



PUBLIC UTILITIES COMMISSION OF SRI LANKA

Ensuring a Sustainable Energy Future

REGULATORY FRAMEWORK FOR ROOFTOP SOLAR PV SYSTEMS AND BESS SYSTEMS

INTEGRATED WITH RTSPV SYSTEMS



**PROMOTING
RENEWABLE
ENERGY**



**INTEGRATING
ENERGY
STORAGE**



**ENSURING SAFETY,
RELIABILITY &
COMPLIANCE**



**TRANSPARENCY
AND FAIR
PRACTICES**



**SUSTAINABLE
ENERGY FUTURE
FOR SRI LANKA**



**REGULATED
BY PUCSL**



**IN ACCORDANCE WITH
SRI LANKA ELECTRICITY ACT
NO. 20 OF 2009 (AS AMENDED)**



**CONSUMER CENTRIC
AND INCLUSIVE**



**SUPPORTING SRI LANKA'S
CLEAN ENERGY AND NET
ZERO GOALS**

LIST OF ABBREVIATIONS

AC	Alternating Current
BS	British Standard
BESS	Battery Energy Storage System
DL	Distribution Licensee
DER	Distributed Energy Resources
ECSL	Engineering Council of Sri Lanka
EDL	Electricity Distribution Lanka Ltd
GOSL	Government of Sri Lanka
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IESL	Institute of Engineers Sri Lanka
LECO	Lanka Electricity Company (Pvt) Ltd
PCC	Point of Common Coupling
PUCSL	Public Utilities Commission of Sri Lanka
RTSPV	Rooftop Solar PV
SLEA	Sri Lanka Electricity Act

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APPLICABILITY

This Regulatory Framework applies to all entities involved in the planning, design, supply, installation, commissioning, operation, maintenance, modification, expansion, ownership, and decommissioning of grid-connected Rooftop Solar Photovoltaic (RTSPV) systems and Lithium-ion Battery Energy Storage Systems (Li-ion BESS) integrated with or connected to such RTSPV systems within Sri Lanka.

The provisions of this Framework shall apply to, but are not limited to, the following entities:

- Prosumers in all consumer categories owns and operate grid-connected RTSPV systems and Owners and operators of Li-ion Battery Energy Storage Systems (BESS) integrated with RTSPV systems.
- Solar PV service providers such as installers and contractors registered with the Sri Lanka Sustainable Energy Authority (SLSEA),
- Electricity Transmission and Distribution Licensees, National Transmission Network Service Provider (NSO, NTNSP, EDL and LECO) responsible for processing applications, granting grid connections, operating the Transmission/distribution network, and ensuring compliance with the applicable technical requirements.
- Manufacturers, importers, suppliers, distributors, and retailers of RTSPV system components, hybrid inverters, battery energy storage systems, and associated equipment placed on the Sri Lankan market.
- Distributed Energy Resource (DER) aggregators, Virtual Power Plant (VPP) operators, or any other entities authorized to aggregate, control, or manage distributed energy resources under applicable laws or regulations.

LEGAL & POLICY FOUNDATION

This Regulatory Framework is established pursuant to the powers and functions vested in the Public Utilities Commission of Sri Lanka (the **Commission**) under the **Sri Lanka Electricity Act, 2024 (as amended)**, and the **Public Utilities Commission of Sri Lanka Act, No. 35 of 2002**.

This Framework prescribes the regulatory, technical, operational, and compliance requirements applicable to Rooftop Solar Photovoltaic (RTSPV) systems and Battery Energy Storage Systems (BESS) integrated with RTSPV systems. The provisions of this Framework outline the applicable provisions of the Sri Lanka Electricity Act, 2024 (as amended), and all regulations, codes, rules, guidelines, standards, directions, and directives issued by the Commission from time to time, including but not limited to:

1. Safety, Quality and Continuity of the Electricity Supply Regulations, 2016;
2. Regulations on Electricity (Distribution) Performance Standards

3. **Regulation on Electricity (Transmission) Performance Standards**
4. The Grid Code;
5. The Distribution Code;
6. Generation License and Statutory Exemption
7. Electricity (Dispute Resolution Procedure) Rules/ Regulation
8. Any other regulations, codes, guidelines, rules, directions, methodologies, determinations, standards, or directives issued by the Commission under the applicable legislation; and
9. Any other statutory instruments or regulatory requirements applicable to the planning, design, installation, operation, maintenance, and decommissioning of RTSPV systems and BESS.
10. Feed-in Tariff Decisions issued by the Commission from time to time.

INSTITUTIONAL & GOVERNANCE ARRANGEMENTS

- The key stakeholders and governance institutions involved in the RTSPV and BESS sector in Sri Lanka comprise the Ministry of Energy, the Public Utilities Commission of Sri Lanka (PUCSL), Electricity Distribution Licensees, the Sri Lanka Sustainable Energy Authority (SLSEA), and the Sri Lanka Standards Institution (SLSI). These institutions collectively provide policy direction, regulatory oversight, technical standardization, licensing, network integration, and industry development support for the safe, reliable, and sustainable deployment of RTSPV and BESS systems.

