Eskom	Scope of Work	Research, Testing &Development

Title: **Hybrid Wind and Solar PV Microgrid Research Facility**

Unique Identifier:	**240-RTD-785**
Alternative Reference Number:	**N/A**
Area of Applicability:	**RT&D-TS&RM**
Documentation Type:	**Report**
Revision:	**1**
Total Pages:	**24**
Next Review Date:	**N/A**
Disclosure Classification:	**Controlled Disclosure**

Compiled by	Functional Responsibility	Authorized by
Mashudu Ndwambi **Senior Advisor** **RT&D**	**Monde Soni** **Chief Engineer** **Distribution**	**Ouma Bosaletsi** **Senior Manager** **RT&D**
Date: 19/03/2025	Date: 20 March 2025	Date: 21 March 2025

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

AUTHORISATION

This document has been seen and accepted by:

Name and Surname	Designation	Signature & Date
Sibusiso Maphumulo	Contract Manager	
Edison Makwarela	Senior Consultant, Distribution	
Vincent Mabodi	Engineer, Distribution	

Controlled Disclosure

When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

TABLE OF CONTENTS

Controlled Disclosure

When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

Controlled Disclosure

When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

1 Description of the Works

1.1 Executive Overview

A Microgrid is defined as a group of interconnected loads and distributed energy resources with defined electrical boundaries that acts as a single controllable entity and is able to operate in both grid-connected and island mode.

Microgrids are predominantly applied in areas where grid connectivity solutions to energy access are a challenge or feasibility is not cost justifiable. To still provide access to electrical power, alternative access solutions such as decentralized power is one option to consider.

To select areas suitable for microgrids solution, the following criteria is applied:

- Far from the existing conventional networks
- Farm-dweller houses where farming business operations do not favour overhead lines in the farm.
- Access challenges such as lack of bridges and roads
- Situated on valleys or mountain tops making it difficult to reach using conventional networks and pose maintenance and operating challenges post construction.
- Requiring costly infrastructure to be connected such as substations and long line upgrades.
- Constrained networks – grid-tied solution
- Projects with higher cost per connection
- Areas that are environmentally sensitive and which may influence wildlife, protect plants, or have a visual impact.
- Areas prone to site and servitude acquisition challenges for big infrastructure
- Lower and manageable risk of vandalism
- Must be the least life cycle cost solution when compared to a conventional solution.

Concept – the existing Eskom Microgrid currently being deployed is the basis of the concept for the envisaged research facility.

A project to establish a microgrid research facility is being developed as a source (supply and install) project. A microgrid plant that will be used for research purposes to advance and improve the existing offering on microgrids. The facility will be situated at Eskom's RT&D Rosherville facility.

The **Microgrid Research Facility** will have the following major components that are integrated to operate as a unit:

- Solar PV panels
- Wind Turbine Generators (WTG)
- Batteries
- Power conversion system (PCS)
- Programmable load
- Control room
- Monitoring and Control system

Controlled Disclosure

When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- All auxiliaries

1.2 Site and Physical Orientation

The facility being procured will be situated at Eskom RT&D at the following physical address:
Lower Germiston Rd,
Rosherville,
Johannesburg,
2095
GPS coordinates: 28° 6'47.69"E 26°13'58.08"S

The aerial map below is accompanied by the .kmz files that can be viewed in Google Earth Pro for a more refined locational information.

