Eskom	Standard	KZN OU

Title: **FUNCTIONAL SPECIFICATION FOR THE INSTALLATION OF SOLAR PV AND BATTERY ENERGY STORAGE SYSTEMS (BESS) AT THE WESTVILLE MENSTON COMPLEX**

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Executive Summary

The Distribution Division of Eskom aims to grow and retain sales by offering competitive, innovative products and services. A key component of this strategy is the integration of flexible Distributed Energy Resources. In line with this objective, an opportunity has been identified to deploy solar photovoltaic (PV) and battery energy storage systems (BESS) at various buildings, including offices and Customer Network Centres (CNCs), within the Central East Cluster.

This functional specification outlines the requirements for implementing PV-BESS at the Menston Office Complex, a Customer Care Centre within the KwaZulu-Natal Operating Unit in Westville. The solution is designed to allow the building to operate primarily on solar power during daylight hours, with energy storage systems providing power outside these hours. Integration with existing grid connections, standby generators, and other energy-efficient building systems is essential for the success of this initiative.

The document provides a detailed overview of the scope, functional, technical, and structural requirements for the PV-BESS system. It covers key components such as PV panels, battery systems, inverters, protection mechanisms, metering, HVAC, fire detection, physical security, and IT and communication systems, including SCADA and Human-Machine Interface (HMI) requirements. In addition, the specification includes essential guidelines for ensuring equipment warranties, maintenance, and operational (M&O) responsibilities.

This document serves as the foundation for an open tender to procure the PV-BESS systems and outlines the responsibilities and requirements for the successful integration of renewable energy into the Distribution Division's Central East Cluster infrastructure.

1. Introduction

The Distribution Division (Dx) has a strategic objective to grow and retain sales by offering competitive products and services. In alignment with this goal, flexible distributed energy resources (DER) have been identified as a key solution to support this objective. An opportunity has arisen to deploy solar photovoltaic (PV) and battery energy storage systems (BESS) at the Menston Office Complex, one of the Customer Care Centres in the KwaZulu-Natal Operating Unit, located in Westville.

The proposed solution should enable the building to operate primarily using solar PV cells during daylight hours, estimated to be approximately 5 hours. While the system will include energy storage for off-peak hours (specifically backup power for four (4) hours), it's important to note that due to limited roof space, the solar PV system will primarily serve as a supplementary power source for the building. Integration with the grid and the standby generators (eThekwini distribution network), remains crucial.

2. Supporting clauses

2.1 Scope

This document defines the functional requirements for the implementation of a combined PV and BESS solution at Eskom's Menston Office Complex, located in Westville.

The solution shall be designed to supplement power supply to the following areas within the Menston Office Complex:

- Ground floor of the main building
- First floor of the main building, including the contact centre and server room

Additionally, the following requirements must be adhered to as per the planning engineer's report:

- Integration of an HVAC system
- Maximisation of rooftop PV capacity
- Battery energy storage designed to support four (4) hours of daily loadshedding.
- The supply to the annex will need to be disconnected if both the standby generator and main supply are unavailable. As part of the scope, the wiring must be inspected and, if necessary, modified to ensure the annex is properly isolated when power from either the standby generator or main supply is lost. The necessary modifications shall be included in the Contractor's detailed design proposal.

This scope ensures that the combined PV and BESS solution will enhance energy efficiency, reliability, and sustainability at the Menston Office Complex.

Note: The external office block located beneath the main building is referred to as "the annex."

2.1.1 Purpose

The purpose of this document is to outline the functional requirements for the installation of an integrated solar PV and BESS at the Menston Office Complex. This will promote efficient energy use and support the organization's sustainability and operational goals, while also advancing the division's strategic objective of growing and retaining sales by leveraging flexible distributed energy resources to achieve these aims.

2.1.2 Applicability

This document is applicable exclusively to Eskom's Distribution Division within the Central East Cluster.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] 240-75655504 Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Materials and Structures Manufactured from Steel Standard

[3] 240-171000418 Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids

[4] 240-105658000 Supplier Quality Management Specification

[5] SANS 10142-1 The wiring of premises Part 1: Low-voltage installations.

[6] 240-120804300 Standard for The Labelling of Electrical Equipment within ESKOM Wires Networks

[7] 240-170000103 Lithium Iron Phosphate Batteries Standard

[8] 240-170000189 Standard for Current and Future Metering Implementation

[9] 240-170000777 Engineering Instruction for Operating LV Networks with Small Scale Embedded Generators (SSEG)

[10] 240-54937439 Fire Protection / Detection Assessment Standard

[11] 240-54937450 Fire Protection and Life Safety Design Standard

[12] 240-55410927 Cyber Security Standard for Operational Technology

[13] 240-56536505 Hazardous Locations Standard

[14] 240-57649065 LV Protection Standard

[15] 240-57855874 Photovoltaic Modules and Regulators

[16] 240-61182045 Maintenance Engineering Standard for Batteries and Chargers

[17] 240-62629353 Specification for Panel Labelling Standard

[18] 240-64636794 Generic Equipment Specification Wire, Wire Marking, Cable Numbering, Fibre Optical Cable Installation and Labelling

[19] 240-75661043 Services Standard

[20] 240-84924080 Metering Requirements for Small Scale Embedded Generation

[21] 240-76628631 Standard for Sealing of Metering Equipment

2.2.2 Informative

[22] IEC 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

[23] IEC 61215-1:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements

[24] IEC 61215-2:2021 Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test procedures

[25] IEC 61326-1:2020 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General requirements

[26] IEC 61730-1:2016 Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction.

[27] IEC 61730-2:2016 Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing.

[28] IEC 62109-1:2010 Safety of power converters for use in photovoltaic power systems - Part 1: General requirements

[29] IEC 62109-2:2011 Safety of power converters for use in photovoltaic power systems - Part 2: Requirements for inverters

[30] IEC 62619:2022 Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

[31] IEC 60529 Degrees of protection provided by enclosures.

[32] NRS 097-2-1:2024 Small-scale Embedded Generation, Utility Interface

[33] SANS 121:2011 Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.

[34] SANS 657:2011 Steel tubes for non-pressure purposes.

[35] SANS 1200 C, Standardized specification for civil engineering construction Section C: Site clearance

[36] SANS 1200 DA, Standardized specification for civil engineering construction Section DA: Earthworks (small works)

[37] SANS 61000-6-2, 3 and 4: Electromagnetic compatibility (EMC)

[38] SANS 61439 Low-voltage switchgear and control gear assemblies

[39] SANS 61641 Enclosed low-voltage switchgear and control gear assemblies

[40] SANS 61643-12 Low-voltage surge protective devices - Part 12: Surge protective devices connected to low-voltage power systems.