LICENSING / AUTHORIZATION FRAMEWORK

- RTSPV and BESS prosumers shall obtain the relevant licence or exemption, as applicable, in accordance with the **Electricity (Applications for Licenses and Exemptions) Regulation** issued by the Commission.
- RTSPV and BESS prosumers shall strictly comply with all conditions specified in the applicable **Licence/ Statutory exemption** as well as the requirements of this Regulatory Framework. Failure to comply with such conditions may result in enforcement action by the Commission or the relevant Distribution Licensee, including the suspension or disconnection of the RTSPV and/or BESS from the electricity network, in accordance with the applicable laws and regulations.
- RTSPV and BESS prosumers shall obtain the design, installation, testing, commissioning, operation, and maintenance services only from Photovoltaic (PV) Service Providers holding a valid and active registration or licence issued by the Sri Lanka Sustainable Energy Authority (SLSEA) as required by the Sri Lanka Sustainable Energy Authority (SLSEA).
- RTSPV and BESS prosumers shall ensure that all major equipment, including photovoltaic modules, inverters, battery energy storage systems, and associated

equipment, is procured from suppliers or importers authorized in accordance with the applicable regulatory requirements and complies with the standards and certification requirements enforced by the Commission, SLSEA or SLSI.

- A Photovoltaic (PV) Service Provider engaged in the importation, supply, design, installation, testing, commissioning, operation, or maintenance of grid-connected, off-grid, hybrid RTSPV systems or Battery Energy Storage Systems shall,
 - Hold a valid registration or licence issued by the Sri Lanka Sustainable Energy Authority (SLSEA) as required by the SLSEA.
 - Obtain the necessary authorization from the Sri Lanka Sustainable Energy Authority (SLSEA) for the importation of photovoltaic modules, inverters, battery energy storage systems, and other related equipment, in accordance with the applicable statutory requirements. The importation of the respective equipment shall be carried out under the HS Codes specified by the Commission/SLSEA and the import inspection requirements imposed by the relevant authorities.
- The Statutory exempted person or license holders shall comply with all rules and regulations issued by the Central Environment Authority, the Sri Lanka Sustainable Energy Authority, and the Public Utilities Commission of Sri Lanka, as amended from time to time, relating to the safe handling, management, and disposal of electronic waste (E-waste) in the RTSPV and BESS industries.
- Chartered Engineers certifying the system installation shall ensure that all technical requirements are met, and that the installation complies with all applicable legal requirements. The Distribution Licensee (DL) shall obtain a declaration form, duly signed by the Chartered Engineer, in the format prescribed in this framework, at the time of final application submission.

ECONOMIC & TARIFF REGULATION

- The commercial terms and conditions governing the purchase of electricity exported from RTSPV/BESS systems are specified in the Standard Power Purchase Agreement (SPPA) approved by the Commission.
- The Prosumer shall enter into the applicable SPPA with the relevant Distribution Licensee and shall comply with all terms and conditions of the Agreement. The Distribution Licensee shall also comply with the provisions of the approved SPPA and shall not impose any terms or conditions that are inconsistent with the approved Agreement or that adversely affect the rights of the Prosumer.
- The tariff applicable to electricity exported to the distribution network shall be determined by the Commission in accordance with the approved Feed-in Tariff Methodology. The applicable Feed-in Tariff (FiT) will be published by the Commission as per the provisions of the SLEA.

- Newly approved Feed-in Tariff rates shall apply only to Prosumers who become eligible in accordance with the requirements and eligibility criteria specified in the Guidelines on Rooftop Solar PV/BESS system Interconnection and Operation for Distribution Utilities and Prosumers issued by the Commission.

TECHNICAL & SAFETY REGULATION

- Distribution Licensees, RTSPV/BESS Prosumers operating under a licence or exemption, and their contractors shall ensure compliance with all applicable laws, regulations, codes, standards, guidelines, and directions governing the planning, design, installation, commissioning, operation, maintenance, modification, and decommissioning of RTSPV and BESS installations.

