

HESSEQUA MUNICIPALITY

HES-TECH 04/2627

THE SUPPLY, DELIVERY AND INSTALLATION OF RENEWABLE ENERGY INFRASTRUCTURE ON AN AS AND WHEN REQUIRED BASIS FOR A PERIOD OF THREE YEARS

PART C3.1: DESCRIPTION OF WORKS
--

C3.1 DESCRIPTION OF WORKS

C3.1.1 OVERVIEW OF THE WORKS

Hessequa Municipality invites suitably qualified and experienced service providers for the supply, delivery, installation, testing, commissioning and maintenance of renewable energy infrastructure on an as-and-when-required basis for a period of three (3) years.

The Contract shall operate as a framework agreement whereby individual Work Orders will be issued by the Employer as and when required during the Contract period. No guarantee is given regarding the number, nature, value or frequency of Work Orders to be issued.

The Works may include the supply, delivery, installation, testing, commissioning, maintenance, upgrading, expansion, replacement and associated electrical works necessary to provide complete and operational renewable energy systems at municipal facilities throughout the Hessequa Municipal area.

The renewable energy infrastructure may include, but is not limited to, rooftop and ground-mounted solar photovoltaic (PV) systems, battery energy storage systems (BESS), hybrid inverter systems, energy management and monitoring systems, mounting structures, battery enclosures, switchgear, protection equipment, cabling, electrical distribution equipment and all other equipment and components required to provide a complete and operational renewable energy installation.

All Works shall comply with the latest applicable South African legislation, regulations, standards, municipal requirements and the technical specifications contained in this Contract.

C3.1.2 OBJECTIVES OF THE CONTRACT

The objectives of this Contract are to:

- a) establish a framework agreement for the supply, delivery, installation, testing, commissioning and maintenance of renewable energy infrastructure throughout the Hessequa Municipal area;
- b) provide the Municipality with a flexible and efficient procurement mechanism for renewable energy projects on an as-and-when-required basis;
- c) facilitate the implementation of renewable energy projects of varying sizes and configurations at municipal facilities;

- d) ensure that all renewable energy infrastructure supplied and installed under this Contract complies with the applicable South African legislation, regulations, standards and municipal requirements;
- e) promote the implementation of safe, reliable, efficient and sustainable renewable energy infrastructure;
- f) standardise the technical, quality and performance requirements for renewable energy infrastructure supplied under this Contract;
- g) provide a consistent basis for the evaluation of renewable energy solutions using prescribed reference systems and a Levelised Cost of Energy (LCOE) methodology;
- h) provide renewable energy infrastructure that delivers long-term value, reliability and operational performance throughout its design life.

C3.1.3 SCOPE OF THE WORKS

The Contractor shall, upon instruction by the Employer through the issue of a Work Order, undertake such Works as may be required under this Contract. The Works may include, but shall not be limited to, the following:

Activity	Scope of the Works
Site Investigation and Assessment	<i>Site inspections; verification of existing electrical infrastructure; load assessments; condition assessments; feasibility investigations; collection of site data; and verification of installation requirements.</i>
Design and Engineering	<i>System design; preparation of single-line diagrams (SLDs); layout drawings; equipment selection; cable sizing; protection coordination; earthing design; structural coordination; battery sizing; monitoring integration; and supporting engineering calculations, where applicable.</i>
Supply and Delivery	<i>Supply and delivery of renewable energy infrastructure, including photovoltaic (PV) modules, battery energy storage systems (BESS), hybrid inverters, mounting structures, switchgear, protection equipment, monitoring systems, electrical distribution equipment, cabling and all associated components required for a complete installation.</i>
Installation	<i>Installation of rooftop and ground-mounted renewable energy systems; battery energy storage systems; hybrid inverter systems; mounting structures; AC and DC reticulation; protection equipment; monitoring systems; earthing systems; electrical distribution equipment; and associated civil works where required.</i>
Integration and Upgrades	<i>Expansion of existing renewable energy systems; replacement of defective or obsolete equipment; integration with existing electrical infrastructure; system upgrades; and modifications required to improve system performance or capacity.</i>

Testing and Commissioning	<i>Inspection; testing; commissioning; functional verification; protection testing; monitoring configuration; system optimisation; performance verification; and operational acceptance testing.</i>
Documentation and Handover	<i>Provision of Certificates of Compliance; as-built drawings; operating and maintenance manuals; equipment datasheets; warranty documentation; test certificates; training of Employer personnel; and all documentation required for project handover.</i>
Maintenance and Support	<i>Preventative maintenance; corrective maintenance; fault finding; repairs; replacement of defective components; firmware and software updates, where applicable; and warranty support when instructed by the Employer.</i>

The precise combination of activities required for each project shall be specified in the applicable Work Order, and the inclusion of an activity in this general scope shall not constitute an instruction to perform that activity.

C3.1.4 WORK ORDERS

The Contract shall operate as a framework agreement whereby the Employer shall issue individual Work Orders to the Contractor for specific renewable energy projects during the Contract period.

Each Work Order shall define the scope, location, technical requirements, quantities, programme and any special requirements applicable to the specific project.

The Contractor shall only commence the Works upon receipt of a written Work Order issued by the Employer.

Work Orders may comprise a single activity or any combination of activities described in this Contract and may include projects of varying size, complexity and value.

The issue of a Work Order shall not relieve the Contractor of any obligations in terms of this Contract, and all Works shall be executed in accordance with the Conditions of Contract, Specifications, Pricing Data and any additional requirements contained in the applicable Work Order.

Where required, the Employer may specify additional project-specific technical requirements, performance criteria, design parameters, delivery periods or installation constraints within the applicable Work Order, provided that such requirements do not conflict with the Conditions of Contract or the technical requirements contained herein.