[41] SANS 62305-1 to 4 - Parts 1 to 4: Protection against lightning

[42] Grid Connection Code for Renewable Power Plants (RPPs) Connected to the Electricity Transmission System (TS) or the Distribution System (DS) in South Africa (Version 3)

[43] UL 1741 Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources

[44] UL 9540 Standard for Energy Storage Systems and Equipment

[45] 240-150128782 Framework for Design Solutions to Connect Customer Owned SSEG's

[46] 240-152929508 Maximum Generation Limits on LV Networks – Category A1 to A3

[47] 240-170000521 Clarification of Small-Scale Embedded Generation Connection Criteria

[48] 240-61268576 Standard for the Interconnection of Embedded Generation

[49] 240-61523882 LV Operating Regulations

[50] 240-79669677 Demilitarised Zone (DMZ) Designs for Operational Technology

[51] 240-81732810 Operating Guideline for Dedicated LV Networks with Embedded Generation

[52] 240-108650238 Distribution Group Business Plan

[53] 240-64038621 Remote Device Communication Standard for Data Retrieval and Remote Access

[54] NRS 048-2: Electricity Supply – Quality of Supply Part 2: Voltage characteristics, compatibility levels, limits, and assessment methods

[55] SANS 60364-7-712:2018 - Low voltage electrical installations. Part 7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply systems.

[56] IEC 61727 Characteristics of the Utility Interface

[57] IEC 62116 Testing procedure of Islanding Prevention Methods for Utility-Interactive Photovoltaic Inverters

[58] IEC 62103 Electronic equipment for use in power installations

[59] IEC 61000-6-1/2 - EMC Immunity

[60] IEC 61000-6-3/4 - EMC Emission

[61] IEC 61215 – Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval

[62] IEC 61730 – Photovoltaic (PV) module safety class II qualification

[63] IEC 61701 – Salt mist corrosion testing of photovoltaic (PV) modules.

[64] SANS 60146-2:1999 Semiconductor convertors - Part 2: Self-commutated semiconductor converters including direct d.c converters.

[65] SANS 62619:2022 Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

[66] SANS 62620:2023 Secondary cells and batteries containing alkaline or other non-acid electrolytes — Secondary lithium cells and batteries for use in industrial applications.

[67] 240-53114248 Thyristor and Switch Mode Chargers, AC/DC to DC/AC Converters and Inverter / Uninterruptible Power Supplies Standard

[68] KZN-STM-1004-926987-0001: Network Planning Report for Rooftop PV installation at Westville Offices

2.3 Definitions

2.3.1 General

Definition	Description
Battery Cycle	Sequence of a discharge followed by a charge, or a charge followed by a discharge under specified conditions.
Battery Management System	Electronic system associated with a battery, which monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's safety, performance and/or service life and has the functions to cut off in case of overcharging, overcurrent and overheating.
Charge Controller	Battery charge and discharge regulator that prevents overcharging and over-discharging of a battery in a photovoltaic system by reducing the photovoltaic current, or by disconnecting the load.
Distributed Energy Resources	Generators, including loads having a generating mode (such as electrical energy storage systems) connected to the low or medium voltage distribution network, with their auxiliaries, protection, and connection equipment.
Inverter	Device that changes DC input into AC output.
Small Scale Embedded Generator	Embedded generator rated at up to 1 MVA which includes the energy conversion device (devices), the static power converter (converters), if applicable, and the control and protection gear within a customer's network that operates in synchronism with low-voltage networks. For avoidance of any doubt, the point of generator connection must be at low voltage even if the point of utility supply is not at low voltage.
Standard Test Conditions	Conditions where the irradiance is 1000 W/m², the photovoltaic cell temperature is 25°C, and the air mass is 1.5 – air mass represents the total amount of atmosphere that solar radiation must travel through.

2.3.2 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
BESS	Battery Energy Storage System
BMS	Battery Management System
CEC	Central East Cluster
CMMS	Computerised Maintenance Management System
CMS	Control and Monitoring System
CNC	Customer Network Centre
CoC	Certificate of Compliance
c-Si	Crystalline Silicon
DB	Distribution Board
DC	Direct Current
DER	Distributed Energy Resources
Dx	Eskom’s Distribution Division
ECSA	Engineering Council of South Africa
EMS	Energy Management System
EOL	End-of-life
EPC	Engineering, Procurement and Construction
FAT	Factory Acceptance Test
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input Output
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
IP	Internet Protocol
LCD	Liquid Crystal Display
LCD	Liquid Crystal Display
LFP	Lithium-iron-phosphate
LPU	Large Power User
LV	Low Voltage – (<1000V)
M&O	Maintenance and Operations
MCB	Main Circuit Breaker
MES	Maintenance Engineering Strategy
MIS	Maintenance Implementation Standard

MPP	Maximum Power Point
MPPT	Maximum Power Point Tracking
Ni-Cad	Nickel Cadmium
OEM	Original Equipment Manufacturer
OPC	OLE (Object Linking and Embedding) for Process Control
OU	Operating Unit
PV	Photovoltaic
QEM	Quality Event Management
RTU	Remote Terminal Unit
SAT	Site Acceptance Test
SCADA	Supervisory, Control and Data Acquisition
SoC	State of Charge
SoH	State of Health
SSEG	Small Scale Embedded Generator
STC	Standard Test Condition
TCP	Transmission Control Protocol
UPS	Uninterruptible Power Supply

2.5 Roles and Responsibilities

This functional specification has been developed by the KZN OU Standards & Implementation Department and will be included in an open tender for the procurement of the outlined solutions.

The appointed evaluation team will be responsible for ensuring that all tender submissions meet the requirements set forth in this document. During the execution phase, the assigned project manager (PM) will oversee compliance of the manufactured, delivered, and constructed products with this specification, or any agreed-upon and approved deviations.

Regarding Maintenance and Operations (M&O), the respective OU/Cluster M&O Managers will be responsible for overseeing all contractual M&O activities. The Contractor, in coordination with the OEMs, will develop and deliver the required Maintenance Engineering Strategies (MES), Maintenance Implementation Standards (MIS), and associated documentation for all relevant asset classes included in the solution.

Eskom will provide the necessary templates and guidance for this process. At the commencement of the M&O phase, the OU/Cluster M&O Managers will ensure the entry of all required plant data into the CMMS (Maximo) system.

Additionally, the Contractor will be responsible for capacity building within Eskom, particularly with respect to training and the development of training materials. All M&O activities performed by the Contractor shall adhere to Eskom Dx's standard processes, such as work management systems and dispatching, to ensure a seamless handover to Eskom Dx at the end of the initial or extended contract period. During this phase, the Contractor shall involve relevant M&O staff in all activities to facilitate effective knowledge transfer and ensure a smooth transition.

2.6 Process for Monitoring

Maintenance processes and requirements will be integrated into the existing work management systems and managed accordingly. For instance, during the initial or extended M&O contract periods, plant data will be entered into the Dx CMMS (Maximo), and preventative maintenance work orders, as outlined in the relevant MIS, will be generated by Dx for the Contractor's execution. The Contractor is responsible for providing ongoing feedback to the KZN OU on all breakdown-related activities, and the OU will continuously update Maximo with this information.

2.7 Related/Supporting Documents

Not applicable.