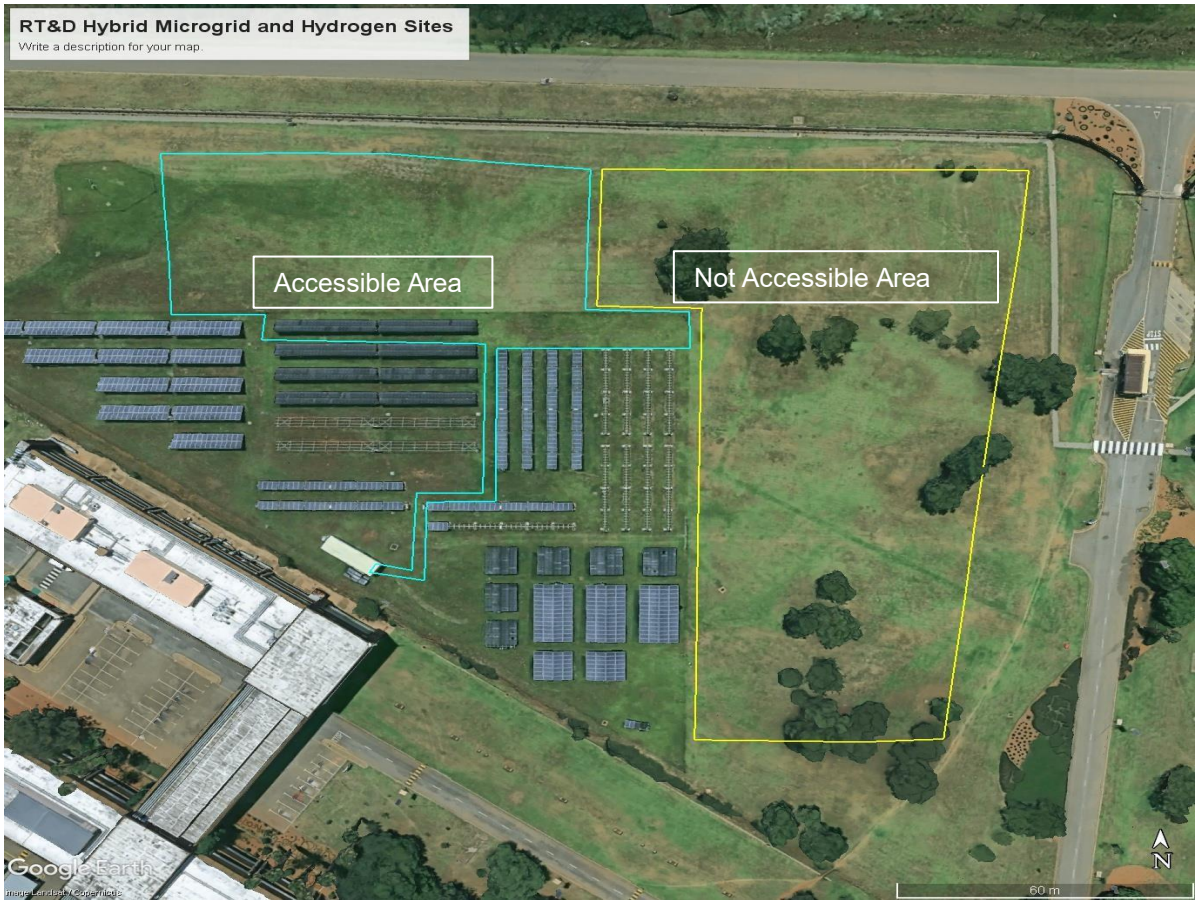

Figure 1: Planned Microgrid Facility Layout at Eskom RT&D, Rosherville

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Ho ld i n g s SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

1.3 Employer's Requirements

The scope of work shall include the procurement of a complete hybrid wind and solar PV microgrid facility with all its components and the control room as shown in the below schematic. The following main components and parameters are required:

- 30kWac solar PV with single axis tracking
- 60kWh BESS
- 30kW wind energy turbine (can be 2x15kW turbines)
- 30kW Power conversion system with voltage and frequency control capabilities
- 30kW Programable load with power factor range 0.8 lead/lag
- Network communication unit
- ADMS capability
- Circuit breakers for protection and isolation
- Site office and control room

- Detailed design of the microgrid facility in line with the required connection topology
- Commissioning of microgrid facility to Eskom Research and Innovation Centre,
- Project management service, and
- Training of Eskom staff to operate the microgrid facility.