The Contractor shall review each Work Order upon receipt and promptly notify the Employer of any discrepancies, ambiguities or technical constraints that may affect the successful execution of the Works. Each Work Order shall identify the applicable Pricing Schedule items, instructed quantities and any project-specific deliverables required for the Works.

The reference renewable energy systems used for tender evaluation shall be for evaluation purposes only and shall not limit the type, size, configuration or location of renewable energy infrastructure that may be procured under individual Work Orders during the Contract period.

C3.1.5 LOCATIONS OF THE WORKS

The Works may be undertaken at any municipal facility or property owned, operated or managed by Hessequa Municipality within the municipal area.

Locations may include, but are not limited to, administrative buildings, depots, libraries, community facilities, water treatment works, wastewater treatment works, pump stations, reservoirs, electrical substations, workshops, sport facilities, traffic facilities and any other municipal property identified by the Employer.

The Contractor shall be deemed to have made allowance for the execution of the Works at any location within the Hessequa Municipal area. Any adjustment to the Contract Price arising from project-specific location requirements shall only be made where expressly provided for in the Pricing Data or the applicable Work Order.

C3.1.6 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall:

- a) execute all Work Orders in accordance with the Conditions of Contract, Specifications, Pricing Data and the requirements of the applicable Work Order;
- b) supply all labour, supervision, materials, plant, equipment, tools, transport and temporary works necessary to complete the Works, unless otherwise specified;
- c) ensure that all materials and equipment supplied under this Contract are new, unused and fit for their intended purpose;
- d) ensure that all Works are carried out by suitably qualified, competent and authorised personnel;
- e) comply with all applicable South African legislation, regulations, standards, codes of practice and municipal requirements;
- f) comply with all occupational health and safety requirements applicable to the Works;
- g) protect existing municipal infrastructure and make good any damage arising from the execution of the Works;
- h) coordinate the Works to minimise disruption to municipal operations and public services;
- i) provide all documentation, test certificates, commissioning records, warranties and operating manuals required in terms of this Contract;
- j) promptly notify the Employer of any conditions that may affect the successful completion of the Works; a
- k) maintain effective communication with the Employer throughout the execution of each Work Order; and
- l) verify all dimensions, quantities, site conditions and existing infrastructure relevant to the applicable Work Order before ordering equipment or commencing installation.

C3.1.7 EMPLOYER'S RESPONSIBILITIES

The Employer shall:

- a) issue Work Orders in accordance with the Conditions of Contract;
- b) provide the Contractor with all available information relevant to the Works;
- c) provide reasonable access to municipal properties where the Works are to be undertaken;
- d) review and respond to submissions, drawings and documentation submitted by the Contractor within a reasonable period;
- e) inspect the Works and witness testing and commissioning where required;
- f) issue instructions and approvals necessary for the execution of the Works;
- g) certify completed Works and process payments in accordance with the Conditions of Contract; and
- h) identify the Employer's authorised representative for the administration of each Work Order.

C3.1.8 APPLICABLE STANDARDS AND LEGISLATION

All Works, materials, equipment and installations shall comply with the applicable South African legislation, regulations, standards, codes of practice and municipal requirements in force on the date of issue of the applicable Work Order, unless otherwise instructed by the Employer.

This includes, but is not limited to, the following:

- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended.
- Construction Regulations, 2014, as amended.
- Electrical Installation Regulations.
- SANS 10142-1 – The Wiring of Premises.
- SANS 10142-3 – Low-Voltage Embedded Generation.
- NRS 097 Series.
- SANS/IEC 62548.
- SANS/IEC 62446 Series.
- IEC 61215.
- IEC 61730.
- IEC 62109 Series.
- IEC 62116.
- IEC 61727.
- IEC 62619.
- Applicable municipal Small-Scale Embedded Generation (SSEG) requirements.
- Applicable electricity distributor requirements.
- Any other applicable South African legislation, regulations, standards and codes of practice.

Where legislation, regulations or standards are amended or superseded during the Contract period, the applicable requirements shall be determined by the Employer for the relevant Work Order.

HESSEQUA MUNICIPALITY

HES-TECH 04/2627

THE SUPPLY, DELIVERY AND INSTALLATION OF RENEWABLE ENERGY INFRASTRUCTURE ON AN AS AND WHEN REQUIRED BASIS FOR A PERIOD OF THREE (3) YEARS

PART C3.2: REFERENCE SYSTEMS FOR TENDER EVALUATION

C3.2 REFERENCE SYSTEMS FOR TENDER EVALUATION

C3.2.1 GENERAL

The reference systems contained in this section have been established solely for the purpose of evaluating Tenders on a consistent, objective and comparable basis.

The reference systems shall not constitute guaranteed Work Orders and shall not limit the type, size, configuration or location of renewable energy infrastructure that may be procured under the Contract.

Individual Work Orders may differ from the reference systems with regard to system capacity, equipment selection, installation arrangement, site conditions and project-specific requirements.

The technical and financial evaluation of the reference systems shall be undertaken using the Employer-issued Microsoft Excel pricing workbook and the Tendered Rates entered in Pricing Schedules A to D.

C3.2.2 PRESCRIBED REFERENCE SYSTEMS

The following reference systems shall be used for tender evaluation:

Reference system	PV capacity	Inverter capacity	Usable BESS capacity	Installation type	Evaluation weighting
Small Reference System	16 kWp	16 kW	20 kWh	Rooftop	20%
Medium Reference System	50 kWp	50 kW	100 kWh	Rooftop	30%
Large Rooftop Reference System	100 kWp	100 kW	200 kWh	Rooftop	25%
Large Ground-Mounted Reference System	100 kWp	100 kW	200 kWh	Ground-mounted	25%

The prescribed capacities and evaluation weightings shall not be amended by the Tenderer.

