



## **ARC – NRE, WATER SCIENCE**

25 October 2024

**Supply and Installation of a 5.55 kWp Grid-Tied Solar PV System with 12kWh Lithium-ion batteries) at ARC-NRE, Cedara Research Station (The project includes the actual design of the solar PV system as per the guidelines in the specifications below)**

### **TECHNICAL SPECIFICATIONS**

#### **Solar panels and Hybrid Inverters**

- Supply and install 555Watt Monocrystalline solar PV panels x 10, to yield a maximum power output of 5.55-kilowatt Peak(kWp).
- The inverter must be listed on the attached approved Photovoltaic (PV) Inverter List.
- The solar panel modules will be mounted on roofing.
- Supply and install a single-phase hybrid inverter to match a 5.55 kWp from the solar PV array.
  - Inverter MPPTs=2.
  - MPPT Input Voltage=150Vd.c ~ 425Vd.c
  - The PV array output should not exceed the maximum PV array input rating (Max. DC Input Power (W)) of the hybrid inverter). The Max. DC Input Power (W)) of the hybrid inverter must be 6500W.
- Wiring configuration: Number of panels per string as per the maximum MPPT range and maximum power voltage of the solar panel.
  - Number of strings=2
  - Number of solar panels on each string=5
- Install DC isolators for each string.
- Supply all the solar panels and battery wiring, and all sundries.
- Inverter must include communication with BMS.
- Supply communication cables for Inverters & Batteries.

#### **Batteries**

- Supply and install a lithium-ion battery of 12 kWh.
- Min Output Power from batteries of 5 kW (Dischargeable power from the batteries)
- Must allow at least 1 parallel connection for scalability of energy storage
- Dischargeable at 80% Depth of Discharge (DoD).
- Performance cycle life ≥6000 cycles.
- Safe and secure with thermal management features.
- Battery management system.
- Installation Type: Floor Stand or Wall Mounted (To be finalized with end-user).
- Supply battery rack/cabinet for support of batteries, where applicable.
- Ensure the battery model is compatible with the inverter, especially since it must allow for parallel connections.

## **Lightning Protection and Earthing for Solar PV**

Apply measures to prevent catastrophic damages and failures of the installed PV system due to lightning. South Africa is in a highly lightning-dense region when compared to the rest of the world. Therefore, lightning strikes can still pose a risk to any electrical system, including solar panels, **installing lightning protection specific to the installed solar PV system.** Proper grounding, surge protection, and adherence to safety guidelines are crucial to minimizing the potential damage caused by lightning strikes. Grounding involves connecting solar panels, inverters, and other electrical components to the Earth's surface, creating a path for electrical currents to safely dissipate into the ground. **Use earthing, electrical configurations, and protection products based on standard compliance and protection.**

## **Hail protection for solar panels**

To ensure durability against hail, the solar PV system must incorporate hail-resistant panels, preferably rated to withstand impact from hailstones up to 25 mm in diameter at 80 km/h, as per IEC 61215 standards. The mounting system should be designed with an adequate tilt angle and robust materials to prevent damage from hail impact.

## **Application for management**

The solar PV system must include a user-friendly mobile and desktop application for monitoring and managing system performance. This app should provide real-time data on energy generation, battery status, and grid interaction, allowing users to track energy usage, savings, and system health. It should feature intuitive dashboards, alert notifications for system faults, and customizable settings to optimize energy consumption. The app must be compatible with Android, iOS, and web platforms, and allow remote access to ensure easy monitoring and control of the system, enhancing user engagement and system management efficiency.

The system provider must offer comprehensive training on how to effectively use mobile and desktop applications for monitoring and managing the solar PV system. This training should cover all key functionalities, including tracking energy generation, battery performance, and system health, as well as setting alerts and optimizing energy usage. Additionally, the provider should offer ongoing support for at least three months post-installation, ensuring users have access to assistance in case of any technical issues or questions regarding the app or system operation. This support will help ensure smooth adoption and optimal use of the system.