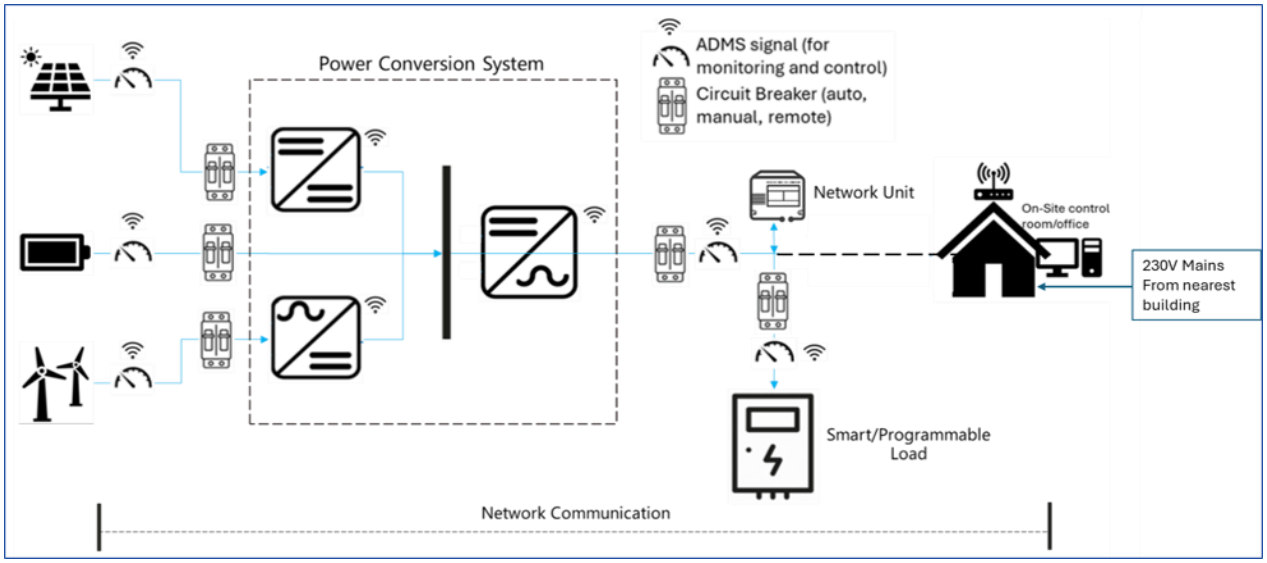

Figure 1: Microgrid architecture diagram

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

1.4 The *Employer* has the following specific requirements for the hybrid wind and solar PV microgrid research facility, which the Contractor shall adhere to:

1.4.1 This will inform the *Contractor* of the site-specific requirements for the design of the Hybrid Wind and Solar PV Microgrid Research Facility.

1.4.2 Determine the appropriate location at the selected sites for the installation of the Hybrid Wind and Solar PV Microgrid Research Facility to ensure effective measuring and monitoring.

1.5 Design the Hybrid Wind and Solar PV Microgrid Research Facility with the following range of functionalities to ensure comprehensive control, efficient operation, and robust performance:

- Manual Control: The microgrid system must provide the capability for manual control, allowing the operator to intervene directly when necessary. This is essential for testing different scenarios and making real-time adjustments to the system's operation.
- Voltage Control (Volt-var Control): The system must be equipped with voltage control capabilities to maintain stable voltage levels across the microgrid. This involves adjusting reactive power to manage voltage variations, ensuring that all connected loads receive power within the specified voltage range.
- Frequency Control: Maintaining the frequency of the AC supply within acceptable limits is critical for the stability and reliability of the microgrid. The system shall include frequency control mechanisms to adjust the power output and balance generation with consumption, preventing frequency deviations.
- P-Control (Curtailment): The microgrid must manage and curtail power output to match demand and prevent overloading. This functionality is essential for maintaining system stability, especially during periods of high demand or limited generation capacity.
- Load Management: Effective management of load demand is a key functionality of the microgrid. The system must dynamically adjust load consumption based on real-time data read from the load metres, ensuring optimal performance and preventing using the batteries beyond optimum limits. This helps in maintaining a stable and reliable power supply to all connected loads.
- Switching: The microgrid includes advanced switching capabilities to seamlessly transition between different power sources. This ensures a continuous and reliable supply of electricity, even when switching from one generation source to another.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- Metering and Revenue Collection: The system shall feature advanced metering solutions to accurately measure energy consumption at various points within the microgrid. This data can be used for revenue collection and billing purposes, as well as for detailed analysis of energy usage patterns. Accurate metering is essential for managing costs and optimizing system performance.