Without limitation, compliance shall include, but not be limited to, the following:

- Safety, Quality and Continuity of the Electricity Supply Regulations, 2016;
- Grid Code
- Distribution Code.
- BS 7671 – Requirements for Electrical Installations (IET Wiring Regulations), as adopted or recognized by the Commission.
- Guidelines on the Interconnection and Operation of Rooftop Solar Photovoltaic (RTSPV)/BESS Systems for Distribution Utilities and Prosumers
- Guidelines on the Installation, Operation, and Maintenance of Rooftop Solar Photovoltaic (RTSPV) Systems for Solar Service Providers
- Code of Practice for the Installation and Operation of Battery Energy Storage Systems (BESS) Integrated with Solar Photovoltaic Systems (Pending)
- Technical Specifications for Photovoltaic (PV)-Integrated Battery Energy Storage Systems (BESS) (annexure 01)
- Applicable Sri Lanka Standards (SLS) including SLS 1522 and any subsequent revisions, International Electrotechnical Commission (IEC) standards, and any other technical standards adopted or enforced by the Commission.
- Any regulations, rules, codes, guidelines, directions, or technical requirements issued by the Commission from time to time.

OPERATIONAL & PERFORMANCE STANDARDS

- All parties shall operate and maintain their respective systems in accordance with the operational and performance requirements stipulated in the applicable regulations, codes, standards, and guidelines referenced under section 6.

STAKEHOLDER (CONSUMER AND REGULATED ENTITIES) PROTECTION FRAMEWORK

- Prosumers and Distribution Licensees (DLs) shall lodge and escalate complaints in accordance with the provisions specified in the Interconnection Guidelines. Such

complaints shall be addressed and resolved by the Commission through the complaint resolution mechanism established by the Commission.

- Complaints pertaining to Solar Service Providers and equipment-related matters shall be forwarded to the Sri Lanka Sustainable Energy Authority (SLSEA) for investigation and necessary action.

COMPLIANCE MONITORING, COMPETITION OVERSIGHT & ENFORCEMENT

- The Commission may, from time to time, conduct inspections and compliance monitoring of the relevant premises on a random basis or in response to complaints, disputes, or suspected non-compliance. If any non-compliance with the applicable regulations, codes, standards, guidelines, or licence conditions is identified, the Commission may direct corrective actions and, where necessary, require the disconnection of the system from the grid until such non-compliance is rectified.

DATA, REPORTING & TRANSPARENCY FRAMEWORK

- All RTSPV/BESS Prosumers shall permit the monitoring, control, inspection, and data acquisition of their systems where required under the applicable licence or exemption, the Standard Power Purchase Agreement (SPPA), the Grid Code, the Distribution Code, the Grid Interconnection Guidelines, or any other requirements specified by the Commission or the relevant Distribution Licensee with the approval of the Commission.
- All regulated entities, including Distribution Licensees, RTSPV/BESS Prosumers, contractors, and other relevant parties, shall submit to the Commission any technical, operational, financial, or other information and data required by the Commission, in the format, manner, frequency, and within the time period specified by the Commission.

REVIEW, AMENDMENT & TRANSITIONAL PROVISIONS

- The Commission may periodically review and update this Regulatory Framework to ensure its continued relevance and effectiveness in response to changes in applicable legislation, regulations, codes, guidelines, technical standards, and the evolving requirements of the electricity sector. Such revisions may include amendments, additions, or removals of regulatory requirements, procedures, technical provisions, or regulatory tools necessary to facilitate the safe, reliable, and efficient integration of Rooftop Solar Photovoltaic (RTSPV) systems and Battery Energy Storage Systems (BESS) and will be informed accordingly.

ANNEXURES:

REGULATORY INSTRUMENTS TO BE FOLLOWED AND COMPLIED WITH BY LICENSEES, PROSUMERS, AND RELEVANT CONTRACTORS PRESENTLY IN PLACE.

1. [Electricity \(Safety, Quality and Continuity\) Regulations, 2016](#)
2. [Electricity \(Applications for Licenses and Exemptions\) Regulation, 2009](#)
3. [Regulations on Electricity \(Distribution\) Performance Standards](#)
4. [Regulations on Electricity \(Transmission\) Performance Standards](#)
5. [Electricity \(Dispute Resolution Procedure\) Rules/ Regulation](#)
6. Standard Power Purchase Agreement (SPPA) for Rooftop Solar Photovoltaic (RTSPV) and Battery Energy Storage System (BESS) Installations (Pending)
7. [Exemption from the requirement of obtaining a license to generate electricity using Rooftop Solar PV Systems.](#)
8. Guidelines on the Interconnection and Operation of Rooftop Solar Photovoltaic (RTSPV)/BESS Systems for Distribution Utilities and Prosumers
9. [Guidelines on the Installation, Operation, and Maintenance of Rooftop Solar Photovoltaic \(RTSPV\) Systems for Solar Service Providers](#)
10. Code of Practice for the Installation and Operation of Battery Energy Storage Systems (BESS) Integrated with Solar Photovoltaic Systems (Pending)
11. Technical Specifications for Photovoltaic (PV)-Integrated Battery Energy Storage Systems (BESS) (Annexure 01)
12. Feed-in Tariff Methodology for Renewable Energy Generation Facilities
13. Sri Lanka Standards (SLS) Applicable to Rooftop Solar Photovoltaic (RTSPV) and Battery Energy Storage Systems (BESS)- (Refer to References 9 and 11)
14. Declaration form to be signed by the Chartered Electrical Engineer (Annexure 02)

TECHNICAL SPECIFICATION FOR PV-INTEGRATED BATTERY ENERGY STORAGE SYSTEMS (BESS)

1 SCOPE

This Technical Specification establishes the minimum technical, safety, performance, installation, commissioning, operation, maintenance, monitoring, and documentation requirements for lithium-based Battery Energy Storage Systems (BESS) integrated with Solar Photovoltaic (PV) systems and installed within electrical installations in Sri Lanka.