C3.2.3 REFERENCE-SYSTEM CONFIGURATION

Each reference system shall comprise, as applicable:

- a) photovoltaic modules;
- b) a hybrid inverter system;
- c) a battery energy storage system;
- d) mounting structures;
- e) AC and DC reticulation;
- f) switchgear, protection and isolation equipment;
- g) earthing and bonding;
- h) monitoring and communication equipment;
- i) installation, testing and commissioning;
- j) engineering, compliance and handover services; and
- k) the maintenance and replacement-cost components prescribed in the pricing workbook.

The specific quantities and scheduled items used for each reference system are contained in the Employer-issued pricing workbook.

C3.2.4 EVALUATION ASSUMPTIONS

The Employer has prescribed the assumptions required for the calculation of the Levelised Cost of Energy of each reference system.

These assumptions include, but are not limited to:

- a) an analysis period of twenty-five years;
- b) annual photovoltaic-module degradation;
- c) system availability;
- d) a real discount rate;
- e) battery and inverter replacement years;
- f) annual energy yield;
- g) route lengths and installation assumptions; and
- h) the evaluation weightings applicable to each reference system.

The prescribed assumptions are contained in the locked Assumptions worksheet of the Employer-issued pricing workbook.

The Tenderer shall not amend, substitute or deviate from any prescribed assumption.

C3.2.5 TENDERER INPUTS

The Tenderer shall complete only:

- a) the designated information fields on the Cover worksheet; and
- b) the designated bidder-input cells contained in Pricing Schedules A to D.

The reference-system quantities, assumptions, calculations, formulae and evaluation weightings shall be locked and shall not be amended.

The Tenderer is not required to prepare separate manual cost calculations or LCOE calculations for the reference systems.

C3.2.6 TECHNICAL COMPLIANCE

Equipment priced for the reference systems shall comply with the minimum technical requirements specified in Part C3.3 and the Technical Compliance Schedules contained in Part C3.4.

The Tenderer shall submit the required manufacturer details, models, datasheets, warranties and compliance information for the proposed major equipment.

The use of standardised reference-system quantities for financial evaluation shall not relieve the Tenderer of the obligation to demonstrate technical compliance.

C3.2.7 COMPOSITE LCOE

The pricing workbook shall calculate a separate LCOE for each prescribed reference system.

The individual LCOE values shall be combined using the evaluation weightings specified in C3.2.2 to determine the Composite LCOE.

The Composite LCOE shall be used as the evaluated price in accordance with Part C2.3 and the Tender Data.

C3.2.8 EVALUATION USE ONLY

The reference systems, quantities, lifecycle assumptions and LCOE calculations shall be used solely for tender evaluation.

They shall not:

- a) guarantee that any corresponding Work Order will be issued;
- b) establish minimum or maximum quantities under the Contract;
- c) constitute a final design for any municipal site; or
- d) restrict the Employer from issuing Work Orders for systems of different capacities or configurations.

HESSEQUA MUNICIPALITY

HES-TECH 04/2627

THE SUPPLY, DELIVERY AND INSTALLATION OF RENEWABLE ENERGY INFRASTRUCTURE ON AN AS AND WHEN REQUIRED BASIS FOR A PERIOD OF THREE (3) YEARS

PART C3.3: TECHNICAL SPECIFICATIONS
--

C3.3 TECHNICAL SPECIFICATIONS

C3.3.1 GENERAL TECHNICAL REQUIREMENTS

All renewable energy infrastructure supplied, installed, tested and commissioned under this Contract shall comply with the requirements of this Contract, the applicable Work Order, all applicable South African legislation, regulations, standards, codes of practice, electricity distributor requirements and municipal requirements.

The Contractor shall be responsible for the complete design, supply, delivery, installation, integration, testing, commissioning and handover of renewable energy systems suitable for the intended application.

All systems shall be designed and installed to ensure safe, reliable, efficient and long-term operation throughout the intended design life of the installation.

The Contractor shall ensure that all equipment and materials supplied under this Contract are:

- a) new, unused and free from defects;
- b) suitable for the intended application and installation environment;
- c) manufactured by reputable manufacturers with proven experience in renewable energy applications;
- d) compliant with the applicable standards, certifications and grid-connection requirements;
- e) compatible with all other proposed and existing system components;
- f) supported by appropriate manufacturer warranties, technical documentation and after-sales support; and
- g) capable of being maintained and supported within South Africa for the foreseeable service life of the equipment.

The Contractor shall undertake all design activities necessary to provide a complete and operational renewable energy installation, including, where applicable:

- site investigation and verification of existing infrastructure;
- load assessment and analysis;
- renewable energy system sizing;
- photovoltaic array design;
- battery energy storage sizing;
- inverter selection and configuration;
- electrical design;
- cable sizing and voltage-drop calculations;
- protection coordination and fault-level assessment;
- earthing and bonding design;

- structural assessment and coordination;
- grid-connection and export-control design;
- monitoring, metering and communication integration; and
- preparation of all drawings, calculations, schedules and supporting technical documentation.

The Contractor shall verify all dimensions, quantities, routes, connection points, equipment ratings, available capacities and site conditions relevant to the applicable Work Order before ordering equipment or commencing installation.

Where information supplied by the Employer is incomplete, inaccurate or inconsistent with the actual site conditions, the Contractor shall promptly notify the Employer before proceeding with the affected work.

The Contractor shall verify the compatibility of all proposed equipment, including:

- a) PV module and inverter voltage and current ratings;
- b) inverter and BESS voltage ranges;
- c) battery management system and inverter communication protocols;
- d) monitoring, metering and energy-management interfaces;
- e) firmware and software compatibility;
- f) protection equipment ratings and coordination; and
- g) compatibility with existing municipal infrastructure where integration is required.

Equipment shall not be ordered until the Contractor has completed the necessary design and compatibility verification.