- Short-Term Forecasting: It shall be equipped with short term forecasting capability and use the resource forecast to optimise its dispatch strategy between the available energy resources in the facility.

- Programmable Load: The microgrid shall include a programmable load feature that can emulate different load classes and profiles. This allows for comprehensive testing of the system's response to various load conditions, including different power factors and demand patterns. The programmable load can simulate maximum demand and 24-hour profiles, providing valuable data for optimizing the microgrid's performance.

- Economic Dispatch: the system must be equipped with capability that will make it possible to programme it to do economic dispatch. Such capability shall make choosing between the solar, wind and batteries possible based on the programme

1.5.1 Solar PV Requirement:

The solar PV panels will be installed on a ground-mounted support structure, providing a stable and accessible platform for the array. To maximize energy capture, the PV system will include single axis tracking capability, allowing the panels to follow the sun's movement throughout the day. This feature significantly enhances the efficiency and output of the solar PV system, making it a valuable component of the microgrid. The required PV power output for this facility is 30kWac.

1.6 Battery Energy Storage Requirements:

Batteries are required to charge from the PV and from the wind turbines' generation outputs. The usable BESS capacity required for this microgrid is 60kWh. Thus, the successful respondent must design the capacity (constructed) such that the usable output is 60kWh. The design must account for manufacturer's suggested DoD.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

1.7 Wind Turbine Generator Requirements:

The turbines are required to provide power generation during the night-time and when the solar resource is scarce. The output of the turbines shall be 30kWac. The functionality to control power output/curtailment in line with the load demand shall be made available. The following scope of work must be carried out:

- Geotechnical Study
- Foundation Type Based on Soil Conditions
- Wind Resource Assessment
- Wind Direction & Turbulence
- Turbine Sizing & Capacity Matching
- Environmental Impact Assessment
- Structural Analysis of Turbine Components
- Permitting & Legal Compliance
- Noise Assessment

1.8 Power Conversion System (PCS) Requirements:

The power conversion system shall convert the combine output of the PV and BESS from DC to AC (230V, 50Hz). In addition, the power conversion system must allow the BESS to charge from the WTG.

The power conversion system is expected to play a vital role of providing the AC output in line with the standards discussed in sections below. It must provide volt-var support and frequency control support. It shall be able to take set-points and provide outputs as per the set-points that will be provided by the measurement and control unit of the microgrid.

The power conversion system shall have a capacity of 30kW.

For the cases where the PCS capacity is greater or equal to 100kW and grid-tied, a grid forming capability will be required to provide grid support.

1.9 Programmable Load Requirements:

The programmable load will complete the microgrid by representing the customers. It shall be equipped with capability to take the following load profiles:

- 24-hour profile
- 8760-hour profile
- Generalised seasonal profiles (typical summer, winter day, etc)

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- Typical week and weekend day profile
- Data resolution: 15 minutes data
- Profile length: 8760 hours (1 year)
- Input data: apparent power (kVA); real power (kW); reactive power (kvar); power factor

The input data will be provided in MS Excel spreadsheets.

This load must be capable of maximum demand of 30kW at 0.8 power factor (lead/lag)

1.10 Network Unit Requirements:

The network will carry sensors, and smart meter services.

10.1.1. Network Switch :

- Fan-free and dual-power supply redundancy design.
- Supports PoE++.
- Supports at least 8 x 10/100/1000Base-T Ethernet ports, 4 x 10GE SFP+ ports.
- long-term operating at -40°C to 65°C.
- Fault-free operation under strong magnetic interference, meeting the requirements of IEEE1613.
- Complies with the requirements of the strict environmental standard IEC61850-3 for substations.
-

10.1.2. Network Router:

- Industry-grade and high-performance edge computing
- Fan-free and dual-power supply redundancy design
- Supports at least 2 x RS485/RS232, 3 x GE electrical ports, 2 x GE SFP ports
- long-term operating at -40°C to 65°C
- 5G, LTE TDD, LTE FDD, WCDMA
- Fault-free operation under strong magnetic interference, meeting the requirements of IEEE1613
- Complies with the requirements of the strict environmental standard IEC61850-3 for substations.
- Fault-free operation under strong magnetic

10.1.3. AC collection unit:

- Supports the IEC62056-46 protocol.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- Supports analogue quantity acquisition functions such as voltage and current, and can measure voltage, current, power, power factor, etc.
- Accuracy: 0.2S active power level, 2 reactive power level.

