



E-Tender No.: AGL/Head Office/Contract and Purchase/15/24-25/ET/15 [SOLAR PV POWER PLANT]
SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF GRID-TIED ROOFTOP SOLAR PV POWER PLANT ALONG WITH LIAISONING & EXECUTION OF CONNECTIVITY WITH MPEB GRID



AAVANTIKA GAS LIMITED
(A JOINT VENTURE COMPANY OF GAIL & HPCL)

**CITY GAS DISTRIBUTION PROJECT IN INDORE, UJJAIN,
PITHAMPUR & GWALIOR**

SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF GRID-TIED ROOFTOP SOLAR PV POWER PLANT ALONG WITH LIAISONING & EXECUTION OF CONNECTIVITY WITH MPEB GRID AT ALL MOTHER STATION- INDORE, GWALIOR, PITHAMPUR & COCO STATIONS (RAJIV GANDHI INDORE & VIJAY NAGAR INDORE)

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TECHNICAL VOLUME II OF II
SCOPE OF WORK AND TECHNICAL SPECIFICATIONS



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SCOPE OF WORK/SUPPLY & TECHNICAL SPECIFICATIONS

A. Scope of Work:

1.0 General Information

1.1 The Scope of Work includes but not limited to Design & Engineering, Procurement & Supply of Equipment and Materials, Testing at manufacturers works, Inspection, Packing and Forwarding, Supply, Receipt, Unloading and storage at site, carrying out associated Civil works, Services, Permits, Licences & Statutory clearances, Installation and Incidentals, Insurance at all stages, Erection, Testing and Commissioning of Grid-Tied Rooftop Solar PV Power Plant and performance demonstration with associated equipment and materials along with associated Distribution system (By means of Cables using the existing route wherever possible otherwise, similar cabling arrangement should be made in the missing portion of the cableroute) upto Electrical Power Panel of the Aavantika Gas Limited and including Execution of connectivity with MPEB Grid, Liaisoning, Installation of net metering with associated parts.

1.1 Site Description

Particulars	Description
Mother Station, Indore	
Details of proposed/expected capacity of the Solar power plant.	08 KW DC Grid Connected Rooftop SPV Power Plant.
	Location – Office Building
Power system	415 Vph-ph - TPN system (Neutral solidly grounded)
Village	Sanwer
District	Indore
State	Madhya Pradesh
Location (Project Site)	AGL Mother station, 247/1 & 248/1, Sector-E, Industrial Area, Sanwer Road, Indore, M.P
Evacuation system	Through HT cable 11 KV Consumer Code: H1865904000
Latitude	22.782744
Longitude	75.843238
Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power.
	Power shall be provided by the Employer at single point.
Rooftop	Flat but with waterproof system. No damage to rooftop waterproof system will be allowed.



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Rajiv Gandhi Square(COCO)	
Details of proposed/expected capacity of the Solar power plant.	04 KW DC Grid Connected Rooftop SPV Power Plant.
	Location – Office Building
Power system	415 Vph-ph - TPN system (Neutral solidly grounded)
City	AICTSL DEPOT,RING ROAD
District	Indore
State	Madhya Pradesh
Location (Project Site)	M/S Aavantika Gas Limited Khasra No.266 Part, Rajeev Gandhi Square,Aictsl Depot, Ring Road , 452001 Indore
Evacuation system	Through HT cable 11 KV Consumer Code: H3421001117
Latitude	22.682205
Longitude	75.857258
Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power.
	Power shall be provided by the Employer at single point.
Rooftop	Flat but with waterproof system. No damage to rooftop waterproof system will be allowed.
Vijaynagar WOW hotel(COCO)	
Details of proposed/expected capacity of the Solar power plant.	08 KW DC Grid Connected Rooftop SPV Power Plant.
	Location – Office Building
Power system	415 Vph-ph - TPN system (Neutral solidly grounded)
City	Vijay nagar
District	Indore
State	Madhya Pradesh
Location (Project Site)	M/S Aavantika Gas Limited Khasra No. 224/225 Part, On Sayaji Square To Rasoma Road, Vijay Nagar, Indore 452001
Evacuation system	Through HT cable 11 KV Consumer Code: H3421001123
Latitude	22.749608
Longitude	75.89283