Where existing renewable energy infrastructure is to be expanded, upgraded, replaced or integrated, the Contractor shall inspect and record the existing system configuration and shall identify any incompatibilities, limitations or additional equipment required before finalising the design.

No existing equipment shall be disconnected, modified, reconfigured, removed or replaced without the prior approval of the Employer.

The Contractor shall provide all labour, supervision, materials, equipment, plant, tools, temporary works, transport and services necessary to deliver a complete and operational installation, unless otherwise specified in the applicable Work Order.

All equipment shall be installed in accordance with:

- a) the approved design;
- b) the manufacturer's installation instructions;
- c) applicable legislation, standards and codes of practice;
- d) electricity distributor and municipal requirements; and
- e) the requirements of the applicable Work Order.

The Contractor shall ensure that the installation does not compromise the safety, reliability, performance, warranties or statutory compliance of any existing municipal infrastructure.

Where a proposed installation or modification may adversely affect existing infrastructure or municipal operations, the Contractor shall notify the Employer and shall not proceed until written instruction has been received.

All renewable energy systems shall comply with the applicable standards listed in C3.1.8 and any additional project-specific standards identified in the applicable Work Order.

C3.3.2 SOLAR PHOTOVOLTAIC (PV) MODULES

The Contractor shall supply and install photovoltaic (PV) modules suitable for the intended application and environmental conditions at the installation site.

PV modules shall be new, unused and manufactured by an established manufacturer with proven experience in commercial, industrial or municipal-scale solar photovoltaic installations.

The PV modules shall comply with the requirements of this Contract and applicable international and South African standards.

The Contractor shall ensure that the selected PV modules are suitable for the applicable environmental conditions, including exposure to coastal conditions, humidity, wind loading, temperature variations and ultraviolet radiation.

<i>Parameter</i>	<i>Requirement</i>
<i>Module Technology</i>	<i>Monocrystalline photovoltaic modules or equivalent proven technology</i>
<i>Module Type</i>	<i>Commercial/utility-grade high-efficiency PV modules</i>
<i>Cell Technology</i>	<i>N-type or equivalent high-performance technology</i>
<i>Certification</i>	<i>IEC 61215 and IEC 61730 certified</i>
<i>Module Efficiency</i>	<i>Minimum 21.5%</i>
<i>Power Tolerance</i>	<i>0 W to +5 W</i>
<i>Annual Degradation Rate</i>	<i>Maximum 0.50% per annum</i>
<i>Product Warranty</i>	<i>Minimum 15 years</i>
<i>Performance Warranty</i>	<i>Minimum 30 years</i>
<i>Maximum System Voltage</i>	<i>Suitable for proposed system design</i>
<i>Environmental Suitability</i>	<i>Suitable for local climatic and environmental conditions</i>
<i>Salt Mist Resistance</i>	<i>Required for coastal installations where applicable</i>
<i>PID Resistance</i>	<i>Required</i>

PV modules shall be installed in accordance with the manufacturer's requirements and shall include suitable mounting arrangements, cable management, mechanical fixing and protection against environmental exposure.

The Contractor shall ensure that all PV modules are correctly designed, supplied, installed, tested and commissioned in accordance with the manufacturer's requirements, applicable standards and the requirements of this Contract.

The Contractor shall provide all relevant technical documentation, certification documentation, warranty certificates, serial number records and commissioning records required for project handover

C3.3.3 HYBRID INVERTERS

The Contractor shall supply and install hybrid inverter systems suitable for the intended application and compatible with the proposed photovoltaic (PV) and Battery Energy Storage System (BESS) configuration.

Hybrid inverters shall be new, unused and manufactured by an established manufacturer with proven experience in commercial, industrial or municipal renewable energy applications.

The hybrid inverter system shall be designed to safely integrate PV generation, battery energy storage and the municipal electrical supply network.

The hybrid inverter shall comply with the applicable South African standards, grid connection requirements and the technical requirements specified in this Contract.

The following minimum requirements shall apply:

<i>Parameter</i>	<i>Requirement</i>
<i>Inverter Type</i>	<i>Three-phase or single-phase hybrid inverter as required by the applicable Work Order</i>
<i>Application</i>	<i>Grid-connected operation with battery storage capability</i>
<i>Output Voltage</i>	<i>Suitable for 230/400 V AC, 50 Hz municipal distribution systems</i>
<i>Grid Connection</i>	<i>Compliant with applicable grid connection requirements</i>
<i>Battery Compatibility</i>	<i>Compatible with lithium-ion battery systems, including LiFePO₄ where applicable</i>
<i>PV Input</i>	<i>Minimum two MPPT inputs, suitably rated for the proposed PV array configuration</i>
<i>Efficiency</i>	<i>Minimum 97%</i>
<i>Protection Functions</i>	<i>Anti-islanding, over-voltage, over-current, short-circuit and thermal protection</i>
<i>Operating Modes</i>	<i>Grid-connected, battery backup and energy management modes</i>
<i>Export Control</i>	<i>Capable of export limitation and zero-export operation where required</i>

Parallel Operation	<i>Capable of parallel operation in accordance with manufacturer requirements</i>
Communication Interfaces	<i>CAN, RS485, Modbus and/or Ethernet communication capability</i>
Remote Monitoring	<i>Web-based or cloud monitoring capability</i>
Firmware Updates	<i>Remote firmware update capability where supported by manufacturer</i>
Environmental Rating	<i>Minimum IP65 or suitable for the proposed installation environment</i>
Product Warranty	<i>Minimum 5 years</i>

Where required by the applicable Work Order, the inverter shall comply with NRS 097, IEC 62109, IEC 62116 and IEC 61727, or equivalent recognised standards acceptable to the Employer.

The hybrid inverter shall be selected to ensure compatibility with the photovoltaic (PV) array, battery energy storage system (BESS), protection equipment, monitoring platform and existing municipal electrical infrastructure.