10.1.4. HPLC/G3PLC communication unit:

- Supports the IEC62056-46 protocol.
- A maximum of 2000 STAs and 15-level trunks are supported.

10.1.5. Protection Requirements:

Key components of the facility shall be equipped with circuit breakers that can be controlled locally and remotely. The role of such breakers is to provide overcurrent fault protection during fault condition, detection and isolation of faulty sections of the facility and auto-reclosing after the fault was cleared. The state of these breakers (on/off) must be viewable from the office and the system must allow manual changes to switch state. The fault current rating of the protection breaker shall be calculated as part of the design by the successful bidder.

10.1.6. Monitoring and Control Functionality Requirements:

The monitoring and control functionality will show the physical working status of each entity. It will provide all the information about the facility and will be displayed in the dashboard format in the Office Room. The following minimum functionalities are applicable:

- Configuration of devices in the field.
- Activation and deactivation of devices.
- Replacement of faulty devices and keeping a record and history of replaced devices.
- Configuration of thresholds on devices.
- Device data collection & processing.
- Two-way communication capability (Remote connect\disconnect)).
- On demand request and response capabilities.
- Device lifecycle management.
- Demand response management.
- Management of smart grid data and non-consumer devices.
- Managing of device events (tampers, outages) and alarms)).
- Reporting and Analytics.
- Outage and Power Quality analysis.
- Remote firmware upgrade of field devices.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- Remote disconnection/ reconnection of energy supply.
- Ability to Maintain system time synchronization across all devices to ensure accuracy of data.
- Ability to provide Output of Generation.
- Measurement of load customer.
- Ability to Collect and analyse the power consumption data of end user/load for the purposes of power consumption monitoring, load management, and line loss analysis.
- Real time monitoring.

10.1.7. Office Room Signals:

The control room is to be equipped to monitor and report a wide range of signals, ensuring comprehensive oversight and management of the microgrid. It must be equipped with the following

- Viewing screen (>80cm): all-in-one interactive smart whiteboard for training (interactive touch panel; video conferencing; built-in speaker; built-in microphone; built-in camera),
- Screen to support voice tracking and auto framing function,
- Compatible with Microsoft Teams, zoom and other meeting software, wireless projection with/without Wi-Fi network.
- Manual input controls for the facility (for switching, setpoints, etc)
- Data storage and cloud upload capability

The control room will be hosted in the container which needs to meet the specification as follows:

Container specifications	20ft
Inner dimensions of the container (mm)	6058*3100*3100
Air conditioning type	Integrated fluorine pump air conditioner + dual system backup
Fire extinguishing method	Heptafluoropropane automatic fire extinguishing system
Trigger fire extinguishing	Smoke sensor and temperature sensor (standard configuration), fire alarm system, emergency manual button triggering, and fresh air and smoke exhaust system after a disaster
Monitors	Supports local and remote web page access and provides the alarm function.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

These signals will be provided by the Monitoring and Control system discussed in 5.8 above, the key signals include:

- Frequency: Monitoring the frequency of the AC supply to ensure stability.
- Voltage Regulation: Ensuring that voltage levels remain within specified limits.
- Reactive Power Flows: Tracking the flow of reactive power to manage power quality.
- Active Power: Monitoring the active power generated and consumed.
- Quality of Supply: Assessing the quality of the electrical supply, including voltage dips and harmonics.
- BESS State of Charge (SOC): Tracking the SOC of the BESS to manage energy storage.
- BESS Cell Health: Monitoring the health of individual BESS cells to ensure longevity and reliability.
- BESS Charging and Discharging Power: Tracking the power levels during charging and discharging cycles.
- System topology/
- Data collected from these signals will be archived in the cloud, providing a valuable resource for future analysis and applications.
- Low power factor detection
- Unbalance phases monitoring and detection.
- System tampering and unauthorised access.