3. Document Content

3.1 Functional Requirements

3.1.1 The Contractor is responsible for the design, engineering, manufacturing, procurement, and supply of all materials and labor. This includes delivery to the site, offloading, construction, erection, installation, as well as off-site and on-site testing.

3.1.2 The Contractor will handle commissioning, performance testing, providing samples, and preparing detailed design and as-built record drawings. Additionally, they will provide maintenance manuals and instructions for the works, all in compliance with the general and performance requirements outlined in this document.

3.1.3 The Contractor shall provide Eskom with all the required asset governance documents, including, but not limited to:

a. Concept design
b. Design philosophy
c. Detail design
d. Test certificates
e. Connection of embedded generator application (eThekwini Municipality)
f. Bills of quantities (BOQ)
g. Design and as-built drawings
h. Maintenance manuals
i. QEM documents

3.1.4 The scope of work includes the M&O activities for the first two (2) years of operation, with an option to extend this period.

3.1.5 The Contractor is responsible for providing the necessary spare parts for the maintenance and repair tasks as mentioned above.

3.1.6 The scope also covers training relevant KZN OU staff in the maintenance and operation of the system from the start of the M&O contract period, facilitating a smooth handover to the OU at the end of the initial 2-year period.

3.1.7 The Contractor shall deliver the works as specified in this document, along with a complete quality management plan in line with the 240-105658000 Supplier Quality Management Specification [4].

3.1.8 The Contractor is required to apply sound, recognized, and up-to-date engineering practices in all designs, drawings, and manuals. Any deviations from the requirements in this document shall be properly justified and supported by the Contractor.

3.1.9 The Contractor shall provide a comprehensive list of specifications applicable to the system and its sub-components. This document includes a list of Eskom, national, and international standards relevant to the design, procurement, construction, commissioning, maintenance, and operation of a solar PV and BES system. If the Contractor proposes deviations or alternative comparable standards, these must be clearly stated and justified in the tender submission.

3.1.10 The Contractor shall conduct a thorough inspection of the designated sites and buildings to identify and ensure compliance with all statutory requirements and site-specific details. This includes performing an evaluation of the available roofing space to accommodate the installation of PV panels, optimizing the layout to maximize solar exposure. The assessment must also account for the structural load distribution on the rooftop to ensure it can support the installation. Additionally, the Contractor may be required to propose a suitable design for a combination of rooftop and carport PV module arrangements to achieve the desired energy output.

3.1.11 The Contractor is responsible for identifying all maintainable items and spare parts for the system. Where applicable, the Contractor shall ensure that Eskom equipment standards are adhered to, and that appropriate spares are stocked.

3.1.12 The Contractor shall provide a method statement or proposal detailing the use of a building energy management system to optimize the utilization of the installed PV and BESS. This system will be integrated with the existing grid connection and the on-site diesel generator to ensure efficient energy management and seamless operation.

3.2 Technical Requirements

The technical requirements will vary based on the specific characteristics of each site, including geographical layout, building management systems, and limitations on the amount of PV power that can be generated due to average sunshine hours. These factors will influence the design approach for each location, resulting in site-specific designs. However, by utilizing renewable energy sources like solar power in conjunction with a battery energy storage system (BESS), the overall power consumption from the South African National Grid will be reduced. This aligns with Eskom's mandate to lower carbon emissions. The system will incorporate a design like the one shown in Figure 1.

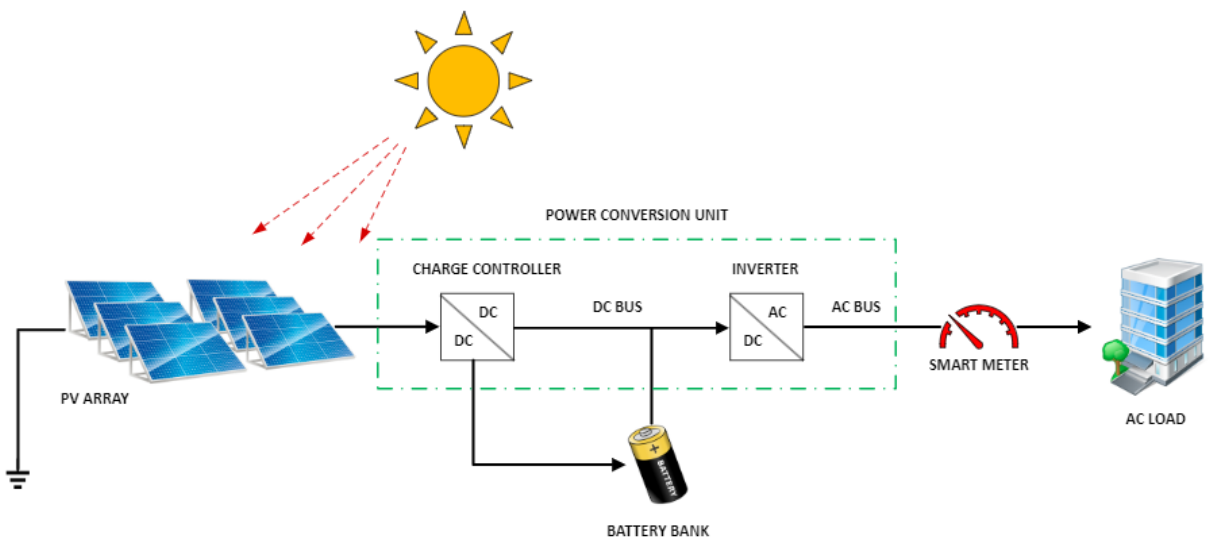

Figure 1: Solar PV System with Battery Energy Storage – High-Level System Overview

In an integrated energy system, PV panels in an array capture sunlight and convert it into electrical energy. This energy is regulated by a charge controller to ensure efficient charging of the BESS. During daylight, the PV system supplies electricity directly to the building, with excess energy stored in the BESS. When sunlight is insufficient or during the night, the stored energy is released to power the building or, depending on the design and site-specific scope, selected areas of the building.

An inverter is used to convert the DC power generated by the PV panels and stored in the batteries into AC power, which is compatible with most electrical systems in buildings. A smart meter monitors energy usage and generation, providing real-time data to an energy management system (EMS). The EMS works in coordination with a battery management system (BMS) to optimize the use of energy, balancing power drawn from the PV system, stored energy, and the grid. By managing these sources effectively, the building can operate on solar power during daylight and switch to stored energy when needed, minimizing reliance on the grid, and contributing to reduced carbon emissions.

This integrated system, which consists of solar PV, battery energy storage and energy management systems, ensures continuous operation of the buildings outlined in this document. The system harnesses solar energy during daylight hours and utilizes stored energy during off-peak periods, reducing dependence on the South African National Grid.

The use of renewable energy resources, such as solar PV, to supplement energy usage at KZN OU sites directly supports Eskom's goals of reducing operational costs and lowering carbon emissions. By pursuing renewable energy, Eskom can help South Africa reach its target of net zero carbon emissions by 2050, while still nurturing economic growth and creating sustainable jobs. Utilizing renewable energy at these sites reduces grid dependency and operational expenses, aligning with Eskom's objective of financial and operational stability.