The Contractor shall ensure that all hybrid inverter systems are correctly designed, supplied, installed, configured, tested and commissioned in accordance with the manufacturer's requirements, applicable standards and the requirements of this Contract.

The Contractor shall provide all relevant technical documentation, manufacturer datasheets, compliance documentation, warranty certificates, configuration records, test results and commissioning records required for project handover.

C3.3.4 BATTERY ENERGY STORAGE SYSTEMS (BESS)

The Contractor shall supply and install Battery Energy Storage Systems (BESS) suitable for the intended application and compatible with the proposed renewable energy system configuration.

Battery Energy Storage Systems shall be new, unused and manufactured by an established manufacturer with proven experience in commercial, industrial or municipal energy storage applications.

The BESS shall be designed to safely store and discharge electrical energy generated from renewable energy sources and shall be suitable for integration with hybrid inverter systems and municipal electrical infrastructure.

The BESS shall comply with the applicable South African legislation, standards and safety requirements applicable to energy storage systems.

The following minimum requirements shall apply:

Parameter	Requirement
Battery Technology	<i>Lithium-ion battery technology</i>

Battery Chemistry	<i>Lithium Iron Phosphate (LiFePO₄) or equivalent proven battery chemistry</i>
System Configuration	<i>Battery system suitable for the required energy capacity and compatible with the proposed inverter configuration</i>
Nominal Voltage	<i>Suitable for the proposed inverter system</i>
Usable Capacity	<i>As specified in the applicable Work Order</i>
Depth of Discharge	<i>As recommended by the manufacturer</i>
Battery Management System (BMS)	<i>Integrated BMS required</i>
Thermal Management	<i>Integrated thermal monitoring and protection</i>
Safety Protection	<i>Over-voltage, over-current, over-temperature and short-circuit protection required</i>
Inverter Compatibility	<i>Compatible with the proposed hybrid inverter system</i>
Communication	<i>CAN, RS485, Modbus or equivalent communication capability</i>
Monitoring	<i>Remote monitoring of battery status, alarms and performance data</i>
Scalability	<i>Capable of future expansion where required</i>
Installation Environment	<i>Suitable for the proposed indoor or outdoor installation location</i>
Enclosure Protection	<i>Suitable IP rating for the installation environment</i>
Performance Warranty	<i>Minimum 10 years</i>
End-of-Life Capacity	<i>Minimum 80% remaining capacity at end of warranty period</i>

The BESS installation shall include all equipment necessary for the safe, reliable and complete operation of the energy storage system, including the battery modules, battery management system (BMS), protection devices, isolation equipment, enclosures, communication interfaces and associated accessories.

The Contractor shall ensure that all Battery Energy Storage Systems (BESS) are correctly designed, supplied, installed, configured, tested and commissioned in accordance with the manufacturer's requirements, applicable standards and the requirements of this Contract. The Contractor shall provide all relevant technical documentation, manufacturer datasheets, safety certifications, warranty documentation, test results, commissioning records and as-built documentation required for project handover.

C3.3.5 MOUNTING STRUCTURES

The Contractor shall supply and install mounting structures suitable for the proposed photovoltaic (PV) installation type and site conditions.

Mounting structures shall be designed to provide secure mechanical support for PV modules throughout the intended design life of the installation and shall comply with all applicable structural, safety and environmental requirements.

The Contractor shall ensure that all mounting structures are suitable for the applicable installation environment, including exposure to wind loading, temperature variations, moisture, corrosion and coastal conditions where applicable.

The following minimum requirements shall apply:

Parameter	Requirement
Installation Type	<i>Suitable for rooftop and/or ground-mounted PV installations as required</i>
Design Life	<i>Minimum 25 years</i>
Structural Material	<i>Aluminium, galvanised steel or equivalent corrosion-resistant material</i>
Corrosion Protection	<i>Suitable for the installation environment, including coastal conditions where applicable</i>
Wind Loading	<i>Designed for site-specific wind loading requirements</i>
Mechanical Strength	<i>Capable of safely supporting PV modules and associated loads</i>
Module Compatibility	<i>Compatible with proposed PV module dimensions and fixing requirements</i>
Fasteners and Hardware	<i>Stainless steel or corrosion-resistant fasteners suitable for the environment</i>
Earthing/Bonding	<i>Provision for electrical bonding and earthing in accordance with applicable standards</i>
Roof Integration	<i>Suitable for the existing roof type without compromising roof integrity</i>
Ground Mounting	<i>Suitable foundations and support structures for ground-mounted installations</i>

The Contractor shall be responsible for verifying the suitability of existing roof structures where rooftop PV installations are proposed.

Where roof penetrations are required, the Contractor shall ensure that such penetrations are properly sealed and waterproofed and that the integrity of the existing roof is not compromised.

For ground-mounted installations, the Contractor shall undertake all necessary assessments and provide suitable foundations, support structures and civil works required for a complete and stable installation.

Ground-mounted structures and foundations shall be designed with due consideration to site-specific wind loading, soil conditions, drainage and corrosion exposure.

The Contractor shall provide mounting structure drawings, design information, material specifications and manufacturer documentation where required by the Employer.

C3.3.6 DC ELECTRICAL INSTALLATION

The Contractor shall design, supply, install, test and commission all DC electrical infrastructure required for the complete operation of the photovoltaic (PV) system.

All DC electrical installations shall comply with the applicable electrical installation regulations, standards and manufacturer requirements.

The Contractor shall ensure that all DC components are correctly selected, installed and protected to ensure safe operation under normal operating conditions and foreseeable fault conditions.