Remote access: It shall be possible to remotely access the monitoring and control system remotely via a secured network. In addition, the same dashboard displayed in the Office Room shall be accessible remotely.

The control room shall include the following furniture's:

1. **Operator(s) Workstation**
   - 4 x Ergonomic Office Chairs – Adjustable height, cushioned seats, armrest with wheels for easy movement.
   - Under-Desk Pedestal Drawers – Small, lockable storage for personal and work-related items.
   - Wall-Mounted Shelves – For storing manuals, small tools, and frequently used documents.
   - Wi-Fi access point – For internet connectivity.
   - 7 x Ethernet cables and sockets – For internet connectivity.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- 6 x Standard Size: 32'' to 43" monitors – For expanded display.
- 3 x Telephones – For calls.
- Notice Board 244cm(L) x 5cm(W) x 125cm(H) – for notices.
- Whiteboard with Marker Tray – Task planning, updates and brainstorming.
- Personal Storage Lockers – Small, lockable units for staff belongings.
- Integrated Power Outlets - Desks with built-in power supply and charging ports for convenience.

2. Conference & Meeting Area (Boardroom)

- Rectangular Conference Table – For meetings and discussions to accommodate 10 people.
- 10 x Ergonomic Office Chairs – Adjustable height, cushioned seats, with wheels for easy movement.
- Multifunctional Whiteboard/Blackboard – For writing notes or drawing system flow diagrams.
- Power Outlets at the Conference Table – Built-in outlets and for charging devices or connecting laptops.
- Projection Screen and Projector – A retractable screen for presentations, integrated with the conference table or ceiling.
- Speakers – For sound during meetings.

3. Staff Break Area

- Compact Kitchenette with Cabinets – Small kitchen area with a counter, sink, and cupboards for storing snacks and drinks.
- Round or Square Dining Table – A simple table with 4-6 chairs for quick meals or breaks.
- Compact Refrigerator – A small, budget-friendly fridge for storing food and beverages.
- Microwave & Coffee Station – Basic microwave and coffee maker for quick heating and beverage preparation.
- Water Cooler – Freestanding water cooler.

4. Other Items

- Trash Bins.
- Wall Clocks & Digital Timers.
- First Aid Kit.
- Fire extinguisher.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

10.1.8. Housing enclosure for batteries, power conversion and other sensitive electronics:

Batteries shall be stacked and/or housed in a suitable enclosure that makes it easy to transport.

The contractor shall provide a separate enclosure to house batteries, power conversion system and other sensitive electronic and electrical equipment. This is to protect sensitive equipment from weather elements. It shall have effective fire detection and protection, and effective cooling mechanism. The enclosure must not exceed the dimensions (mm) (BxWxH): 1000x1000x2000. To prove ease of transportability, the enclosure must demonstrate the possibility of being transported in components than as a single unit. As such, it must be possible to transport the enclosure by means of labour personnel.

10.1.9. Overall Generating Capacity:

The generation capacity of the facility is to be designed to meet various research and operational needs.:

- AC voltage must be 230V, 50Hz in the facility,
- The PV system will have an output of 30 kWac,
- BESS to be rated at 60 kWhac, providing ample storage for energy management,
- Power conversion system, with a capacity of 30 kW, will convert DC power from the PV panels and BESS to AC power for distribution,
- The wind turbine generator will also contribute a total of 30 kWac to the system,
- The programmable load to have a maximum of 30 kWac at 0.8 power factor, ensuring that the microgrid can simulate different load scenarios effectively.
-

10.1.7.1 The expected life span of the hybrid wind and solar PV microgrid research facility shall be at least 15 years.

10.1.7.2 All components and accessories required for the successful operation of work under the scope of this project, either specified in detail or not, shall be supplied, installed and commissioned by the *Contractor* as necessary.