The Technical Specification applies to fixed BESS installations having a nominal DC voltage not exceeding 1500 V and intended for:

- Self-consumption of solar energy;
- Backup power applications;
- Export of electrical energy to the utility network;
- Grid-connected operation;
- Standalone operation; and
- Off-grid renewable energy systems.

The Technical Specification applies to AC-coupled, DC-coupled, and hybrid inverter configurations utilizing lithium-based battery technologies only.

This Technical Specification applies to the following categories of BESS installations:

- a) **Residential Systems:**
 - systems with rated inverter capacity up to 5 kW for single-phase installations; and
 - systems with rated inverter capacity up to 40 kW for three-phase installations;
- b) **Commercial Systems:**
 - systems with rated inverter capacity exceeding 40 kW and up to 1 MW;
- c) **Industrial Systems:**
 - systems with rated inverter capacity exceeding 1 MW.

The maximum usable energy capacity of the battery system in kWh shall not exceed 5 times the rated continuous power of the connected inverter(s) in kW.

NOTES

1. *This requirement is intended to ensure that the battery energy capacity is adequately matched to the inverter's power rating, thereby preventing underutilization of stored energy, ensuring the inverter has sufficient capacity to fully charge the battery within standard daily operational cycles, and managing the total chemical energy footprint at the installation site.*
2. *For the purpose of this Technical Specification, the calculation shall be determined using the maximum rated continuous output power of the inverter (kW) and the usable battery energy capacity (kWh) as specified by the manufacturers.*

Examples:

- a) A BESS comprising a 5 kW inverter and a 25 kWh usable battery capacity complies with the requirement, as the capacity does not exceed the maximum allowed threshold ($5 \text{ kW} \times 5 \text{ h} = 25 \text{ kWh}$).
- b) A BESS comprising a 5 kW inverter and a 30 kWh usable battery capacity exceeds the maximum allowed threshold ($5 \text{ kW} \times 5 \text{ h} = 25 \text{ kWh}$) and does not meet the recommended requirement. Such a system may result in underutilization of the stored energy and an excessive onsite chemical energy footprint, and shall require additional technical justification.

NOTE:

The maximum usable energy capacity of the battery systems relative to the aggregate rated continuous power of the connected inverter(s) may exceed the specified limit only where supported by a detailed technical assessment and a written recommendation prepared by a Chartered Electrical Engineer. Such assessment shall verify compliance with applicable requirements relating to safety, thermal management, protection coordination and battery operating limitations.

All installations shall comply with applicable utility requirements, the Distribution Code, and BS 7671.

To withstand local atmospheric conditions, all external metallic components shall be protected against corrosion to a minimum C4 (High Corrosivity) classification in accordance with ISO 9223.

2 NORMATIVE REFERENCES

The latest editions of the following documents shall apply:

- BS 7671 – Requirements for Electrical Installations
- IEC 62619: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications
- IEC 63056: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems
- IEC 62620: Secondary cells and batteries containing alkaline or other non-acid electrolytes – secondary lithium cells and batteries for use in industrial applications
- IEC 62109-1: Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
- IEC 62109-2: Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
- IEC 62116: Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
- IEC 61727: Photovoltaic (PV) systems - Characteristics of the utility interface
- IEC 61000 Series: Electromagnetic compatibility (EMC)
- IEC 61683: Photovoltaic systems - Power conditioners - Procedure for measuring efficiency

- IEC 60068 Series: Environmental testing
- IEC 60269-7: Low-voltage fuses - Part 7: Supplementary requirements for fuse-links for the protection of batteries and battery systems
- IEC 60947-2: Low-voltage switchgear and controlgear - Part 2: circuit-breakers
- IEC 60947-3: Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse combination units
- SLS 1680: Sri Lanka Standard Specification for Safety of Hybrid Inverter for Solar PV System
- Distribution Code of Sri Lanka
- Applicable PUCSL, CEB and LECO requirements

3 TECHNICAL REQUIREMENTS FOR BESS

3.1 BATTERY REQUIREMENTS

3.1.1 Battery Technology Requirements

The Battery Energy Storage System (BESS) shall exclusively utilize lithium-ion battery technologies certified in accordance with applicable international standards (e.g., IEC 62619, IEC 62620 and IEC 63056 or equivalent Sri Lanka Standards approved by SLSI). The battery module or the individual battery pack enclosure shall have a minimum Ingress Protection rating of IP54 in accordance with IEC 60529.