This shift also supports Eskom's Just Energy Transition (JET) program, which seeks to balance the need for economic development with environmental sustainability, ensuring a stable, affordable, and equitable energy supply for the future.

3.2.1 PV Panels

3.2.1.1 Crystalline silicon (c-Si) PV modules will be used for the installation.

3.2.1.2 The usable peak output power specified will be effective from the start of operations, after commissioning and handover.

3.2.1.3 To make the best use of space, the modules shall have an efficiency of at least 19% under Standard Test Conditions (STC), which include an irradiance of 1000 W/m², AM 1.5 spectrum, and a cell temperature of 25°C.

3.2.1.4 A bypass diode shall be included for every 18 to 24 cells in a module.

3.2.1.5 During the first year, the actual output power of the PV modules shall be within 3% of the rated capacity.

3.2.1.6 From the second year to the twentieth, the module output power should not drop by more than 0.8% per year, and this will be guaranteed by the OEM.

3.2.1.7 The PV panels shall comply with the requirements as outlined in 240-171000418 Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3].

3.2.1.8 The Contractor shall supply and install PV modules to meet the specified performance levels for a design lifespan of 25 years, considering the prevailing environmental conditions at the site, which the Contractor is responsible for investigating and determining.

3.2.1.9 All PV modules provided for each site shall be uniform in type, model, size, and batch, sourced from a single manufacturer, and installed per the manufacturer's guidelines.

3.2.1.10 The proposed PV module type must have been operational in similar ambient temperatures (≥38°C) for at least 12 months in commercially financed, non-recourse projects.

3.2.1.11 The peak power of the PV system shall be determined based on the module's rated peak power under Standard Test Conditions (STC), using the sum of the manufacturer's nameplate data sheets for each module.

3.2.1.12 Modules must feature anti-reflective coatings and have corrosion-resistant frames (e.g., Aluminium Alloy, Anodized Aluminium) with valid IEC certifications. The Contractor is responsible for optimizing module arrangements to reduce mismatch losses.

3.2.1.13 A proper sorting method shall be used, ensuring that only modules from the same batch are used within the same string.

3.2.1.14 All transportation, storage, handling, and installation shall follow the manufacturer's specifications to maintain the module manufacturer's warranty.

3.2.1.15 The Contractor shall verify the quality of the PV modules in accordance with the inspection, testing, and commissioning requirements set out in this specification.

3.2.1.16 The provided PV modules shall comply with the minimum technical requirements outlined in the Tender Technical Schedules.

3.2.1.17 All support structures shall comply to the requirements listed in 240-171000418 Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3]., irrespective if rigid or flexible PV panels are used.

3.2.2 Battery Systems

3.2.2.1 Batteries will be subjected to daily cycling unless the weather is not suitable.

3.2.2.2 Usage will include micro-cycles to adjust for changes in demand and supply.

3.2.2.3 Batteries shall support at least 5000 cycles before their capacity drops to 80% of its original capacity. The capacity at this point (EOL) must be clearly defined.

3.2.2.4 An always online cell-balancing feature shall be available to keep the battery's capacity consistent without needing manual adjustments.

3.2.2.5 The battery energy storage system should be able to restart and function normally after a complete discharge without any manual activation.

3.2.2.6 The battery energy storage system should handle temporary over-current situations, such as the inrush from large equipment, supporting at least a 10% overload for 1 minute. Both the batteries and their inverters shall be capable of this.

3.2.2.7 Batteries should be stacked or placed in a suitable enclosure based on where they are located.

3.2.2.8 All necessary safety laws and regulations, including fire protection and emergency response protocols, shall be adhered to, and not compromised.

3.2.2.9 The BMS and controllers shall support communication with external data-loggers.

3.2.2.10 The battery shall comply with the requirements as outlined in 240-171000418 Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3].

3.2.3 Inverters

3.2.3.1 The inverters shall be of the hybrid type (bi-directional) that are able to accept power from various power sources (i.e., PV panels, batteries, standby generators, and the grid) and optimally manage the energy from these power sources to ensure a reliable AC supply to the connected loads.

3.2.3.2 Hybrid inverters shall exclusively be used in the solution, utilising a single internal DC bus and single DC to AC inverter step.

3.2.3.3 Only inverters producing pure sine waves shall be used.

3.2.3.4 The inverter shall be suitably rated to carry the full load current as well as the load inrush current. Load inrush current to be limited to within the overload capability of the inverter i.e., 125% for 10minutes and 150% for 1 minute.

3.2.3.5 Inverter systems shall include their own built-in control and protection system.

3.2.3.6 Inverters shall support communication to external data-loggers using the protocols and interfaces specified in this document. Data must be easily obtained at no additional cost to the client (i.e., Wi-Fi or Web Application).

3.2.3.7 Inverters shall support a dedicated generator input, capable of accepting the inverter's full rated continuous power output. This input shall also support the charging of batteries.

3.2.3.8 Individual PV string level monitoring will be provided by the system.

3.2.3.9 The inverter shall have a user friendly, access controlled, Human-Machine Interface (HMI) that allows the user to read settings, configure setpoints and control the inverter based on the user's level of access.

3.2.3.10 The HMI shall indicate the system status and raise local warnings and alarms visually and audibly.

3.2.3.11 The inverter shall be able to function as an off-grid (grid forming) inverter or a grid-tied (grid-following) inverter dependent on the application.

3.2.3.12 The inverters shall be able to operate in parallel.

3.2.3.13 The inverters shall be single-phase or three-phase. However, it is important to note that the Menston Office Complex is internally wired in a three-phase configuration currently supplying both three-phase and single-phase loads.

3.2.3.14 The output voltages shall comply with requirements as stipulated in SANS 10142-1 - The wiring of premises Part 1: Low-voltage installations.

a. 230V ± 10% for single-phase systems,

b. 230/400V ± 10% for three-phase four-wire systems.

3.2.3.15 Inverters that are designed as single-phase units shall be able to be configured to operate as a three-phase, multi-unit system.

3.2.3.16 The inverters shall be wall-mounted or suitable for mounting in either a floor standing panel or wall mounted cabinet.

3.2.3.17 The inverter shall comply with the requirements as outlined in 240-171000418 Major Equipment Requirements for Distribution Solar PV and BESS: SSEG and Microgrids [3].

3.2.3.18 The Contractor provides an inverter arrangement that gives overall optimal energy yield over the life of the Project, considering the site conditions and the proposed module layouts and configurations.

3.2.3.19 Inverters selected shall conform to the following specifications:

a. Inverter minimum nominal capacity (without deration)

b. Inverter is selected with respect to local climatic and environmental condition and is equipped to operate in high temperature regions,

c. The inverter type or series offered has been deployed and in operation on field (with ambient temperature up to ≥ 38 °C) in past 12 months,

d. The inverter power is not derated for the temperature range between -10 °C and +45 °C,

e. Inverters selected has a minimum of 10 years product guarantee against manufacturing defects.