10.1.7.3 The hybrid wind and solar PV microgrid research facility shall be complete with all the equipment and material necessary for the safe, reliable operation, maintenance and support post installation of the hybrid microgrid system.

10.1.7.4 Any equipment and or function of the hybrid wind and solar PV microgrid research facility not specified herein shall be designed and supplied as required by the overall design of the hybrid microgrid system.

10.1.7.5 The *Employer* and *Contractor* shall agree on the site prioritisation in terms of the execution of the design, installation and commissioning of the hybrid wind and solar PV microgrid research facility accordingly.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

10.1.10. Interpretation and Terminology

Microgrid: is a group of interconnected loads and distributed energy resources with defined electrical boundaries that acts as a single controllable entity and is able to operate in both grid-connected and island mode.

The following abbreviations are used in this Scope Document:

Abbreviation	Meaning given to the abbreviation
AFC	Approved for Construction
OBL	Outside Battery Limits
BESS	Battery Energy Storage System
PV	Photovoltaic
PCS	Power Conversion System
SOC	State of Charge
AC	Alternating Current
DC	Direct Current
PCS	Power Conversion System

11 Management Strategy and Start Up

11.1 The Contractor's Plan

The *Contractor* shall provide, the scope execution plan which complies to the requirements of this scope.

The *Contractor's* plan takes into consideration the employer's requirements as stated in section 1.2 above and below information:

11.1.1 Submit installation, commissioning, operating and maintenance manuals and procedure for the Hybrid Wind and Solar PV Microgrid Research Facility.

11.1.2 Facilitate acceptance testing of the at the *Contractor's* premises.

11.1.3 Submit a training proposal for the practical training which will be approved by the Employer. As a minimum, the training proposal shall address the following requirements:

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

- Number of Participants: 10
- Requirements: This should be carried out as part of the installation and commissioning of the Hybrid Wind and Solar PV Microgrid Research Facility,and shall be based on the training proposal submitted by the contractor.
- Training Location: at a selected Eskom site.
- Training Duration: Should be based on installation and commissioning duration.
- Training Modules: Should include but not be limited to the following aspects: Installation, commissioning, operation, maintenance, software operation and troubleshooting, web-based application operation and troubleshooting, download and analysis of results, safety aspects.
- Program per training intervention: Proposal to be submitted by the contractor.
- Certification: Issuing certificates of attendance to all participants.

11.1.3.1 Supply a Hybrid Wind and Solar PV Microgrid Research Facility complete with all accessories and material required, as per the approved design.

11.1.3.2 The Contractor provides the quality control plan and inspection test plan for all activities of this scope.

11.1.3.3 Install and commission the Hybrid Wind and Solar PV Microgrid Research Facility at the *Employer*'s selected site.

11.1.3.4 Provide practical training to the *Employer*, as part of the installation and commissioning works.

11.1.3.5 Submit a training proposal for the theoretical training which will be approved by the Employer. As a minimum, the training proposal shall address the following requirements:

- Number of Participants: 20
- Requirements: Classroom training. Complete training manuals to be provided covering all training modules to be presented.
- Training Duration: Suppliers to declare duration of training based on contractor's training proposal.
- Training Modules: Should include but not be limited to the following aspects of the Hybrid Wind and Solar PV Microgrid Research Facility: Installation, commissioning, operation, maintenance, software operation and troubleshooting, web-based application operation and troubleshooting, download and analysis of results, safety aspects. The training content of the training modules shall be approved by the Employer.
- Program: Based on contractor's training proposal.
- Certification: Issue certificates of attendance to all participants.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

11.1.3.6 Provide theoretical training to the *Employer* once commissioning is completed.
11.1.3.7 Provide technical support to the *Employer* on an as-and-when required basis.
11.1.3.8 The *Contractor* may be required to participate in knowledge transfer workshops on request from the *Employer*, on an as-and-when required basis.