The manufacturer/developer shall explicitly declare the following technical specifications and performance characteristics of the battery system:

- Rated Battery Capacity (Ah)
- Usable Battery Capacity (Ah)
- Rated Energy Capacity (kWh)
- Usable Energy Capacity (kWh)
- Nominal Voltage (V)
- Operating Voltage Range (V to V)
- Maximum Charge and Discharge Current Limits (A)
- Operating Temperature Range (°C)
- Thermal Runaway and Mitigation Characteristics (including compliance with UL 9540A or equivalent)
- Fire Performance and Suppression Characteristics
- Cycle Life Performance (at specified Depth of Discharge)
- Round-Trip Efficiency (%)

Note:

Unless otherwise specified by the relevant Sri Lankan utility or regulatory authority, all battery performance characteristics shall be carried out in an ambient temperature of 25 °C ± 5 °C.

3.1.2 Minimum Performance Requirements

a) Residential Systems:

- Minimum cycle life: 6,000 cycles at 80% Depth of Discharge (DoD), under a 0.5C charge/discharge rate, maintaining a minimum of 80% capacity retention at end-of-life.

b) Commercial and Industrial Systems:

- Minimum cycle life: 8,000 cycles at 80% Depth of Discharge (DoD), under a 0.5C charge/discharge rate, maintaining a minimum of 80% capacity retention at end-of-life.

c) Battery round-trip efficiency:

- Standard systems: minimum 85%.
- Premium systems: minimum 90%.

d) Minimum energy density of the cell:

- 150 Wh/kg.

Note:

The minimum gravimetric energy density of the battery cell shall be declared by the cell manufacturer and supported by a valid test report issued by an accredited testing laboratory.

3.1.3 Battery Management System (BMS) shall provide:

- Cell voltage monitoring
- Battery current monitoring
- Temperature monitoring
- State-of-Charge (SoC) estimation
- State-of-Health (SoH) estimation
- Fault detection and isolation
- Event logging
- Communication interfaces
- Automatic protective shutdown under unsafe operating conditions.

Supported communication protocols shall include one or more of:

- Modbus
- CAN Bus
- IEC 61850; or
- RS 485

3.1.4 Applicable standards shall comply:

- IEC 62619: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
- IEC 63056: Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems.
- IEC 62620: Secondary cells and batteries containing alkaline or other non-acid electrolytes – secondary lithium cells and batteries for use in industrial applications.
- IEC 62281: Safety of primary and secondary lithium cells and batteries during transport, or UN 38.3 (United Nations transport safety testing requirement for lithium batteries of Tests and Criteria, Part III, Sub-section 38.3).
- The battery system, including the Battery Management System (BMS), shall comply with the applicable EMC requirements of the IEC 61000 series.

3.2 POWER CONVERSION EQUIPMENT (PCE) REQUIREMENTS

3.2.1 Permitted Configurations and Waveform Type

The following Power Conversion Equipment (PCE) configurations are permitted under this specification:

- AC-coupled systems
- DC-coupled systems
- Hybrid inverter systems
- Standalone inverter systems
- Off-grid inverter systems.

All permitted PCE shall output a true (pure) sine wave type waveform with total harmonic distortion (THD) within allowable regulatory limits.

3.2.2 Applicable standards shall comply:

The Power Conversion Equipment (PCE) shall comply with the latest editions of the following international, national, and utility standards:

- IEC 62109-1: Safety of power converters for use in photovoltaic power systems - Part 1: General requirements.
- IEC 62109-2: Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters.
- IEC 62116: Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures.

- IEC 61727: Photovoltaic (PV) systems - Characteristics of the utility interface.
- IEC 61000 Series: Electromagnetic compatibility (EMC).
- IEC 61683: Photovoltaic systems - Power conditioners - Procedure for measuring efficiency.
- IEC 60068 Series: Environmental testing.
- SLS 1680: Sri Lanka Standard Specification for Safety of Hybrid Inverter for Solar PV System.

The PCE shall additionally support and execute the following network-integration functions in accordance with the rules established by the Public Utilities Commission of Sri Lanka (PUCSL), the Sri Lanka Sustainable Energy Authority (SLSEA), and respective Distribution Licensees:

- Low-Voltage Ride-Through (LVRT) capabilities
- Arc-Fault Circuit Interrupter (AFCI) protection
- Active Voltage Support Functions, including Volt-VAR and Volt-Watt autonomous control modes.