3.2.3.20 The Contractor confirms the inverter manufacturer's warranties for the site-specific environment and installation type. The Contractor also mentions if the inverter warranties can be extended. Possible extension of warranties is preferred.

3.2.3.21 The Contractor provides the list of spare parts required for the operation of inverter over 15 years period, recommended by the inverter manufacturer.

3.2.3.22 Inverters meet the following general requirements:

a. Due to maintenance reasons and a conservative spare part approach, inverters of the same type, model and size from the same manufacturer is deployed over the whole project.

b. Inverters are equipped with communication capabilities as required by the CMS; all inverters shall be controlled/supervised by the same software or CMS system.

3.2.3.23 The inverter shall comply with safety requirements according to IEC 62109 [28 & 29].

3.2.3.24 All inverters shall be provided with lockable DC disconnect switch and AC disconnect switch for isolation.

3.2.3.25 An IP protection class of at least IP21 is required for indoor mounting of the inverters and at least IP65 [31] is required for outdoor mounting.

3.2.3.26 The Contractor submits calculations for ensuring electrical compatibility between the inverters and the modules selected including, selection of appropriate inverter dimensioning factor and ensuring system voltages lie within acceptable MPPT ranges across the range of operating conditions for the site and for the long-term operation of the project.

3.2.3.27 All transportation, storage, handling and installation of the inverters are in accordance with the specifications from the manufacturer, as to not void the inverter manufacturer's warranty.

3.2.4 AC & DC Reticulation

3.2.4.1 All wiring shall comply with SANS 10142-1, The wiring of premises Part 1: Low-voltage installations [5].

3.2.4.2 The AC and DC circuit breakers, contactors and switches shall comply with the relevant parts of SANS 60947 series of standards.

3.2.4.3 All LV switchgear and control gear shall comply with the requirements of SANS 61439 [38] or equivalent technical standards.

3.2.4.4 The ability of the assembly of LV switchgear to limit the risk of personal injury, damage of assemblies and its suitability for further service because of an internal arcing fault shall be in accordance with SANS 61641 [39 & 40] or equivalent technical standards.

3.2.4.5 Fuse-links for the protection of solar photovoltaic (PV) energy systems shall comply with all the requirements of SANS 60269-1, Low-voltage fuses Part 1: General requirements and SANS 60269-6:2021, Low-voltage fuses Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems.

3.2.4.6 The PV wires shall comply with SANS 62930, Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC.

3.2.4.7 The DC connectors for the PV wires shall comply with SANS 62852, Connectors for DC-application in photovoltaic systems - Safety requirements and tests.

3.2.4.8 The combiner and fuse boxes shall be rated for outdoor environments, specifically designed to withstand corrosive conditions, with a minimum design life of 25 years. These boxes shall remain corrosion-free throughout their lifespan and provide at least IP65 ingress protection as defined by IEC 60529 [31].

3.2.4.9 The combiner box shall be capable of housing devices for overcurrent protection for each string, string-level monitoring equipment, an on-load disconnector switch for array isolation, and surge arrestors for overvoltage protection.

3.2.4.10 The combiner box shall include DC string protection for each string and operate at a maximum DC voltage of 1000V DC.

3.2.4.11 The DC combiner box shall include, at a minimum, lightning, and overvoltage protection. Surge protection shall be provided on both the DC and AC sides of the solar system.

3.2.4.12 The DC combiner box shall feature an array on-load disconnect switch for protection and isolation, which meets the following criteria:

a. Accessible without opening the combiner box.

b. Lockable for safety.

c. Double-pole, capable of isolating both positive and negative PV array cables.

d. Rated specifically for DC operation.

e. Able to break under full load conditions.

f. Rated for the system voltage and maximum current expected.

g. Clearly labelled with safety signs.

3.2.4.13 The combiner box shall include a DC short circuit protection device to disconnect the supply in case of fault conditions.

3.2.4.14 The combiner box shall be equipped with sun shields if exposed to direct sunlight. To prevent overheating, reduced terminal occupancy is considered in the design. The installation location shall be easily accessible and provide a secure working base.

3.2.4.15 Clear cable labelling and a single-line diagram of the connections shall be included inside each combiner box.

3.2.4.16 The primary combiner boxes, or secondary if specified in the design, shall include a string monitoring system that communicates with the SCADA/CMS server.

3.2.4.17 The combiner box shall have a minimum ingress protection rating of IP65.

3.2.4.18 The fuse box shall include individual fuses for each input coming from the combiner box.

3.2.4.19 The fuse box shall also be equipped with sun shields when exposed to direct sunlight, and reduced terminal occupancy is considered to prevent overheating. The installation location must be easily accessible and provide a secure base for working on the device.

3.2.5 Protection

The PV-BESS system shall be equipped with the following self-protection features, ensuring autonomous operation in a safe state without external user intervention:

3.2.5.1 Subsystem Self-Protection

a. Protection against user commands that could cause the system to operate outside its intended design parameters.

b. Protection against internal faults, including faults in other subsystems, ensuring the system transitions to a safe state autonomously.

3.2.5.2 Fault Protection Design – the system shall be specifically designed to handle the following fault conditions:

a. Earth leakage protection.

b. Low impedance fault protection.

c. High impedance fault protection.

d. Overload protection.

e. Over-voltage and under-voltage protection.

3.2.5.3 The power supplies shall include the following protections of which shall feature automatic reset functionality upon fault removal:

a. Over-temperature protection.

b. Current overload cut-outs.

c. Over-voltage limiting.

3.2.5.4 The Tenderer may propose additional protection and risk mitigation measures to safeguard the PV-BESS against other significant risks, which should be clearly outlined in the tender submission.

3.2.6 Metering

3.2.6.1 A metering system shall be installed to measure and record the total power consumption of loads supplied by the PV-BESS (Photovoltaic-Battery Energy Storage System) installation, as well as for each individual load within the building. A smart metering solution is required for this purpose.

3.2.6.2 The Contractor shall design, supply, and install an energy metering panel inside a PV-DB or a separate indoor metering kiosk (if it cannot fit inside the PV-DB).

3.2.6.3 The Contractor shall provide a complete metering solution including but not limited to CTs, VTs and CT and VT test blocks.

Table 1: Three-phase smart meters included in Eskom's National Contract for Smart Meters (Landis + Gyr Contract No. 4600069375)

SAP Material No.	Material Description
0621051	Landis+Gyr BS Footprint Three Phase PLC Split Meter with CIU Voltage: 400 V; Current: 100 A; Phases: 3Ph; Landis+Gyr, Three phase smart AMI meter; Communications: G3 Plc Between Meter, Customer Interface Unit and Data Concentrator; Meter incorporates integral 100A load switch; ,RTC, Time-of-Use, smart post-payment and STS prepayment; Includes P160 Customer Interface. Application: Meter must be linked to a DC, mainly used in residential areas where meters are concentrated. Can be downgraded/upgraded remotely up to 100A per phase.
0693563	Landis+Gyr BS Footprint Three Phase Split Meter with CIU + External GSM Modem Voltage: 400 V; Current: 100 A; Phases: 3Ph; Landis+Gyr, Three phase smart AMI meter; Communications: G3 PLC between meter and Customer Interface Unit, GSM between meter and HES; Meter incorporates integral 100A load switch; RTC, Time of-Use, smart post-payment and STS prepayment; Includes P160 Customer Interface Unit and external GSM modem. Application: To be used where it is not economical to install a DC – areas where meters are scattered, and signal is weak. Antenna can be extended. Can be downgraded/upgraded remotely up to 100A per phase.