11.1.4 The following general requirements shall apply:

- All components and accessories required for the completion and successful operation of the Work covered under the scope of this project, either specified in detail or not, shall be supplied by the *Contractor* as necessary.
- The Hybrid Wind and Solar PV Microgrid Research Facility shall be complete with all the equipment and material necessary for the safe, reliable operation and maintenance of the Hybrid Wind and Solar PV Microgrid Research Facility.
- Any equipment and/or function of the Hybrid Wind and Solar PV Microgrid Research Facility not specified herein shall be designed and supplied as required by the overall design of the Hybrid Wind and Solar PV Microgrid Research Facility.
- The Contractor shall provide transportation of all equipment and accessories required as part of the work to the relevant sites.
- The Contractor shall provide suitable storage of all equipment during installation and commissioning activities.
- Provide all the required documentation pertaining to the Hybrid Wind and Solar PV Microgrid Research Facility.

.

11.1.5 Design Review Meetings

The *Contractor* shall present the Design to the *Employer* for technical review along with all relevant drawings.

A design review in a planned exercise is envisaged to ensure that there is a common understanding of the applicable standards and specification requirements, and to provide an opportunity to scrutinize the design to ensure the requirements meet the *Employer*'s requirements.

During this meeting, the comments of the *Employer* on the design will be reviewed and discussed in detail to finalize the design for the Hybrid Wind and Solar PV Microgrid Research Facility system. The *Contractor's* installation and commissioning methodology will reviewed as part of the design review.

The design shall be accepted by the Project Manager for approval.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

Table 1: Project Deliverables

No.	Milestones	Completion Date
1	Completion of Detail Design Phase	22 July 2026
2	Complete Procurement of all plant items	07 January 2027
3	Complete Construction of the Plant	27 May 2027
4	Complete Commissioning & Testing	24 June 2027

12 Health and Safety, the Environment and Quality assurance

12.1 Health and Safety Risk Management

The Contractor and his employees shall comply with the relevant Eskom policies, standards, procedures, and other statutory regulatory requirements and specifications. The Contractor complies fully to the requirements of the Occupational Health and Safety Act of 1993.

12.2 Environmental Constraints and Management

The Contractor shall construct and/ or implement all the necessary environmental protection measures in each area before any work will be allowed to proceed. The Employer may suspend the Works at any time in terms the Conditions of Contract should the Contractor, in the Employer's opinion, fail to implement, operate, or maintain any of the environmental protection measures adequately.

Environmental management is concerned not only with the results of the Contractor's operations to carry out the Works but also, and most importantly, with the way his operations are carried out. It is thus a requirement that the Contractor shall comply with the environmental requirements. The Contractor shall comply with all relevant laws, environmental legislation and regulations, conditions of environmental approvals, environmental management plans, and Employers Policies and Procedures.

The Contractor shall comply with the environmental criteria and constraints stated in the Employer's SHE specification.

The Contractor ensures that all goods, services, or Works supplied in terms of the Contract comply with all applicable environmental legislation.

Controlled Disclosure
When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30

The Contractor is responsible to keep the work area clean of any rubble. All waste introduced and/or produced on the Employer's premises by the Contractor for this contract, is handled in accordance with the minimum requirements for the Handling and Disposal of Hazardous Waste in terms of Government Legislation as proclaimed by the Department of Water Affairs and Forestry and Eskom environmental requirements including Eskom Environmental waste management procedure 32-245.

Where required, the Employer provides special colour coded bins for refuse disposal. The Employer will empty these bins.

The Contractor ensures that all workers under his control strictly adhere to the correct use of refuse bins.

12.3 Quality Assurance Requirements

The Contractor complies with the Eskom Quality Requirements Standards.

- The Contractor and all sub-Contractors to comply with the Employer's quality requirements including those listed in the Employers specification document called "Supplier Quality Management Specification" number 240-105658000
- Certification to ISO 9001 is a mandatory requirement for this contract. The Contractor uses the QMS for all phases of the Project. The Contractor provides evidence of a fully implemented QMS within its own organisation. The Employer may at his sole discretion carry out an audit on any supplier; sub-supplier's or Subcontractor's QMS for acceptance.

Controlled Disclosure

When downloaded from the document management system, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the system. No part of this document may be reproduced in any manner or form by third parties without the written consent of Eskom Holdings SOC Ltd, © copyright Eskom Holdings SOC Ltd, Reg No 2002/015527/30