3.3 BESS INSTALLATION REQUIREMENTS

All Battery Energy Storage System (BESS) installations shall comply with the following conditions:

- Location:** Be installed outdoors or within garages or along ventilated corridors or inside the building dedicated equipment rooms or standalone enclosures.
- Ventilation:** Maintain adequate natural or mechanical ventilation to prevent heat and gas accumulation.
- Clearance:** Comply strictly with the manufacturer's specified minimum clearances for safety, maintenance access, and thermal dissipation.
- Enclosure Rating:** Maintain a minimum structural or installation enclosure protection rating of IP54;
- Environmental Protection:** Be protected from direct water ingress, heavy dust accumulation, and corrosive environmental conditions.
- Cabling:** Utilize flame-retardant, UV-stabilized, and appropriately rated DC cables specifically designed for solar PV or battery storage applications.
- Wiring Protection:** All electrical interconnecting wiring between the battery system and the Power Conversion Equipment (PCE) shall be enclosed within steel conduit or steel trunking. All other exposed wiring systems shall be provided with equivalent robust mechanical protection to prevent physical damage.
- Standards Compliance:** Be installed in absolute accordance with the latest edition of **BS 7671** (Requirements for Electrical Installations).

3.4 FIRE SAFETY AND MITIGATION REQUIREMENTS

Battery Energy Storage System (BESS) installations shall be equipped with comprehensive fire protection and mitigation systems. The installation shall incorporate at least one or a combination of the following fire safety measures, subject to the scale of the installation and local Fire Service Department regulations:

- a) **Thermal Runaway Mitigation:** Integrated cell-level and module-level thermal management systems, including liquid immersion cooling, designed to prevent, detect, and mitigate thermal runaway propagation.
- b) **Early-Warning Detection Systems:** Dedicated smoke detection systems and gas detection systems (specifically calibrated for off-gassing common to lithium-ion cells, such as carbon monoxide and hydrogen).
- c) **Continuous temperature detection, monitoring and controlling systems:** Continuous temperature detection, monitoring systems and control mechanism shall be integrated directly with the Battery Management System (BMS).
- d) **Fire Suppression Systems:** Clean-agent fire suppression systems or aerosol fire suppression systems are recommended.

3.4.1 Emergency Shutdown Facilities (ESD)

- a) A highly visible, clearly labeled, and easily accessible Emergency Shutdown (ESD) switch/button shall be installed externally to the BESS enclosure or at the main point of grid interconnection.
- b) Activating the ESD shall immediately isolate the battery system from the inverter, terminate all charging/discharging operations, and safely trip the relevant circuit breakers to minimize electrical hazards during an emergency response.

3.5 GRID INTEGRATION REQUIREMENTS

Grid-connected BESS installations shall comply with:

- The Distribution Code
- Utility interconnection requirements
- Applicable regulations.

Systems with inverter capacity greater than 50 kW shall provide communication capability for utility monitoring and control.

Where inverter capacity exceeds the approved export capacity, the system shall provide:

- Configurable export limitation functionality
- Dynamic power management capability
- Utility-accessible control interfaces.

3.6 ELECTRICAL PROTECTION AND CABLING REQUIREMENTS

The Battery Energy Storage System (BESS) and its associated power conversion equipment shall be equipped with comprehensive protection systems to ensure operational safety and system reliability. The following protective devices and installation standards shall be strictly adhered to:

3.6.1 Isolation and Overcurrent Protection

- a) **DC Isolation:** Readily accessible DC isolation switches shall be installed on the DC side of the system, fully compliant with IEC 60947-3.
- b) **DC Overcurrent Protection:** Dedicated overcurrent protective devices shall be integrated into the DC circuits: (Fuse-links shall comply with IEC 60269-7 and Circuit breakers shall comply with IEC 60947-2).
- c) **AC Overcurrent Protection:** Overcurrent protection on the AC side shall be achieved via circuit breakers complying with either IEC 60898-1 or IEC 60947-2.

3.6.2 Residual Current Protection

Residual Current Devices (RCDs) shall comply with IEC 61008-1 and IEC 62423, and shall be selected based on the following circuit configurations:

- a) **Grid Connection (PCE to PCC):** Where residual current protection is provided between the Power Conversion Equipment (PCE) and the Point of Common Coupling (PCC), the RCD must be specifically rated for inverter-based topologies. Type B RCDs shall be utilized to ensure proper operation in the presence of DC residual currents.
- b) **Essential Power Supply (EPS) Circuit:** Where residual current protection is implemented on the backup or EPS output circuit, the RCD shall be installed at or immediately adjacent to the EPS output terminals. Type A or Type B RCDs shall be selected in strict accordance with the inverter manufacturer's specifications and BS 7671.

3.6.3 Surge Protection Devices (SPDs)

To protect against atmospheric overvoltage and switching transients, Type 2 (Class II) SPDs shall be installed as a minimum requirement on both the DC and AC networks:

- DC-side SPDs shall comply with IEC 61643-31.
- AC-side SPDs shall comply with IEC 61643-11.