3.2.6.4 The energy meter shall provide tariff metering, bi-directional energy measurements and power quality monitoring. The power quality monitoring and assessment shall be as described in Section 9 of Renewables Grid Connection Code Ver. 2.6 [42], NRS048-2 [54] and SANS61000.

3.2.6.5 For approved energy meters without power quality monitoring capability, a separate power quality monitoring meter shall be provided that meet the minimum power quality requirement in Section 9 of Renewables Grid Code Ver. 2.6, NRS048-2 and SANS61000 and shall be installed in the panel with the energy meter.

3.2.6.6 The energy meter and power quality meter shall communicate with the respective control and instrumentation devices. The minimum communication protocol is RS485.

3.2.7 HVAC

3.2.7.1 The enclosures will consist of an HVAC or ventilation system specifically engineered to uphold ambient temperatures within the parameters deemed acceptable by the OEM's standard warranty conditions.

This is essential to optimize operational longevity and efficiency, while ensuring the system's capacity is maintained for all site-specific seasons and climatic conditions.

3.2.7.2 The system shall operate fully automatically, and the supplier shall specify whether redundancy is incorporated within the system design.

3.2.7.3 The air-handling systems shall be designed to prevent dust intrusion effectively.

3.2.7.4 The system shall be powered primarily by the PV-BESS when in operation. However, it must also be capable of receiving power from the distribution network. The PV-BESS shall have priority for supplying power, but in the event that it is unavailable, the HVAC/ventilation systems must remain operational, either through the metered distribution network or the standby diesel generator.

3.2.8 Fire Detection and Suppression

The fire detection and suppression system equipment shall comply with the following Standards:

a. SANS 10139 Code of practice for design, installation, commissioning and maintenance of fire detection and alarm systems in non-domestic premises.

b. SANS 14520 Gaseous Fire Extinguishing Systems – Physical Properties & System Design

c. SANS 15779 Condensed Aerosol fire extinguishing systems – General Requirements

3.2.9 Physical Security Systems

The system shall comply with the following standards where applicable in support of the threat-and-risk assessment of the site:

a. 240-91190304 Specification for CCTV Surveillance with Intruder Detections

b. 240- 76368574 High Security Mesh Fencing Standard

c. 240-102220945 Specification for Integrated Access Control System (IACS) for Eskom Sites

d. 240-78980848 Specification for Nonlethal Energized Perimeter Detection System (NLEPDS) for Protection of Eskom Installations and its Subsidiaries

3.3 Structural Requirements

This structural standard applies to all PV-BESS installations across carports, rooftops, containers, and ground installations within the Central East Cluster. Each site shall adhere to these specifications to ensure that the structure meets the requirements of stability, strength, and serviceability when additional load is added.

3.3.1 Enclosure Protection

3.3.1.1 All enclosures shall be protected against water and dust ingress with a minimum rating of IP55 as per IEC 60529.

3.3.1.2 Outdoor enclosures shall include measures to prevent condensation build-up.

3.3.1.3 The structures must be designed to withstand the harshest expected environmental conditions, with appropriate corrosion protection measures.

3.3.1.4 The structural material shall be at least 6mm thick and made from 3CR12 stainless steel or other corrosion-resistant materials.

3.3.1.5 All enclosures, whether installed indoors or outdoors, must be protected against vermin and insect intrusion.

3.3.1.6 All enclosures shall be adequately reinforced and fitted with handling facilities (as per ISO standards) to allow for safe transportation, handling, and placement using standard cranes, sling sets, forklifts, or other lifting equipment.

3.3.1.7 The Tenderer may propose additional protection and mitigation measures to safeguard the BESS against any identified significant risks. These measures shall be detailed in the tender submission.

3.3.1.8 If shipping containers are used, they shall comply to these requirements:

a. 40-foot (12.2 m), with maximum “cargo” weight 26460 kg

b. 20-foot (6.1 m), with maximum “cargo” weight 28230 kg

3.3.1.9 Corrosion protection shall be applied to the shipping container or any other metallic enclosure according to 240-75655504.

3.3.1.10 The container shall be earthed as indicated in drawing D-DT-4407 sheet 1D.

3.3.1.11 The following foundation shall be used for the container installations:

a. 40-foot container: D-DT-5282 sheets 1A and 1B or 1C and 1D depending on the soil conditions,

b. 20-foot container: D-DT-5282 sheets 1A or 1C depending on the soil conditions.

3.3.1.12 The Tenderer shall submit a draft layout of the colour scheme, logos, and wording for approval by the Eskom Corporate Identity Department.

3.3.2 Locking Mechanism for High-Risk Areas

3.3.2.1 The locking mechanisms shall be designed for high-risk areas, where vandalism is likely, and safety risks and non-technical losses are high.

3.3.2.2 All enclosure doors must be recessed to be flush with the sides of the enclosure.

3.3.2.3 Exterior doors shall be reinforced with additional steel strength members, diagonally welded on the inside surface from corner to corner.

3.3.2.4 Heavy-duty hinges shall be used for all exterior doors.

3.3.2.5 A four-point locking mechanism (top-centre, bottom-centre, left-centre, right-centre) with bars operated by a heavy-duty door handle shall be installed.

3.3.2.6 Alternative locking mechanisms may be proposed for review by Eskom. The proposal shall include operational details and information on the effectiveness of the system in preventing unauthorized access.

3.3.3 Noise Control

The maximum noise level generated by the system, including any associated equipment, shall be limited to 65 dBA, measured at 15 meters in any direction from the site perimeter.

3.4 IT and Communication Requirements

3.4.1 Remote Engineering Access (REA)

3.4.1.1 The system shall support a detailed, low-level data and information view of each component/device (e.g., inverter, BESS, control modules etc.) in the system. This level should expose all possible data from, and send settings and controls to, the equipment/devices.

3.4.1.2 No internet connection shall be allowed to enable any functionality detailed in this section.

3.4.1.3 The REA system will eliminate any direct access needed to any equipment to monitor, affect setting changes, or perform controls.

3.4.1.4 Remote engineering access which may include data retrieval and configuration shall be provided for the following systems/devices which include but is not limited to:

a. Fire Detection and Suppression

b. Video Surveillance

c. Inverters

d. Battery Management System

e. Protection devices

f. SCADA Gateway

g. Generator control system

3.4.1.5 As required, Modbus RTU/Serial ports shall be encapsulated within TCP/IP utilizing Serial Device/Port Servers and directly made available to the REA system.