## **Commissioning**

The PV system will be grid-tied; thus, the following commissioning procedure will apply as per regulations, codes of practice, and National Energy Regulator of South Africa (NERSA) guidelines for grid-tied systems:

- The Solar PV system is to be signed off by a Professional Electrical Engineer (Pr. Eng.) or Professional Electrical Engineering Technologist (Pr. Tech.).
- PV solar system design must be approved by Pr. Eng. or Pr. Tech.
- Letter of installation and commissioning approval from Eskom or municipality.
- Installation must have been performed under the supervision of a qualified electrician, according to the approved design.
- **The electrician has to sign a certificate of compliance (COC) for the installation.**
- Pr. Eng. signs off an as-built drawing, after system works as specified.
- The installer or service provider must supply any additional documents and reports for commissioning.
- All compliance certificates/Municipality registration/permission and requirements according to current government regulations at the time of commissioning.
- Installation must comply with SANS-10142 and all applicable regulations and standards.
- The Solar PV system installation will not be approved to proceed until the municipal/relevant authority's approval is secured.

## Warranty

All equipment (Inverters, solar panels, batteries, etc) installed must have a manufacturer's warranty. The service provider shall provide a 12-month guarantee on the workmanship of the work undertaken at no cost to the ARC. If during this period the equipment is not in good working order, or not working satisfactorily owing to faulty material, design, or workmanship, the service provider will be notified and immediate steps must be taken by the service provider to rectify the defects and/or replace the affected parts on-site, at no cost to ARC.

Inverters and batteries must be installed by a qualified electrical wireman (Proof of qualification to be provided with proposal) or Master electrician with a valid registration with the Department of Labour. A valid electrical certificate of compliance must be issued once installed, specific to the installation of the backup solar system. The installation must be compliant with SANS 10142 and all its parts. The installation must comply with all warranty claim processes specific to each brand of equipment. The service provider must hand over all documents related to warranties.

Expected Warranties Periods:

Inverters 5 Year warranty • Solar Panels 15-year warranty • Batteries 5-year warranty to be provided with proposal

## Security

Installing one surveillance camera and on motion-sensor light near the solar panels.

Use tamper-resistant hardware for mounting solar panels, to make it difficult for thieves to remove them.

## Experience

Qualified service providers are required, but more than that, experience is required. Service providers must provide a list of recently completed projects with similar size specifications (they should be grid-tied and a minimum of 5kW in size) and traceable contact details and two reference letters with the minimum value of R100 000.00 to be provided.

## Miscellaneous

All preliminary work, including draft technical drawings, must be discussed with ARC personnel before construction begins.

Any downtime when connecting new solar power to the existing grid should be communicated with the point of contact (Dr Alanna Rebelo) at least 24 hours in advance.

## Distribution Box Installation

The critical loads to be powered are **desktop computers, laptops, servers, LED lights, and fridges**. These electrical loads are currently tapping power from a nearby room in another department which normally gets locked and when supply circuit breakers get tripped, the water science unit is disconnected from the power supply. Therefore, this solar project includes installing a new distribution box wired to the mains electricity. The solar system must be grid-tied to this new DB box. In addition, there are a few old wires and electrics in the office that would need to be removed as part of this project. The scope of the work must include disconnecting the water science unit from next-door room's power supply DB and removing/cleaning up the wiring in the Water Science Unit office.

## Place of installation

Delivery to Water Science Unit, NRE, Cedara Research Station, KwaZulu-Natal,

Coordinates: -29.541390233818206, 30.267373642766533

<https://maps.app.goo.gl/NjGT4GYYzrvi964s5>



#### Contact Person

Name: Dr. Alanna Rebelo

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#### Photos



The roof





Current DB box



(L)Some switches for the Water Science (NRE) office on the DB board. (R) The server.



Electrics and wires to be removed.



The potential location for the inverter (on the wall behind the shelf)