3.6.4 Wiring and Mechanical Enclosure

- a) **DC Cabling Specifications:** All DC wiring shall utilize flame-retardant, low-smoke, halogen-free (LSZH) cables specifically rated for photovoltaic/BESS applications, complying with IEC 62930 or SLS 1542.

- b) **Mechanical Protection:** All external or exposed BESS cabling shall be provided with robust mechanical protection, enclosed entirely within heavy-gauge galvanized steel conduits or steel trunking to prevent physical damage and degradation.

3.7 DOCUMENTATION AND SUBMISSION REQUIREMENTS

Prior to grid interconnection and final commissioning approval, the developer/installer shall submit a comprehensive technical documentation package to the relevant utility provider Distribution Licensees and regulatory authority. The documentation package shall include, but is not limited to, the following:

3.7.1 Engineering and Design Documentation

- a) **System Design Report:** A comprehensive engineering report detailing the system topology, sizing calculations (including inverter-to-battery capacity ratios), thermal management, and safety mitigation measures.
- b) **Single Line Diagram (SLD):** A detailed, technical schematic diagram illustrating the entire electrical configuration of the BESS, including DC/AC isolation points, overcurrent protection devices, RCD positions, earthing arrangements, and the Point of Common Coupling (PCC).
- c) **Chartered Electrical Engineer Declaration:** A formal declaration signed and stamped by a Chartered Electrical Engineer registered with the Engineering Council of Sri Lanka (ECSL), validating compliance of the design and installation with national grid codes (See Annex A).
- d) **Protection Coordination Documentation:** A technical study verifying the discrimination and coordination of overcurrent, short-circuit, and residual current protection devices between the BESS and the utility grid network.

3.7.2 Equipment Certifications and Manuals

- a) **Battery Datasheets and Certifications:** Manufacturer-certified datasheets and compliance certificates proving adherence to relevant international and national standards (e.g., IEC 62619, IEC 62620 and IEC 63056 or SLS).
- b) **Power Conversion Equipment (PCE) Datasheets and Certifications:** Manufacturer-certified technical specifications and type-test certificates for the inverters/PCE (e.g., IEC 62109, IEEE 1547).
- c) **Operation and Maintenance (O&M) Manuals:** Detailed user and technical manuals covering routine maintenance protocols, emergency response procedures, troubleshooting guides, and safety workflows.

3.7.3 Post-Construction, Closeout, and Client Handover Records

- a) **Commissioning Test Report:** A formal report detailing the results of field testing, safety function verifications, insulation resistance tests, and emergency shutdown (ESD) functional tests, witnessed and signed by a competent engineer.
- b) **As-Built Documentation:** Revised, post-construction engineering drawings reflecting the exact layout, cable routing, and physical installation of the completed BESS infrastructure.
- c) **Client Handover Package:** A complete copy of all the aforementioned documents, certificates, and reports (Sections 3.7.1 through 3.7.3) shall be formally compiled and issued to the Client alongside the final signed Commissioning Test Report to serve as the permanent operation, safety, and asset record for the facility.

4.0 MONITORING AND DATA LOGGING REQUIREMENTS

The Battery Energy Storage System (BESS) shall be equipped with an integrated Supervisory Control and Data Acquisition (SCADA) system, Energy Management System (EMS), or an advanced Battery Management System (BMS) capable of executing comprehensive telemetry, data acquisition, and logging functions.

The system hardware and software architecture shall provide the following mandatory capabilities:

- a) **Real-Time Parameter Monitoring:** Continuous tracking and real-time visualization of critical operational parameters at both the system and rack level, including:
 - Voltage (V)
 - Current (A)
 - Power (Active Power in kW, Reactive Power in kVAR)
 - Temperature (Module and ambient cell temperatures in °C)
 - State of Charge (SoC, %)
- b) **Event Recording:** Automatic time-stamped logging of all operational status changes, system state transitions, user interventions, and control commands.
- c) **Alarm and Fault Logging:** Active monitoring and historical recording of all system alarms, faults, and critical safety trips (e.g., over-voltage, over-temperature, communication loss, and emergency shutdown events). Alarms shall be categorized by severity levels.
- d) **Data Storage and Retention Capacity:** On-site or non-volatile local storage hardware capable of continuously logging and retaining all monitored parameters, event logs, and alarm records for a minimum period of 12 months without data degradation or overwriting.
- e) **Remote Monitoring and Telemetry Functionality:** Secure remote access capability via standardized communication protocols (e.g., Modbus TCP/IP, DNP3, or IEC 60870-5-104) to enable real-time data transmission to the client's monitoring platform and, where applicable, the utility provider's Distribution Licensees Control Center.

Note:

All remote monitoring links shall implement robust encryption and cybersecurity protocols to protect the installation from unauthorized access and external operational disruptions.