3.4.1.6 Should this REA solution include the use of network devices (switches/routers/serial port servers) as well as telecommunications modems/routers, Eskom standardized equipment shall be used in the solution unless a more cost effective/optimized solution is offered.

3.4.2 Communication Gateway

3.4.2.1 The communication gateway equipment for the PV and BESS shall be an RTU or Gateway approved by Eskom, as per Eskom's Gateway/RTU Contract.

3.4.2.2 The approved gateway shall be installed at the PV and BESS site.

3.4.2.3 Control of the EMS and SCADA shall interface with the approved gateway via IED/local interface ports, adhering to all required cybersecurity standards.

3.4.2.4 The Tenderer/Contractor shall provide the communication infrastructure to connect the EMS control system to the approved gateway on-site.

3.4.2.5 The Tenderer/Contractor is responsible for determining the approved Gateway/RTU details from Eskom and sourcing it from the approved vendor. Ordering information is available in document 240-61268576 [48].

3.4.3 SCADA

The SCADA system shall be engineered to deliver, encompass, and be structured to provide:

3.4.3.1 Real-time monitoring of key parameters such as power generation, energy storage levels, battery charge/discharge status, and weather conditions (solar irradiance, temperature, etc.).

3.4.3.2 Continuous data collection from all connected devices, including inverters, energy meters, battery management systems (BMS), and weather sensors.

3.4.3.3 Accurate timestamping of all data points for historical analysis and reporting.

3.4.3.4 Ability to remotely control inverters, battery charge/discharge operations, and other balance of system components.

3.4.3.5 Enable/disable operation of the PV system or BESS based on system conditions or external commands.

3.4.3.6 Automatic alarms for critical events such as overvoltage, overcurrent, temperature limits, earth faults, and system malfunctions.

3.4.3.7 Configurable notifications via email, SMS, or system alerts for operational or maintenance personnel.

3.4.3.8 Optimization of power flow between PV, battery storage, and the grid to maximize efficiency.

3.4.3.9 Load forecasting and energy dispatch planning based on real-time data and historical trends.

3.4.3.10 Continuous monitoring of battery SoC and SoH, ensuring safe operation and longevity of the battery system.

3.4.3.11 Alarms for abnormal battery behaviour, such as rapid depletion or degradation.

3.4.3.12 Integration of cybersecurity measures to protect against unauthorized access, ensuring secure communications between the SCADA system and devices The proposed SCADA system shall demonstrate compliance to relevant international cyber security standards as well as 240-55410927 Cyber Security Standard for Operational Technology [12].

3.4.3.13 Compliance with industry standards for encryption and firewall protection.

3.4.3.14 Capability to store long-term operational data for performance analysis, trend identification, and compliance reporting.

3.4.3.15 Customizable reports on system performance, energy output, efficiency, and fault logs.

3.4.3.16 An intuitive and customizable user interface for operators, displaying system status, alarms, and real-time metrics.

3.4.3.17 Different access levels for administrators, operators, and maintenance staff.

3.4.3.18 The system shall include redundancy for critical components (e.g., communication links, power supplies) to ensure continuous operation.

3.4.3.19 Automatic failover mechanisms to backup systems in case of a hardware or software failure.

3.4.3.20 Secure remote access to the SCADA system for monitoring and control from off-site locations.

3.4.3.21 Ability to perform diagnostics, software updates, and remote maintenance.

3.4.3.22 The SCADA system shall be scalable to accommodate future expansion of the PV-BESS installation (e.g., additional PV arrays or battery capacity).

3.4.3.23 Eskom will possess full licensing rights and ownership of the related SCADA software, encompassing operational firmware, monitoring and control software utilized on-site, as well as HMI's and remote monitoring, control, and communication software. The software will not be subject to any feature restrictions or time limitations.

3.4.4 HMI Requirements for Battery and Energy Management Systems

3.4.4.1 The BMS and EMS shall provide a local HMI located in the designated control room, allowing operators to locally control the system while displaying real-time plant statuses and alarm conditions. The operating philosophy shall ensure that most or all local operations are performed via the HMI and not directly on individual devices.

3.4.4.2 The HMI shall offer a graphical interface for monitoring and controlling the system, including the ability to visualize the installed solar PV and BESS with appropriate status indicators and alarms. IEC-approved electrical symbols (e.g., bi-directional converter, energy storage device) should be supported in the HMI's graphical tool.

3.4.4.3 The HMI should enable access to configuration settings and allow control of subsystem components where applicable.

3.4.4.4 The HMI system shall be designed for continuous 24/7 operation, ensuring high reliability.

3.4.4.5 The HMI interface shall be accessible through a display (either touch or non-touch) for all monitoring and control functions.

3.4.4.6 The HMI hardware and display shall be rated for operation in harsh environmental conditions, appropriate to the installation site.

3.4.4.7 The HMI hardware shall have a life expectancy of over 10 years. It should feature fanless operation with redundant solid-state drives for enhanced durability and performance.

3.4.4.8 The HMI should support a web-based view accessible from external web browsers. If this functionality is supported, it shall be based on HTML5 for cross-platform compatibility.

3.4.4.9 As a safety measure, the HMI used for monitoring and controlling the BMS and EMS shall be installed in a location free from equipment that could pose harm to the operator (e.g., switches, inverters, battery banks). A properly demarcated and safe area shall be provided for this purpose.

3.4.4.10 The HMI shall notify operators of any incorrect operations using clear and descriptive text messages displayed on the screen.

3.4.4.11 All control actions related to primary plant data output shall include a confirmation prompt to avoid accidental operations.

3.4.4.12 All control actions initiated via the local HMI shall be appropriately interlocked to ensure safety for both personnel and equipment, maintaining safety standards at all times.

3.4.5 Personal Data Requirements

The Protection of Personal Information Act (POPIA) of 2013 shall be always adhered to during the project.

3.4.6 Data Retrieval and Remote Access

Data retrieval and remote access requirements for the PV and BESS system control devices are provided in document 240-64038621 Remote Device Communication Standard for Data Retrieval and Remote Access [53]. Substation devices, as mentioned in the standard, include BESS control system devices. This specification ensures that the PV-BESS's communication, signalling, and network infrastructure adhere to Eskom's technical standards and requirements for seamless integration with Eskom's control centres.

3.5 Equipment Warranty

The Contractor shall provide an equipment warranty in accordance with the minimum requirements outlined in Table 1. In addition to, and without limiting, the defects liability period, the Contractor shall offer a comprehensive warranty covering all equipment, including strategic components. No equipment warranty provided shall limit or negate any other warranties.

Upon achieving operational acceptance of the installation, the Contractor shall transfer the ownership of all manufacturer equipment warranties to the Employer.