The following minimum requirements shall apply:

<i>Parameter</i>	<i>Requirement</i>
<i>DC System Design</i>	<i>Suitable for the proposed PV array and inverter configuration</i>
<i>DC Cabling</i>	<i>UV-resistant, solar-rated DC cables suitable for outdoor PV applications</i>
<i>Cable Rating</i>	<i>Suitable for the maximum system voltage, current, temperature and installation conditions</i>
<i>PV Connectors</i>	<i>Compatible with PV modules and inverter inputs and installed in accordance with manufacturer requirements</i>
<i>DC Protection</i>	<i>Appropriate DC protection equipment including isolators and overcurrent protection where required</i>
<i>DC Isolators</i>	<i>Rated for the applicable DC voltage and current</i>
<i>Cable Installation</i>	<i>Cables shall be installed to prevent mechanical damage, UV degradation and water ingress and shall not be laid directly on roof surfaces or sharp edges.</i>
<i>Cable Management</i>	<i>Proper routing, securing and separation shall be provided</i>
<i>Labelling</i>	<i>All DC circuits, isolators and equipment shall be clearly labelled</i>
<i>Testing</i>	<i>DC insulation resistance, polarity, continuity and functional testing shall be completed prior to commissioning</i>

The Contractor shall ensure that:

- a) PV strings are designed within the operating voltage and current limits of the selected inverter;
- b) DC cables are appropriately sized to minimise voltage losses and comply with applicable standards;
- c) DC connectors are correctly matched and shall not be mixed between incompatible manufacturers or systems;
- d) all DC equipment is accessible for inspection, maintenance and safe isolation; and
- e) all DC installations are protected against environmental exposure and mechanical damage.

The Contractor shall provide DC design calculations, cable schedules, protection details and test results as part of the project documentation.

C3.3.7 AC ELECTRICAL INSTALLATION

The Contractor shall design, supply, install, test and commission all AC electrical infrastructure required for the complete operation and integration of the renewable energy system with the existing municipal electrical installation.

All AC electrical installations shall comply with the applicable South African legislation, electrical installation regulations, standards, electricity distributor requirements and the requirements of this Contract.

The Contractor shall ensure that all AC components are correctly selected, coordinated and installed to ensure safe, reliable and efficient operation of the renewable energy system.

The following minimum requirements shall apply:

Parameter	Requirement
AC System Voltage	<i>Suitable for the existing municipal electrical supply, typically 230/400 V AC, 50 Hz</i>
Point of Connection	<i>Existing municipal distribution board or designated connection point as specified in the applicable Work Order</i>
AC Cabling	<i>Suitable low-voltage power cables rated for the installation conditions</i>
Cable Sizing	<i>Designed in accordance with applicable standards, current-carrying capacity, voltage drop and protection requirements</i>
Switchgear	<i>Suitable rated switchgear and isolation equipment shall be provided</i>
Protection Equipment	<i>Overcurrent, short-circuit, earth leakage and surge protection as required</i>
Grid Connection Protection	<i>Protection functions suitable for grid-connected operation</i>

Export Control	<i>Export limitation or zero-export functionality where required by the Employer or electricity distributor</i>
Labelling	<i>All AC circuits, equipment and isolation points shall be clearly labelled</i>
Accessibility	<i>Equipment shall be installed to allow safe operation, inspection and maintenance</i>

The Contractor shall ensure that:

- a) the renewable energy system is correctly integrated with the existing municipal electrical infrastructure;
- b) protection settings are coordinated with the existing electrical installation and applicable grid requirements;
- c) voltage rise, voltage drop and fault level considerations are addressed during design;
- d) all switchgear, protection equipment and distribution equipment are suitably rated for the proposed installation;
- e) modifications to existing municipal electrical infrastructure are undertaken only with approval from the Employer; and
- f) all electrical connections are completed by suitably qualified and authorised personnel.
- g) the available fault level, existing protection ratings and capacity of the proposed point of connection are verified before finalising the design.

The Contractor shall provide all relevant updated single-line diagrams, protection settings, cable calculations, test certificates, Certificates of Compliance, commissioning records and any documentation required for municipal SSEG registration or electricity distributor approval.

C3.3.8 MONITORING AND COMMUNICATION SYSTEMS

The Contractor shall supply, install, configure and commission monitoring and communication systems required for the effective operation, supervision and performance monitoring of renewable energy installations.

The monitoring system shall provide the Employer with access to relevant operational data, system status information, alarms and performance information for installed renewable energy systems.

The monitoring and communication system shall be compatible with the installed PV modules, hybrid inverter systems, battery energy storage systems (BESS) and associated equipment.

The following minimum requirements shall apply:

Parameter	Requirement
------------------	--------------------

Monitoring Capability	<i>Real-time monitoring of renewable energy system performance</i>
Data Monitoring	<i>Monitoring of PV generation, battery status, inverter operation and system performance</i>
Remote Access	<i>Web-based and/or application-based remote monitoring capability</i>
Communication Interfaces	<i>Ethernet, Wi-Fi, RS485, CAN, Modbus or equivalent communication protocols</i>
Data Logging	<i>Continuous recording and storage of operational data</i>
Alarm Monitoring	<i>Fault, warning and abnormal operating condition notifications</i>
User Access	<i>Secure access control for authorised municipal personnel</i>
Historical Data	<i>Availability of historical performance data and reports</i>
System Integration	<i>Capability for integration with third-party monitoring or energy management platforms where required</i>
Communication Reliability	<i>Suitable communication method for the installation location</i>

The Contractor shall ensure that:

- a) all monitoring equipment is correctly configured and commissioned;
- b) communication between PV systems, hybrid inverters, BESS and monitoring platforms is fully functional;
- c) the Employer receives all required access credentials and user information;
- d) the Employer receives administrator access and ownership or transferable access rights to the monitoring platform;
- e) system alarms and notifications are configured appropriately;
- f) monitoring data remains available for system performance assessment and maintenance purposes; and
- g) all monitoring equipment is installed in accordance with manufacturer requirements.

The Contractor shall provide all relevant monitoring system documentation, communication configuration details, user manuals, access credentials, data reporting information and training for the Employer's personnel where required.