5.0 OPERATION AND MAINTENANCE (O&M)

A formal maintenance plan is required to ensure the system remains safe and efficient. All service records must be kept in a logbook on-site. Supporting regulatory inspections will be carried out by relevant authorities like the Sri Lanka Sustainable Energy Authority (SLSEA) and the Public Utilities Commission of Sri Lanka (PUCSL).

The programme shall include:

- a) Annual Performance Verification:
 - A full system test once a year to ensure the BESS meets its original design specifications.
 - Testing of all protection relays, circuit breakers, and isolation switches.
- b) Firmware and Software Updates:
 - Regularly install the latest manufacturer updates for the Inverter and Battery Management System (BMS) to fix bugs and improve operational security.
- c) Battery Health Assessment:
 - An annual check of the battery's State of Health (SoH) to measure capacity loss and identify any failing cells or strings.
- d) Safety Inspections:
 - Test the Emergency Shutdown (ESD) button to ensure it cuts power instantly.
 - Check and service early-warning fire detectors and fire suppression systems (Aerosol/Clean-agent).

6.0 ENVIRONMENTAL REQUIREMENTS AND END-OF-LIFE MANAGEMENT

BESS installations shall comply with applicable environmental regulations of Sri Lanka.

The owner or supplier shall provide:

- Battery recycling arrangements
- End-of-life management procedures
- Safe disposal instructions.

APPENDIX A

(normative)

Template of Chartered Engineer Declaration for RTSPV & BESS Installations

Declaration by a Chartered Electrical Engineer

I, the undersigned Chartered Engineer, duly registered and recognized under the relevant professional regulatory framework, do hereby certify that,

1. Compliance with Laws and Regulations

The Rooftop Solar PV (RTSPV) and Battery Energy Storage System (BESS) installation has been designed, installed, and tested in accordance with the Sri Lanka Electricity Act, 2024 (as amended), and all applicable rules and regulations listed under the *Regulatory Framework for Rooftop Solar PV and BESS* enforced by the Public Utilities Commission of Sri Lanka.

2. Standards and Codes

All equipment and installation works conform to the technical standards, codes of practice, and safety requirements enforced in Sri Lanka, listed under the Regulatory Framework for Rooftop Solar PV and BESS enforced by the Public Utilities Commission of Sri Lanka, including relevant international standards where applicable.

3. Safety and Performance Assurance

The installation has been inspected and verified to ensure electrical safety, structural integrity, and operational performance, with due consideration for grid interconnection requirements and consumer protection.

4. Professional Responsibility

I accept full professional responsibility for the certification of this installation and affirm that it meets the prescribed technical and regulatory requirements for connection to the distribution network.

Chartered Electrical Engineer

Signature : _____

Name : _____

ECSL Registration Number : _____

Date : _____

Authorized Electrical Engineer (on behalf of Chartered Engineer)

I hereby confirm that I conducted the site visit and inspection of the installation on behalf of the Chartered Engineer.

Signature : _____

Name : _____

ECSL Registration Number : _____

Designation : _____

Date : _____

Consumer (Witness to Site Visit):

I hereby confirm that the site visit was conducted, and I sign as a witness to this certification.

Signature : _____

Name of Consumer : _____

Date : _____

Draft Chartered Engineer Declaration for RTSPV & BESS Installations**Declaration by Chartered Electrical Engineer**

I, the undersigned Chartered Engineer, duly registered and recognized under the relevant professional regulatory framework, do hereby certify that,

1. Compliance with Laws and Regulations

The Rooftop Solar PV (RTSPV) and Battery Energy Storage System (BESS) installation has been designed, installed, and tested in accordance with the Sri Lanka Electricity Act, 2024 (as amended), and all applicable rules and regulations listed under the **Regulatory Framework for Rooftop Solar PV and BESS** enforced by the Public Utilities Commission of Sri Lanka.

2. Standards and Codes

All equipment and installation works conform to the technical standards, codes of practice, and safety requirements enforced in Sri Lanka, listed under the **Regulatory Framework for Rooftop Solar PV and BESS** enforced by the Public Utilities Commission of Sri Lanka, including relevant international standards where applicable.

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4. Professional Responsibility

I accept full professional responsibility for the certification of this installation and affirm that it meets the prescribed technical and regulatory requirements for connection to the distribution network.

Chartered Electrical Engineer

Signature	:	_____
Name	:	_____
IESL/ECSL Registration Number	:	_____
Date	:	_____

Authorized Electrical Engineer (on behalf of Chartered Engineer)

I hereby confirm that I conducted the site visit and inspection of the installation on behalf of the Chartered Engineer.

Signature : _____

Name : _____

IESL/ECSL Registration Number : _____

Designation : _____

Date : _____

Consumer (Witness to Site Visit):

I hereby confirm that the site visit was conducted, and I sign as a witness to this certification.

Signature : _____

Name of Consumer : _____

Date : _____