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Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power. Power shall be provided by the Employer at single point.
Rooftop	Flat but with waterproof system. No damage to rooftop waterproof system will be allowed.
Mother Station, Pithampur	
Details of proposed/expected capacity of the Solar power plant.	05 KW DC Grid Connected Rooftop SPV Power Plant. Location – Office Building
Power system	415 Vph-ph - TPN system (Neutral solidly grounded)
City	Pithampur Industrial Area Sec-03
District	Indore
State	Madhya Pradesh
Location (Project Site)	M/S AAVANTIKA GAS LIMITED 513/A-B, Sector 3, Near Girnar Fibre, Pithampur, Madhya pradesh.
Evacuation system	Through LT cable 11 KV Consumer Code: N3812005497
Latitude	22.624188
Longitude	75.59239
Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power. Power shall be provided by the Employer at single point.
Rooftop	Flat but with waterproof system. No damage to rooftop waterproof system will be allowed.
Mother Station, Gwalior	
Details of proposed/expected capacity of the Solar power plant.	28 KW DC Grid Connected Rooftop SPV Power Plant. Location – Office Building
Power system	415 Vph-ph - TPN system (Neutral solidly grounded)
Village	Morena
District	Gwalior
State	Madhya Pradesh



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Location (Project Site)	Aavantika Gas Limited CNG Mother Station, Sharma Farm Road, Near ABV-IITM College, Morena Link Road, Gwalior (M.P.) – 474015.
Evacuation system	Through LT cable 11 KV Consumer Code: N2210007867
Latitude	26.254755
Longitude	78.168556
Water and Power for Construction	Employer will provide the construction water and power free of cost as per the requirement of the Bidder during construction/ execution period. However, the Bidder is advised to avoid Wastage of Water and power.
	Power shall be provided by the Employer at single point.
Rooftop	Flat but with waterproof system. No damage to rooftop waterproof system will be allowed.



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2.0 Design of Complete Plant and Sub-Systems:

2.1 The scope of the bidder includes complete System Design and Engineering, Finalization of Drawings/ Documents, Submission of Engineering Drawing / Documents and Processing of their approvals by AGL. Initially contractor shall submit design basis report along with preliminary design showing General System Layout within 15 days from LOA for in principle approval of Engineer In-Charge (EIC). The detailed design shall be submitted by contractor within 15 Days from the date of LOA.

2.2 The scope shall include submission in proper shape & format, all the Drawings including Engineering drawings, Sizing calculation, Data sheet, Test procedures, Equipment layout, Drawings/Data sheets of all the equipment/materials under Scope of Supply, Civil structural/architectural drawings prepared by structural engineer, Load bearing capacity details, detailed design drawings of Earthing system, Lightning system, Inverter etc., Manuals including O&M Manuals, Control System Manuals with details of Error/ fault code, Handbooks of equipment like Inverter, MPPT Charge Controller, PV module etc. and any other required design documents covered under Technical Specifications in requisite numbers at different phases of the project as per the requirement of AGL.

2.3 Contractor shall design their SPV panel structure according to wind load (180 km/hour) and concrete flat roof. Contractor shall also explore the design so that PV Module will have the self-cooling effect to improve the performance. Load bearing strength of Roof top of sales building & canopy and its suitability for installing Solar PV plant, Design of SPV structure and Distribution of load on roof shall be inspected by structural engineer and structural design need to be vetted by structure engineer/consultant. Any changes in structural design suggested by EIC shall be binding on the contractor.

2.4 Bidder shall obtain approval from relevant statutory authorities in respect of design, single line diagram, plan, clearance etc. as mandatorily required by respective authorities in respect of such works.

2.5 Installation (including Civil works):

The scope of the contractor shall be, including but not limited to the following:

- i) Installation of suitable nos. of Solar Photo Voltaic (SPV) modules with power rating of 250 Wp and above.
- ii) Installation of Module mounting structure (MMS) for mounting of Solar PV module at roof top of building and canopy.
- iii) Installation of Junction Boxes.
- iv) Installation of Power Conditioning Unit (PCU).
- v) Installation of String Level Monitoring (SMUs) system if any.
- vi) Installation of LT switchgears as per system requirement.
- vii) Laying of cables on prefabricated GI cable trays and / or within suspended ceiling spaces including cable trays, hangers, supports, cable terminations, all fixing accessories wherever required. Existing cable trays in the area would be used mostly. However, at some places new cable trays would be required which shall also require additional cable tray supports on the existing cable tray structure by



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contractor as per standard specifications.

