

## **Annexure A**

### **RFP 23/2024: Establishment of a Panel of Contractors for Engineering, Designing and Installation of Solar Photovoltaic (PV) System at SARS Offices**

#### **Business Requirements Specification (BRS) Document**



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## 1. Background

SARS is in the process of establishing green alternative power sources for its various offices nationwide. In an effort to achieve this objective SARS successfully appointed various service providers for the supply of necessary components, namely the solar panels, inverters, and batteries. However, it's essential to highlight that these acquired materials, further supplementary materials and professional installation services are required to bring the project to achievement. It is on this basis that SARS is looking to establish a panel of competent contractors that will be requested on an ad-hoc basis for engineering, designing and Installation of a Solar Photovoltaic (PV) System in various SARS offices.

The tender contains the following regions to which bidders are invited to submit their bid proposals for one (1) or more regions:

Region 1	Region 2	Region 3
Gauteng	Western Cape	KwaZulu Natal
	Free state	Limpopo
	Eastern Cape	Northwest
	Northern Cape	Mpumalanga

**BIDDERS MUST COMPLETE ANNEXURE B IN ORDER TO INDICATE THE REGION (S) BIDDING FOR.**

## 2. Solar Panels

The panels supplied for the project, sourced by SARS adhere to the latest edition of IEC PV module qualification test or comply with equivalent SABS standards. Among various types of PV module technologies, our recommendation to utilize half-cut mono crystalline solar panels with the passivated emitter and rear contact (PERC) property due to their higher efficiency. These half-cut modules, achieved by cutting solar cells in half, offer enhanced performance and durability, all while meeting the required standards.

- a. Post Installation:
- b. Providing Material and Performance Warranty:

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- i. Solar panels will be supplied with specified defect or failure free structural warranty (three years).
- ii. The warranty must respond when output decreases by more than 10% after ten years period and 20% after 25 years.
- iii. The supplier and/or installer will address the defects and/or failures of the system for the period of not less than three (3) years from the date of sale to the original customer ("Customer").

### **3. Definition**

#### **a. Components**

- i. Components and parts used in the SPV power plants including the PV modules (Photovoltaic modules), metallic structures, cables, junction box, switches inter etc., should conform to the SANS or IEC or international specifications, wherever such specifications are available and applicable.
- ii. Mounting structures.
- iii. Junction Boxes.
- iv. Earthing and lightening protections.
- v. IR/UV protected PVC Cables, pipes, and accessories.

#### **b. Solar Photovoltaic Modules**

- i. Protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.
- ii. The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.
- iii. The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid. South African Revenue Services /Landlord shall allow only minor changes at the time of execution.
- iv. Other general requirement for the PV modules and subsystems shall be the Following:
  1. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode.
  2. The box shall have hinged, weatherproof lid with captive screws and cable gland entry points or may be of sealed type and IP-65 rated.
  3. I-V curves at STC should be provided by bidder.

### **4. Array Structure**

- a. Hot dip galvanized mounting structures may be used for mounting the modules/ panels/arrays.



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- b. Each structure should have angle of inclination as per the site conditions to take maximum insolation. However, to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.
- c. The mounting structure shall be so designed to withstand the speed for the wind zone of SARS Building location where a PV system is proposed to be installed. It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to SARS. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed.
- d. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts, and bolts. Aluminium structures also can be used which can withstand the wind speed of respective wind zone. Necessary protection towards rusting need to be provided either by coating or anodization. (Coastal regions)
- e. The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.
- f. Regarding civil structures the bidder need to take care of the load bearing capacity of the roof and need arrange suitable structures based on the quality of roof.
- g. The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m<sup>2</sup>.
- h. The minimum clearance of the structure from the roof level should be 300 mm.

### **5. Junction Boxes (JBs)**

- a. The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP/FRP/Powder Coated Aluminium /cast aluminium alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.
- b. Copper bus bars/terminal blocks housed in the junction box with suitable termination threads. Conforming to IP65 standard and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single / double compression cable glands. Provision of earthing. It should be placed at 5 feet height or above for ease of accessibility.
- c. Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs) / SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- d. Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.



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## **6. DC Distribution Board**

- a. DC Distribution Board to receive the DC output from the array field.
- b. DC DBs shall have sheet from enclosure of dust & vermin proof conform to IP 65 protection. The bus bars are made of copper of desired size. Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

## **7. AC Distribution Board**

- a. AC Distribution Board (DB) shall control the AC power from PCU/ inverter and should have necessary surge arrestors. Interconnection from AC DB to mains at LT Bus bar while in grid tied mode.
- b. All switches and the circuit breakers, connectors should conform to SANS IEC 60947.
- c. The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d. All the panels shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz.
- e. The panels shall be designed for minimum expected ambient temperature of 45°C, 80 percent humidity and dusty weather.
- f. All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- g. Should conform to Indian Electricity Act and rules (till last amendment).
- h. All the 415 AC or 230 volts devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

## **8. Protections**

The system should be provided with all necessary protections like earthing, Lightning, and grid islanding as follows:

- a. Lightning Protection
  - i. The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components.
  - ii. The source of over voltage can be lightning, atmosphere disturbances etc the entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors.



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- iii. Lightning protection should be provided as per SANS IEC62305 standard. The protection against induced high voltages shall be provided using metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.
- b. Surge Protection
  - i. Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and -ve terminals to earth (via Y arrangement)
- c. Earthing Protection
  - i. Each array structure of the PV yard should be grounded/ earthed properly as per SANS 10199. In addition, the lighting arrester/masts should also be earthed inside the array field.
  - ii. Earth Resistance shall be assessed in presence of the representative of SARS as and when required after earthing by calibrated earth tester. PCU, AC DB and DC DB should also be earthed properly.
  - iii. Earth resistance shall not be more than five ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.
- d. Grid Islanding
  - i. In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a brief period. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands."
  - ii. Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment.
  - iii. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.
  - iv. A manual disconnect 4-pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personnel to conduct any maintenance.
  - v. This switch shall be locked by the utility personnel.

