calculation shall be done separately and then by adding all the 33 KV outgoing feeder values of the project, the net energy Export value for the project shall be calculated.

6.9

O&M activities - quarterly basis

- (1) Cleaning of PCUs, LT panels, VCB panels, UPS panels etc to remove accumulated dust.
- (2) Monitoring and status review, followed by rectification / calibration / replenishment / replacement actions as necessary and applicable for following:
 - (a) Spare items of all electrical equipment
 - (b) First aid box items - medicines and accessories
 - (c) Safety gadgets
 - (d) Tool kits and measuring instruments
 - (e) Yard lights

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	(f) Pumps, starters (g) Control room appliances: air conditioners, lights, fans, exhaust fans, switch boards etc (3) Pest control for control room (rats, snakes etc) – sprays, chemicals, medicines etc to be applied wherever required. (4) Submission of quarterly report on above activities to BHEL.
6.10	O&M activities – half yearly basis (1) Cleaning of water storage tanks.
6.11	O&M activities – yearly basis (1) BDV measurements for oil samples from all the transformers and submission of report to BHEL / NLC. (2) Filtration of oil to be arranged, if required, based on BDV measurement report. (3) Lubrication of moving contacts (VCBs etc) with appropriate grease etc (4) Cleaning of sewerage lines, septic tanks (if found necessary) (5) Painting of main gate, switchyard gate / fencing, earthing chambers, other steel structures within control room and switchyard if required based on conditions of rusting etc. (6) Checking tightness of hardware in solar array structures and tightening wherever required. (7) Checking tightness of power cable terminations in SPV modules (MC4), SMBs, electrical panels of control room and switchyard.
6.12	O&M activities - as and when required (contextual basis) (1) Monitoring and operation of plant electrical equipment as and when required: (a) VCB on/off: local operations from outdoor VCB panel and remote operations from SCADA system. (b) Settings of numerical relays in VCB panels: review and revision in consultation with BHEL. (c) ACB and MCCB on/off operations on LT side (d) PCU operations: emergency close, LCD displays (selection of settings, monitoring the DC/AC/event/fault status parameters), operation of duct fans (e) UPS panels and Battery bank operations (f) Bore well pump operations to fill the water storage tanks (2) Seasonal tilting of SPV modules from one angle to the other (5, 15 and 30 degrees) based on seasonal tilting chart that will be finalized by BHEL/NLC during detailed engineering phase. This is a critical activity as energy generation is strongly affected by the angle. Vendor shall deploy the necessary tools/tackles, machinery, number of skilled/unskilled labour etc for this purpose. (3) Coordinating, on behalf of BHEL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as electricity boards, CEA/CEIG etc. (4) Repair and replacement of vendor supplied items, by vendor, with urgent action plans and implementation, when the items are found non-working / damaged. The same shall be reported to BHEL within 12 hours from time of observation. (5) Reporting, on an immediate basis (within max 2 hours) of functional problems / damages in BHEL supplied items to facilitate repair / replacement by BHEL. Further, vendor shall correspond / coordinate with respective equipment vendors / service centers, on behalf of

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	BHEL, for getting the service engineers to the site. Later, coordinating with the service engineers during their visit to site, and assisting them in the trouble shooting process until the problem is resolved. Vendor shall report to BHEL (within max 2 hours) immediately after the problem is resolved. (6) Vendor shall keep updating the spares inventory at the site every time there is consumption of spare items towards replacement. In case of shortage of spares, the same shall be reported on an urgent basis (with max 2 hours) to BHEL. (7) Coordinating with sub-station upon grid failures, line problems etc and implementing the needful steps to restore the plant to normal operation. (8) Theft incidents: immediate reporting to BHEL, filing FIRs with police stations on behalf of BHEL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records. (9) Accidents: immediate reporting to BHEL, coordinating with hospitals, logging of events (data, time) and maintaining records.
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