- viii) Laying of cables in cable trenches including providing MS cable markers, backfilling the trenches, making straight through joints using heat shrinkable sleeves for cables or as per applicable norms wherever required, connection, termination and testing of cables to distribution boards, Proper sand bedding must be provided. Existing cable trenches in the area would be used mostly where control and power cables to be laid. However, at some places new cable trenches would be required which is to be made by contractor as per standard specifications. Road crossings, if required, shall be made by trenchless methods and open cutting shall be avoided. Suitable protection i.e. Hume pipe of suitable grade.
- ix) Interconnection of Solar PV Power Plant with the LT Lighting Distribution Board, which includes installation of cables as evacuation line with associated equipment and materials so as to export power from Solar PV power plant to LT Power Panel of AGLS Switchgear room.
- x) Installation of Digital Multi-Function Meter of Import/Export type
- xi) Installation of Earthing system with testing joint for every pit (grounding) system including cutting of roads / paved areas / PCC floor etc. and making as good as in original shape.
- xii) Installation of Lightning arrester and all other protection equipment. If Required
- xiv) Installation of PV Module water washing/cleaning system with necessary pump & piping arrangement.
- xv) Provision for other things that may require for successful Operation and Maintenance of plants and equipment.
- xvi) All Civil works required for proper installation of complete SPV system shall be in the scope of contractor.
- xvii) Synchronization of Solar system with LT Power Panel of Switchgear Room and carry out the inter connection prior to the final commissioning of the Solar PV Power Plant.
- xviii) Fixing of Danger notice plates shall be provided at prominent locations.

2.6 Commissioning:

- i) After installation of all equipment, vendor shall perform commissioning checks to verify the correctness and proper operation of all equipment in all respects. In addition, the vendor shall carry out all other checks and tests recommended by the manufacturers. During the trial operation, SPV plant shall perform trouble-free operation for cumulative 24 hours during which functionality of all plant components shall be demonstrated by the vendor and the system shall be in Generating Mode.
- ii) **Approvals:** Obtaining statutory approvals/clearances on behalf of the AGL from various Government Departments not limited to the following:
- a) Pollution control board clearance, if required.



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- B) CEA, State Electricity Board and other statutory authorities for obtaining clearances for setting up of Solar PV Plant.
- c) All other statutory approvals and permissions, not mentioned specifically but are required to carry out hassle free Construction and O&M of the Rooftop SPV plant.

2.7 Warrantee: -

The Complete Solar Power System shall have warrantee of **5 Years** from date of commissioning, if any fault occurs during this period contractor shall attend within 5 days without any cost implication to AGL.

B. Scope of Supply:

The equipment and materials for Rooftop Solar PV Power Plant with associated system shall be including but not limited to the supply of the followings:

- i) Solar PV Modules
- ii) Module Mounting Structures (MMS)
- iii) Power Conditioning Units including Maximum Power Point Tracker (MPPT)
- iv) Cables including power and control cables and accessories
- v) Protection equipment like Circuit Breakers, Solar Array Fuses, Earthing and Surge Protection System and Lightning Arrester etc.
- vi) Adequate provisions shall be kept for Cable placement with appropriate cable ties for holding the cable in place during the windy condition, including selection of correct size of fuse to avoid fire risk.
- vii) All Earthing related equipment. Design of Earthing systems should avoid breaching the building envelope and damaging either the water proofing system or building electrical system.
- viii) Junction boxes / SMU.
- ix) Multi-Function Digital Meter with Modbus Protocol.
- x) Mandatory spares.
- xi) Tools and Tackles, Caution Boards.
- xii) Applicable Type Test Certificates of all the equipment which are under the scope of material supply
- xiii) Adequate numbers of stairs and arrangements of walk way on the rooftop so that technicians can visit the rooftop Solar PV plant for the purpose cleaning, routine checkups etc.
- xiv) Water supply Arrangements on the rooftop for Module cleaning etc.
- xv) All safety gadgets during Construction period including but not limited to, rubber mats of appropriate grade, PPE, rubber gloves and shoes etc.
- xvi) Any other equipment / material required to complete the Rooftop Solar Power Plant.



C. Technical Specifications:

1.0 General:

In Grid connected Rooftop system, the DC power generated from Solar PV (SPV) panel is converted to AC power using Power Conditioning Unit and is fed to the Grid through 415 V three phase system depending on the capacity of the system installed at location of AGL.

These systems generate power during the day time which is utilized fully by the connected loads. In case, where solar power is not sufficient due to cloud cover etc., the connected loads are served by drawing power from the Grid.

1.1 Islanding Protection:

In case the Grid fails, the back fed of Solar power to the Grid has to be stopped immediately so as to safe-guard any person/technician working in Grid line from getting electrocuted while working on the grid for maintenance.

1.2 System Components:

A grid-connected Solar PV system shall consist of the following main components:

- a) Solar PV (Photo-voltaic) array.
- b) Solar PV array support structure.
- c) Solar Grid inverter.
- d) Import/Export type Digital Energy Meter
- e) Protection devices
- f) Cables (Power and control)
- g) ACDB/PDB suitable for systems for solar power distribution

1.3 Applicable Standards:

Components and parts used in Solar PV systems should conform to the BIS or IEC or other International standards/specifications, wherever such standards/specifications are available and applicable.

2.0 Specification of Solar PV Modules:

Total capacity of PV Modules to be supplied for the system is the cumulative rated capacity of all solar PV module under supply as per relevant IEC standards under Standard Test Condition (STC). Detailed specifications of the solar PV modules are given below:

Type of SPV module	Crystalline silicon
Origin	Manufactured in India
Nominal Power Output	Shall not be less than 250Wp at Standard Test Conditions (STC) with positive tolerance only (+5 W)
Module Efficiency	≥15%
Number of cells	Minimum 60
Fill Factor	≥72%



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Glass for the Crystalline Silicon Modules	Toughened low iron glass with minimum thickness of 2.5mm
Transmittance of the Glass	Above 90% and with bending of less than 0.3%
Back sheet	The back sheet used in the crystalline silicon based modules shall be 3 layered structures. Outer layer of fluoropolymer, middle layer of Polyester (PET) based and Inner layer of fluoropolymer or UV resistant polymer. Back sheet with additional layer of Aluminium also will be considered. The thickness of back sheet should be of minimum 300 microns with Water vapor transmission rate less than 3g/m ² /day. The Back sheet shall have voltage tolerance of more than 1000 V. Alternatively the back sheet can also be made of Toughened low iron glass with minimum thickness of 2.5mm.
EVA	The Ethylene Vinyl Acetate used for the modules should be of UV resistant in nature. No yellowing of the back sheet with prolonged exposure shall occur.
Sealant	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.
Termination/Junction Box	The junction box used in the modules shall have protective bypass diodes to prevent hot spots in case of cell mismatch or shading. The material used for junction box shall be made with UV resistant material preferably Thermo-plastic to avoid degradation during module life and the junction sealing shall comply IP65 degree of protection.
Blocking diodes	Schottky type
PID free modules	The Crystalline Silicon based modules supplied should be of Potential Induced Degradation (PID) free modules and the test certificate from third party lab complying



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	with the same shall be provided.
Wind Speed	Modules should have rugged design to withstand tough environmental conditions and high wind speeds (minimum up to 180 km/h).
Humidity and Temperature	Modules shall perform satisfactorily in relative humidity up to 95% and temperature between -10°C and 85°C (module temperature).
Degradation warranty	Panel output (Wp) capacity to be ≥90% of design nominal power after 10 years and ≥80% of design nominal power after 25 years.
Warranty	The modules shall be warranted for minimum of 10 years against all material/ manufacturing defects and workmanship.
Temperature coefficient	≤ - 0.45%/ °C for P _{max}
Module Mismatch	The module mismatch of the modules connected to an inverter should be less than 2%.
Module frame	The module frame shall be made of anodized Aluminium or corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules. The anodizing thickness shall be 15 micron or better. In case of metal frames are used for modules, it is required to have provision for earthing to connect to the earthing grid.
Safety	SPV module shall have module safety class- II and should be highly reliable, light weight and must have a service life of more than 25 years.



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Identification tag	Identification tag for each solar module shall be provided inside/outside the module and must be able to withstand environmental conditions. Identification tag data: <ul style="list-style-type: none">a) Name of the manufacturer of PV Moduleb) Month and Year of manufacturec) Country of origind) Wm, Imp, Vmp for the modulee) Unique Serial No and Model No of the module
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