Table 2: PV-BESS Equipment Warranty

Equipment	Minimum Warranty Period (in Years)
PV Module - Product Warranty against Manufacturing defects	10
PV Modules – Performance	25
Mounting Structures – Duration of Warranty (Materials)	20
Mounting Structures – Lifetime Design Warranty	25
Inverter	10
HVAC Equipment	5
Fire Protection Equipment	5
Batteries	15
Civil Works	1

3.6 Labelling and Marking of Equipment

a. All labelling of panels shall comply with the requirements of Eskom standard 240-62629353 Specification for Panel Labelling Standard [17].

b. All markings of wiring and cables in substations shall comply with the requirements of Eskom standard 240-64636794, Generic Equipment Specification Wire, Wire Marking, Cable Numbering, Fibre Optical Cable Installation and Labelling [18].

c. The Contractor shall establish a detailed labelling and codification system for the CMS to accurately identify all instruments, cables, cable cores, equipment enclosures, network hardware, power supply systems, signals, OPC tags, and other components. This system shall adhere to Eskom's specified identification and labelling formats as outlined in the referenced specifications.

3.7 Handover and Commissioning

All tests, inspections, and pre-commissioning activities will be conducted in accordance with the 240-150128782 Framework for Design Solutions to Connect Customer-Owned SSEGs [45].

Until SANS 10142-1-2, The Wiring of Premises: Specific Requirements for Embedded Generation Installations Connected to the Low Voltage Distribution Network in South Africa, is officially published, all SSEGs shall, upon commissioning, be signed off using Eskom's established EGI Compliance Test Report [Annexure A]. This will serve as an interim solution to ensure the compliance of SSEG installations.

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Brenda Cebekhulu	Senior Manager: Asset Creation (KZN OU)
Eugene van Heerden	Technologist: Network Planning
Makhosazane Babopeng	Engineer: Network Engineering & Design (KZN OU)
Michael Mavundla	Senior Engineer: Network Engineering & Design (KZN OU)
Mohammed Rashid	Manager: Maintenance & Asset Management
Neville Booyens	Senior Engineer: Standards Implementation (KZN OU)
Patric Kabaze	Senior Technologist: Standards Implementation (FS OU)
Preshnee Chetty	Manager: Network Engineering & Design (KZN OU)
Riaz Asmal	Standards Implementation Manager (KZN OU)
Rudi Kleinhans	Standards Implementation Manager (FS OU)
Shabnum Behari	Senior Engineer: Standards Implementation (KZN OU)
Zaheer Saib	Manager: Control Plant Maintenance

5. Revisions

Date	Rev.	Compiler	Remarks
September 2024	0.0	MY Bux	Draft functional specification document compiled for the installation of solar PV and BESS at the Menston Office Complex, located in Westville.
October 2024	0.5	MY Bux	Final draft functional specification document submitted for review.
October 2024	0.6	MY Bux	Amended the draft document to incorporate the comments received.

Date	Rev.	Compiler	Remarks
October 2024	1	MY Bux	First issue.

6. Development team

The following people were involved in the development of this document:

- Mohammed Bux
- Neville Booyens
- Patric Kabaze
- Riaz Asmal
- Shabnum Behari

7. Acknowledgements

- Andre Bekker
- Christo van Zyl
- Dr Marubini Manyage
- Eugene van Heerden
- Thomas Jacobs

ANNEXURE A: EGI Compliance Test Report

Note 1. **In terms of South African legislation, the user or lessor is responsible for the safety of the embedded generation facility.**
Note 2. **ECSA Professional body registration required for signing off this EGI compliance test report.**
Note 3. **All listed items need to be completed for this form to be valid:**
Note 4. **All tests and requirements in this form must be done in person or witnessed in person by the signatory, for this form to be valid.**
Note 5. **A copy of the signed Certificate of Compliance (CoC), to be submitted as an annexure to this report. This certificate will exclude the EGI components but include all components of the circuit from the Customer Distribution Board up to the terminals at the end of the cable connected to the Embedded Generator. The EG installation shall be certified to comply with all prescriptions in this test report by the ECSA professional (PrEng or PrTech) competent registered person.**
Note 6. **When confirmation is required, answer "Yes" or "N/A" unless specifically instructed to indicate "Yes". The report shall not be issued if any "No" answers appear.**
Note 7. **Supplementary information is provided at the end of the form to further explain what is needed in order to complete this report.**

1. CERTIFICATE OF COMPLIANCE (CoC) NO. Issued under SANS 10142 -1		Date of Issue:
2. Name of building		
3. Physical Address of installation		
4. Type of EG installation: Inverters, batteries, standby generator, other (specify all combinations used)		
5. Total Generation Capacity installed in kWp (DC) AND total kW (AC)		
6. EGI compliance to all inspection and test requirements in NRS 097-2-1 and ALL grid codes (Indicate YES in confirmation)		

7. Signage boards installed at relevant places, agreed with Utility, and in accordance with SANS standards (Indicate YES in confirmation)	
8. Dead Grid Safety Lock (DGSL) Confirm manufacturer details and required electrical tests completed. (Indicate N/A if there is a lockable isolation switch installed that has been agreed with Utility - refer to item 8 in the SUPPLEMENTARY NOTES for more details)	N/A
9. Electromechanical switch with a coil energized from the utility side (Indicate N/A if there is a lockable isolation switch installed that has been agreed with Utility- refer to item 9 in the SUPPLEMENTARY NOTES for more details)	N/A
10. Lockable isolation switch that is accessible to Utility is installed (Indicate YES or N/A. N/A is applicable if a DGSL or electromechanical switch is installed that has been agreed with the Utility.	
11. Have operating instructions been provided for the installation? (Indicate YES in confirmation)	
12. Make of inverters Manufacturer detail – Include details of the inverter test certificates as annexure to this report Model No.'s for all generator units / Inverters No. of generator units / inverters installed including the KW size for each unit / inverter	

13. Islanding test (indicate YES in confirmation of test completion)	
14. Synchronization test (indicate YES in confirmation of test completion)	
15. Notices applied to all control points and the areas containing the EGI in accordance with Electrical Machine Regulation 5. (Indicate YES in confirmation)	
16. Where an alternative supply is installed, it complies with the SANS requirements in respect of these type of connections including a changeover switch and indicator. (Indicate YES in confirmation)	
17. Structural requirements, as per SANS 10400, related to the EGI identified and addressed (indicate YES or N/A)	
18. Reverse power flow blocking protection has been installed and commissioned to prevent reverse power flow into the utility distribution electricity network (Indicate YES or N/A)	
19. Protection settings have been set to comply with NRS 097-2-1 and the approved generation capacity maximum output of the inverter has been limited by appropriate hardware or software settings. (Indicate YES in confirmation)	

I (competent person's name) hereby declare that I have inspected the installation, examined the associated design and documentation. I have witnessed the relevant tests. I confirm that the information given above is correct and complies with the Grid Codes, NRS standards, SANS standards and the applicable statutory requirements.

ECSA Pr Eng or Pr Tech, Registration No. ……………………..…

Date: …………………………….

I confirm that I am "competent" in terms of the ECSA act and regulations.

Name of Competent Person: ……………………………………… (in good standing with the ECSA)

Telephone No. ……………………………………………………..…………..

Email Address: ……………………………………………………..…………..

Signature: ……………………………………………………..…………..