C3.3.9 PROTECTION EQUIPMENT

The Contractor shall design, supply, install, test and commission all protection equipment required for the safe and reliable operation of renewable energy systems.

Protection equipment shall be selected and coordinated to protect the renewable energy installation, existing municipal electrical infrastructure, connected equipment and personnel.

All protection equipment shall comply with the applicable South African legislation, regulations, standards, electricity distributor requirements and the requirements of this Contract.

The Contractor shall ensure that protection systems are suitable for the proposed system configuration, including photovoltaic (PV) generation, battery energy storage systems (BESS), hybrid inverters and grid connection arrangements.

The following minimum requirements shall apply:

<i>Parameter</i>	<i>Requirement</i>
<i>Protection Design</i>	<i>Suitable for the proposed system configuration and connection point</i>
<i>Overcurrent Protection</i>	<i>Required for protection against overload and fault conditions</i>
<i>Short-Circuit Protection</i>	<i>Required for all applicable AC and DC circuits</i>
<i>Surge Protection</i>	<i>Suitable surge protection devices shall be provided where required</i>
<i>Isolation Equipment</i>	<i>Safe isolation facilities shall be provided for maintenance and emergency purposes</i>
<i>Anti-Islanding Protection</i>	<i>Required for grid-connected systems</i>
<i>Over/Under Voltage Protection</i>	<i>Required</i>
<i>Over/Under Frequency Protection</i>	<i>Required where applicable</i>
<i>Earth Fault Protection</i>	<i>Provided in accordance with applicable standards and system requirements</i>
<i>Protection Coordination</i>	<i>Protection settings shall be coordinated with existing municipal electrical infrastructure</i>
<i>Labelling</i>	<i>All protection devices and isolation points shall be clearly identified</i>

The Contractor shall ensure that:

- a) protection devices are correctly rated for the applicable voltage, current and fault levels;
- b) protection settings are configured in accordance with manufacturer requirements and applicable grid connection requirements;
- c) protection equipment remains accessible for inspection, testing and maintenance;

- d) all protection systems are tested and verified during commissioning; and
- e) any modifications to existing municipal protection systems are approved by the Employer prior to implementation.

The Contractor shall provide all relevant protection design details, protection settings, coordination information, test results, inspection records and updated as-built documentation required for project handover.

C3.3.10 EARTHING AND LIGHTNING PROTECTION

The Contractor shall design, supply, install, test and commission all earthing and lightning protection systems required for the safe operation of renewable energy installations.

The earthing and lightning protection systems shall protect personnel, equipment and the municipal electrical infrastructure against electrical faults, lightning events and transient overvoltages.

All earthing and lightning protection installations shall comply with the applicable South African legislation, regulations, standards and the requirements of this Contract.

The Contractor shall ensure that earthing and lightning protection systems are suitable for the proposed installation type, including rooftop PV systems, ground-mounted PV systems, battery energy storage systems (BESS) and associated electrical equipment.

The following minimum requirements shall apply:

<i>Parameter</i>	<i>Requirement</i>
<i>Earthing System</i>	<i>Designed and installed in accordance with applicable standards and installation requirements</i>
<i>Equipment Bonding</i>	<i>All exposed conductive parts shall be bonded and earthed where required</i>
<i>PV Module Frames</i>	<i>PV module mounting structures and frames shall be electrically bonded</i>
<i>Inverter Earthing</i>	<i>Inverters shall be connected to the applicable protective earth system</i>
<i>BESS Earthing</i>	<i>Battery systems and associated enclosures shall be suitably earthed</i>
<i>Lightning Protection</i>	<i>Provided where required based on site conditions and risk assessment</i>
<i>Surge Protection</i>	<i>Coordinated surge protection shall be provided where required</i>
<i>Earth Continuity</i>	<i>Earth continuity shall be verified during testing and commissioning</i>

Testing	<i>Earth resistance and continuity testing shall be completed prior to commissioning</i>
----------------	--

The Contractor shall ensure that:

- a) all metallic structures associated with the renewable energy installation are appropriately bonded;
- b) earthing conductors are correctly sized and installed to prevent mechanical damage and environmental deterioration;
- c) lightning protection measures are coordinated with surge protection equipment;
- d) existing municipal earthing arrangements are assessed prior to connection of new renewable energy infrastructure;
- e) any deficiencies in existing earthing systems are reported to the Employer; and
- f) all earthing and lightning protection systems are tested and documented before system handover.

The Contractor shall provide all relevant earthing and lightning protection design information, test results, inspection records, commissioning records and updated as-built documentation required for project handover.

C3.3.11 EXISTING SYSTEM EXPANSION AND INTEGRATION

The Contractor shall undertake the expansion, upgrading, replacement or integration of existing renewable energy infrastructure where instructed by the Employer through an applicable Work Order.

The Contractor shall ensure that any modifications to existing systems are properly assessed, designed and implemented to maintain safe, reliable and compliant operation of the complete renewable energy installation.

Existing systems may include, but are not limited to, photovoltaic (PV) systems, battery energy storage systems (BESS), inverters, monitoring systems, electrical distribution equipment and associated infrastructure.