## **9. Cables**

- a. Cables of appropriate size to be used in the system shall have the following characteristics:
  - i. Shall meet SANS IEC 60227, SANS IEC 60502 Standards.
  - ii. Temp. Range:  $-10^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ .
- b. Voltage rating 660/1000V
- c. Excellent resistance to heat, cold, water, oil, abrasion, UV radiation flexible.

- d. Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum. The cables should be insulated with a special grade PVC compound formulated for outdoor use.
- e. Cable Routing/ Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by superior quality ferule or by other means so that the cable easily identified.
- f. The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e., 25 years.
- g. The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant provided by the bidder. Any change in cabling sizes if desired by the bidder/approved after citing appropriate reasons. All cable schedules/layout drawings approved prior to installation. Multi Strand, annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation.
- h. Overall PVC/XLPE insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All cables conform to latest edition of IEC/ equivalent BIS Standards as specified below:  
BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC/XLPE insulated cables for working Voltage up to and including 1100 V, UV resistant for outdoor installation SANS IEC 60947. The size of each type of DC cable selected shall be based on minimum voltage drop; however, the maximum drop shall be limited to 1%. The size of each type of AC cable selected shall be based on minimum voltage drop; however, the maximum drop shall be limited to 2 %.

## 10. Connectivity

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the engineer's report. Distribution Code/Supply Code of the State and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

Plant Capacity	Connecting Voltage
Up to 10 kW	240V-single phase or 415V-three phase at the option of the consumer
Above 10kW and up to 100 kW	415V – three phases
Above 100kW	At HT/EHT level (11kV/33kV/66kV)

## 11. Tools & Tackles and Spares

- a. A list of requisite spares in case of PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc. Junction Boxes. Fuses, MOVs / arrestors, MCCBs etc along with spare set of PV modules be indicated, which

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shall be supplied along with the equipment. A minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished.

## **12. Danger Boards and Signages**

Danger boards should be provided as and where necessary as per SANS Act. /SANS rules as amended up to date. Three signage shall be provided one each at battery –cum- control room, solar array area and main entry from administrative block. Text of the signage may be finalized in consultation with SARS / Landlord.

## **13. Fire Extinguishers (Lithium Iron)**

The firefighting system for the proposed power plant for fire protection shall be consisting of:

- a. Portable fire extinguishers in the control room for fire caused by electrical short circuits.
- b. Sand buckets in the control room.
- c. The installation of Fire Extinguishers should confirm to regulations and SANS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the roof or site where the PV arrays have been installed.
- d. Firebomb to be installed at each site.
- e. Add lithium-based suppression.

## **14. Drawings & Manuals**

- a. Two sets of Engineering, electrical drawings and Installation and Operational & Maintenance manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- b. Approved ISI and reputed makes for equipment be used.
- c. For complete electro-mechanical works, bidders shall supply complete design, details, and drawings for approval to SARS/Landlord before progressing with the installation work.





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## **15. Planning and Designing**

- a. The bidder should conduct Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material, and labour. The bidder should submit the array layout drawings along with Shadow Analysis Report to SARS/Landlord for approval.
- b. SARS reserves the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions/requirements.
- c. The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder submits three sets and soft copy Flash drive of final drawing for formal approval to proceed with construction work.

## **16. Drawings to be Furnished by Bidder after Award of Contract from the Panel**

Contractor shall furnish the following drawings and obtain approval.

- a. General arrangement and dimensioned layout.
- b. Schematic drawing showing the requirement of PV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
- c. Structural drawing along with foundation details for the structure.
- d. Itemized bill of material for complete PV plant covering all the components and associated accessories.
- e. Layout of solar Power Array.
- f. Shadow analysis of the roof.

## **17. Solar PV System on the Rooftop for Meeting the Annual Energy Requirement**

The Solar PV system on the rooftop of the selected buildings will be installed for meeting up to 40% of the annual energy requirements depending upon the area of rooftop available and the remaining energy requirement of the office buildings will be met by drawing power from grid at commercial tariff of ESKOMs.

## **18. Safety Measures**

The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Regulation Act No. 4 of 2006: Electricity Regulation Act, 2006. etc.

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## **19. Abbreviations**

°C – Degree Celsius

AC – Alternating Current

DB – Distribution Board

DC – Direct Current

EHT – Extra High Tension

EPDM - Ethylene Propylene Diene Monomer

FRP - Fibreglass Reinforced Polymer

GI – Galvanized Iron

GRP - Glass Reinforced Plastic

HT – High Tension

Hz – Frequency

IEC – International Electromechanical Commission

IGBT – Insulated Gate Transistors

IR – Insulation resistance

ISI - Import substitution industrialization

I-V – Current-Voltage characteristic

JB – Junction Box

Kg – Kilogram

kV – Kilovolt

kW -Kilowatt

LT – Low Tension

m<sup>2</sup> – Square Metre

MCB – Miniature Circuit Breakers

MCCB – Moulded Case Circuit Breakers

MOV - Metal Oxide Varistors

PCU – Power conditioning Unit

PV - Photovoltaic

PVC – Polyvinyl Chloride

SANS - South African National Standard

SAPVIA - South African Photovoltaic Industry Association

SARS – South African Revenue Services

SME – Small and Midsize Enterprises

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SPD – Surge Protective Devices

SPV - Solar Photovoltaic

STC – Standard Test Conditions

UV – Ultraviolet

XLPE – Cross-Linked Polyethylene