The following minimum requirements shall apply:

Parameter	Requirement
Existing System Assessment	<i>Condition assessment and verification of existing equipment and infrastructure prior to modifications</i>
System Compatibility	<i>New equipment shall be compatible with existing equipment where retained</i>
Design Integration	<i>Proposed modifications shall consider existing system capacity, limitations and operational requirements</i>
Existing PV Integration	<i>Existing PV arrays shall be assessed for compatibility with proposed inverter and control systems</i>

<i>Inverter Replacement</i>	<i>Replacement inverters shall be suitable for the existing PV configuration and intended operating requirements</i>
<i>Battery Integration</i>	<i>Additional or replacement BESS shall be compatible with existing energy management and inverter systems</i>
<i>Electrical Integration</i>	<i>All modifications shall comply with applicable electrical standards and municipal requirements</i>
<i>Protection Coordination</i>	<i>Existing and new protection systems shall be assessed and coordinated</i>
<i>Monitoring Integration</i>	<i>Existing and new monitoring systems shall be integrated where required</i>
<i>System Performance</i>	<i>Modifications shall not negatively affect the safety, reliability or performance of the overall system</i>

The Contractor shall ensure that:

- a) existing infrastructure is inspected and verified before commencing any modification works;
- b) all proposed upgrades and integrations are supported by appropriate design documentation;
- c) existing equipment that remains in service continues to operate safely and within manufacturer requirements;
- d) any incompatibilities, limitations or risks associated with existing infrastructure are reported to the Employer before implementation; and
- e) no existing equipment is disconnected, modified, reconfigured or removed without the prior approval of the Employer; and
- f) all modifications are tested and commissioned as part of the completed renewable energy system.

The Contractor shall provide all relevant assessment reports, updated design documentation, revised single-line diagrams, equipment schedules, test results, commissioning records and updated as-built documentation required for project handover.

C3.3.12 SYSTEM LABELLING AND SIGNAGE

The Contractor shall supply and install all labels, warning notices and safety signage required for the safe operation, maintenance and identification of the renewable energy installation.

All labels and signage shall comply with the applicable South African legislation, regulations, standards and the requirements of this Contract.

Labels shall be permanently affixed, clearly legible, weather-resistant and suitable for the installation environment.

The following minimum requirements shall apply:

Parameter	Requirement
General Labelling	<i>All renewable energy equipment shall be permanently identified</i>
PV Array Labelling	<i>PV strings, combiner boxes, junction boxes and DC isolators shall be clearly labelled</i>
AC Labelling	<i>Distribution boards, switchgear, isolators and connection points shall be clearly labelled</i>
Battery Labelling	<i>Battery Energy Storage Systems (BESS), battery enclosures and isolation devices shall be clearly labelled</i>
Inverter Labelling	<i>Hybrid inverters shall be identified with the relevant equipment information and warning notices</i>
Warning Notices	<i>Appropriate electrical hazard and photovoltaic warning notices shall be provided where required</i>
Emergency Information	<i>Emergency shutdown procedures and emergency contact information shall be displayed where applicable</i>
Circuit Identification	<i>All circuits and isolation devices shall be permanently identified</i>
Label Durability	<i>Labels shall be durable, weather-resistant and resistant to fading under normal operating conditions</i>

The Contractor shall ensure that:

- a) all labels and signage are securely installed in clearly visible locations;
- b) all equipment identification corresponds with the approved drawings, single-line diagrams, circuit schedules and operating documentation;
- c) warning notices are provided at all locations where electrical or operational hazards may exist;
- d) labels remain legible throughout the service life of the installation under normal operating conditions; and
- e) all labelling complies with the applicable standards, statutory requirements and the Employer's requirements.

The Contractor shall provide all relevant equipment schedules, circuit identification schedules and updated drawings reflecting the final equipment identification and labelling installed as part of the Works.

C3.3.13 **TESTING AND COMMISSIONING**

The Contractor shall undertake the testing and commissioning of all renewable energy infrastructure installed under this Contract to verify that the completed installation operates safely, reliably and in accordance with the approved design, manufacturer's requirements and the requirements of this Contract.

Testing and commissioning shall be completed prior to the system being placed into service and shall include all equipment, systems and interfaces associated with the Works.

The following minimum requirements shall apply:

<i>Parameter</i>	<i>Requirement</i>
<i>Pre-Commissioning Inspection</i>	<i>Verification that the installation has been completed in accordance with the approved design and applicable standards</i>
<i>Electrical Testing</i>	<i>Inspection and testing of AC and DC electrical installations, protection systems and earthing arrangements</i>
<i>Functional Testing</i>	<i>Verification of the correct operation of PV systems, hybrid inverters, Battery Energy Storage Systems (BESS), monitoring systems and protection equipment</i>
<i>Backup Operation</i>	<i>Verification of automatic changeover and backup operation where required by the applicable Work Order</i>
<i>Protection Testing</i>	<i>Verification of protection settings and correct operation of protection devices</i>
<i>Grid Connection</i>	<i>Verification of the grid connection, synchronisation and export control functions where applicable</i>
<i>Monitoring System</i>	<i>Verification of communication, monitoring, alarms and remote access functionality</i>
<i>Performance Verification</i>	<i>Confirmation that the system performs in accordance with the approved design and manufacturer's requirements</i>
<i>Defect Rectification</i>	<i>Correction of all identified defects prior to practical completion</i>
<i>Commissioning Records</i>	<i>Completion of all required testing and commissioning documentation</i>

The Contractor shall ensure that:

- a) all inspections, testing and commissioning activities are undertaken by suitably qualified and competent personnel;
- b) all defects identified during testing and commissioning are rectified prior to handover;

- c) all protection, monitoring and control systems are fully operational before the system is placed into service;
- d) where backup operation is required, the transfer between grid supply and battery-backed operation is tested and recorded;
- e) the completed installation complies with the applicable South African legislation, regulations, standards and electricity distributor requirements; and
- f) the Employer is provided with the opportunity to witness testing and commissioning activities where required.

The Contractor shall provide all relevant inspection records, test certificates, commissioning reports, Certificates of Compliance, manufacturer commissioning documentation and any other documentation required for project handover.

DECLARATION,

I, THE UNDERSIGNED (NAME)

CERTIFICATE THAT THE INFORMATION FURNISHED ABOVE IS CORRECT. I ACCEPT THAT THE MUNICIPALITY MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

AUTHORISED SIGNATURE:

NAME:

CAPACITY:

DATE: