NATIONAL INSTITUTE OF SOLAR ENERGY

(An Autonomous Institute under Ministry of New & Renewable Energy, Government of India)

NIT No. LAB-18010/1/2026-SDD

Tender (E-Tender) document *for* Design, supply, installation, commissioning, and training of different Battery Energy Storage technology testbed facility at NISE. *Gurugram, Haryana -122003,*

Last Date of Submission: 20th August 2026

Director-General

National Institute of Solar Energy

Gurugram-Faridabad Road

Gwal Pahari, Gurugram – 122003, Haryana, India

Website: www.nise.res.in

National Institute of Solar Energy

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Design, supply, installation, commissioning, and training of different Battery Energy Storage technology testbed facility at NISE. *Gurugram, Haryana -122003*

Sr. No	Description	Details
1.	NIT No.	***LAB-18010/1/2026-SDD***
2.	Tender Type	***E-Tender (Through Tender E-wizard)***
3.	Tender Category	***Product***
4.	Scope of Work	**Design, supply, installation, commissioning, and training of different Battery Energy Storage technology testbed facility at NISE. *Gurugram, Haryana -122003***
5.	**Bid security**	An EMD of ₹ 4,25,000/- has to be submitted in the form of a Demand Draft / FDR / Bank Guarantee from a commercial bank in India should be provided in the form of bid security. MSME bidders are exempted from submitting the EMD, however, bid security declaration should be provided.
6.	Place of submission of quotation	1. The scopes of work to be tendered are available in the complete bid documents, which can be viewed /downloaded from the e-tender portal of http://nise.ewizard.in The bid should be submitted along with complied specifications concurrently duly digitally signed on the website http://nise.ewizard.in No claim shall be entertained on account of disruptions of internet services being used by bidders. Bidders are advised to upload their bids well in advance to avoid last-minute technical snags. 2. All Corrigendum/Amendment/Corrections, if any, will be published on the website http://nise.ewizard.in 3. All the applicants must have a Class-III Digital Signature Certificate signing and encryption (in the name of the person

		who will sign the bid document) from any of the licensed certifying agency. 4. It is mandatory for the applicants to get registered their firm/joint venture with the e-tendering portal of http://nise.ewizard.in to have user ID & Password from M/s ITI. Ltd. Phone: +91-124-285 3075
7.	Period of validity of quotation	Bids shall be valid for at least 120 days from the last date of bid submission.
8.	Pre-bid meeting	11:30 PM, 5th August 2026 All interested bidders should inform NISE by sending an e-mail @ **vikrant.sharma@nise.res.in** or contact at 0124-2853035
9.	Last date & time of submission of Tender	6:00 PM, 20th August 2026
10.	Bid Opening (Technical)	11:30 AM,21st August 2026
11.	Bid Opening (financial)	The financial bid opening date will be informed to technically qualified vendors separately

1. INTRODUCTION

NISE are invited from reputed Professional Registered Companies/ Organisations/Agencies/firms having capacity to provide the design, supply, installation, commissioning, and training of different Battery Energy Storage technology testbed facility at NISE.

a. **Lithium Iron Phosphate Battery (LFP)**
b. **Sodium-Ion Battery (SIB)**
c. **Vanadium Redox Flow Battery (VRFB)**

2. Submission of Tender: All technical bid documents should be uploaded on Ewizard portal. The bidder shall provide the following certificates:

i. Self-attested copies of Certificate of Incorporation under the Indian Companies Act, 1956.
ii. Self-attested copy of PAN Card.
iii. Self-attested copy of TAN Registration.
iv. Self-attested copy of Goods & Service Tax Registration Certificate.
v. Self-attested copy of Shop & Establishment Registration Certificate.
vi. Self-attested copy of Escalation Matrix with contact numbers.

vii. The joint ventures are also eligible for participation in the bid, supporting document should be provided.

3. Special Note

a) Bidder offer is liable to be rejected if they do not upload any of the certificates/documents sought/undertakings and fulfil the eligibility criteria as per the bid documents, ATC and corrigendum, if any.

b) Bidders are requested to study the terms and conditions of the tender carefully and then submit their tenders accordingly. Any tender/quotation received against this tender and any contract resulting from this tender shall be governed by the terms and conditions indicated in the tender document and the tenderer quoting against this tender shall be deemed to have read, understood and accepted the same. No clarification shall be entertained after receiving the bids.

c) Technical Bids shall be opened first and on scrutiny and assessment of technical capabilities, the Financial Bid of the technically accepted bids will be opened.

d) In case no clarification is sought during the period of the bid, it will be deemed that the bidders have understood the parameter / requirement indicated/ enunciated / described completely and are complying with the same at the time of submission of the tender. The bidders may also note that no request for clarifications will be entertained after the closure of the bid.

e). Bid must be submitted giving complete details as sought in the enclosed Forms. The entire schedule of the tender should be quoted for and the quote shall be unconditional, failing which the tender bid shall be rejected. The scope of services proposed should not be altered and if found altered, the tender bid shall be rejected. Bids, which do not comply with the conditions laid down in the tender document, are liable to be rejected.

f). Supporting documents with respect to meeting the criteria listed in the above clauses should be enclosed. Tender document without these enclosures will be summarily rejected. Noncompliance with any of the above conditions and technical specification of the items by the bidder will amount to non-eligibility for the services for which tender has been floated and its tender will be ignored summarily. The tendering agency shall furnish the properly indexed bid having all the information required. Incomplete bids shall be liable to be summarily rejected.

g). Any action on the part of any bidder to influence any Institute officer in the process of examination, clarification, evaluation, and comparison of bids, and decision concerning award of contract, or canvassing in any form, shall make the tender liable for rejection.

h). Institute may waive any minor infirmity or non-conformity or irregularity in a bid which does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any bidder.

i). Financial Bid Evaluation: The financial bids of only those bidders shortlisted from technical bid evaluation shall be opened.

4. Project Overview

Over past more than three decades, rapid expansion of renewable energy generation has significantly influenced power system planning and operation worldwide. India, in line with global commitment for climate action, has set ambitious energy transition targets, including the deployment of 500 GW of non-fossil installation capacity by 2030. While essential for decarbonisation, such high renewable penetration introduces significant challenges in the integrated grid operations due to intermittency and lack of inertia.

Battery Energy Storage System (BESS) has emerged as one of the cost effective and flexible solutions to address the grid integration challenges. BESS can facilitate renewable integration through fast ramping and provide: energy shifting, frequency support, peak shaving, and smoothing of renewable output. As a result, battery systems are slowly becoming part and parcel of renewable energy plants. These are deployed as standalone assets operate under frequent charge-discharge cycles, partial state-of-charge operation, rapid power fluctuations, and diverse duty cycles dictated by grid and market requirements. The various other operational requirement, rather than nameplate capacity alone, play a critical role in determining battery performance, lifetime, and economic viability. For example, the storage capacity shall be useful for shifting the energy from one-time zone to another whereas the rapid charge/discharge capacity shall be helpful in frequency maintenance and grid stability. These requirements may change as per grid conditions and requirements.

Globally, lithium-ion batteries currently dominate the BESS market, accounting for nearly 90 percent of installed storage capacity. However, concerns related to critical material dependence, long-term sustainability, recycling challenges, safety considerations, and cost volatility have driven growing interest in alternative battery chemistries such as Sodium-ion batteries (SIB) and Vanadium Redox Flow Batteries (VRFB). These emerging technologies offer distinct operational characteristics, degradation pathways, and design trade-offs that may be advantageous under specific grid services and cycling regimes. A systematic comparison of such technologies under representative operating conditions can provide an insight in to various performance parameters, which is essential to guide technology selection and policy decisions.

In view of the above, the primary objective of this project is to establish a multi-chemistry battery energy storage testbed facility at the NISE campus to systematically evaluate the performance, degradation behaviour, and operational characteristics of LFP, SIB and VRFB energy storage technologies under realistic operating profiles representative of renewable energy integration in India.

Each testbed system for LFP, SIB and VRFB shall have the following minimum features:

- **20 kWh minimum usable capacity**
- Fully integrated **battery energy storage system with** Battery Management Systems (BMS), Data Acquisition System (**DAQ), Power Converter System (PCS)**, Energy Management Systems (**EMS)**, **thermal sensors**, **fault monitoring**, protection systems and **safety systems**
- Capability for real-time and historical data acquisition, storage, and analysis
- Compliance with international and National performance, testing & safety standards

A single line diagram representation of the testbed facility for the sake of understanding is given in the **Figure 1**.

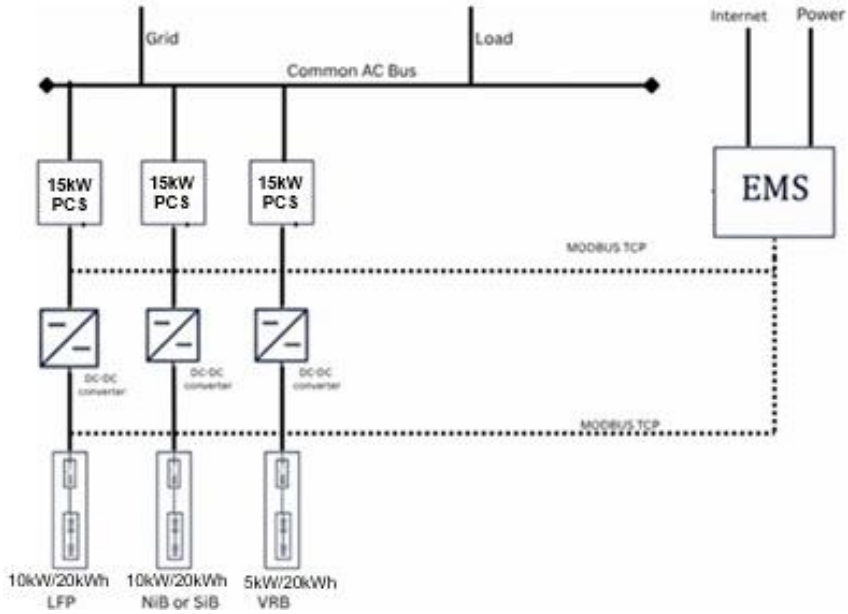

Figure 1: Different battery energy storage technology testbed facility at NISE

The primary aim of the study is to evaluate and compare the performance, degradation behaviour, and operational characteristics of commercially available battery energy storage technologies, including Lithium Iron Phosphate (LFP), SIB, and VRFB, by deploying them in modular testbed systems of 20 kWh capacity each. and collecting the field operational data through a proposed dedicated monitoring data management software platform. The insights generated from this study will support standards development, technology benchmarking, battery selection frameworks, predictive maintenance planning, and system optimization for future solar plus battery, renewable energy plus battery, and standalone energy storage system deployments across the country.

5. Operations:

The proposed testbed facility with different storage technologies will be used as an independent system that connects to the grid in on-grid mode/ NISE micro grid. Thus, this testbed facility combined with NISE solar PV power plant (micro grid) should be capable of smoothening the intermittent energy generation, provides peak shaving, reactive compensation for the grid, and control ramp rate to improve the resilience of the grid. The SCADA system through its programing mechanism should control each inverter for charging and discharging (Grid feeding) logic suitable to each battery technology as per the requirement of the study. This control mechanism should be able to perform different grid support requirements as described below:

a. Peak Load Shifting
b. Peak Regulations and Frequency Modulation
c. Reactive Power Support
d. Load Tracking etc.

6. Key Monitoring Parameters:

To achieve the stated objectives, the following critical parameters will be monitored and analysed using Energy's advanced software platform:

Table 1: Electrical Parameters

- State of Charge (SoC)
- DC voltage at cell, module, and system level
- Internal resistance/impedance
- Depth of Discharge (DoD)
- Round trip energy efficiency
- Self-Discharge rate during idle conditions
- Power factor at point of interconnection
- Standby power consumption, including auxiliary and control loads
- State of Health (SoH)
- Current (charge/discharge)
- Charge and discharge cycle count, including partial and equivalent full cycles
- Coulombic efficiency
- Power output and power density
- Energy Capacity usable capacity over time
- Short-duration overload capability and transient power response

Table2: Thermal Parameters

- Cell/module temperature
- Thermal runaway threshold
- Temperature gradient across battery modules
- Rate of temperature rise during high C-rate operation
- Thermal recovery time following high-stress or high-power operation
- Ambient temperature in battery enclosure or installation area
- Cooling efficiency
- Maximum surface temperature
- Thermal response during fast charging and fast discharging events
- Maximum external surface temperature of battery enclosures or modules

Table 3: Degradation Indicators / Aging Metrics

- Capacity fade over time
- SoH vs. cycle count correlation
- Mechanical degradation indicators, including visible swelling, leakage, deformation, or abnormal structural changes
- Growth in internal resistance
- Calendar aging indicators under defined standby and idle conditions
- Remaining useful life estimation indicators

Table 4: Operational/Usage Patterns

- Charge/discharge rate (C-rate)
- Charging method (standard, fast, variable-rate charging)
- Time spent in defined high and low SoC bands
- Frequency and magnitude of peak power events
- Total energy throughput (kWh Vs time)
- Frequency and duration of idle or standby periods

- Impact of control and dispatch strategies on cycling intensity
- Seasonal variation in operating patterns and performance metrics
- Correlation between operational profiles and degradation acceleration

Table 5: Fault, Protection and Safety Event Logging

- Over-voltage / under-voltage events
- Over-temperature warnings and alarms
- Alerts from BMS
- Over-current and short-circuit events
- Cell/module failure records
- Insulation resistance degradation or ground fault detection
- Time elapsed between fault occurrence, detection, and isolation
- PCS protection events, interlocks, and fault codes
- Manual intervention logs and maintenance-related safety events
- Frequency and root cause of BMS protection triggers
- Emergency shutdown events and subsequent restart behaviour

The outcomes of these studies, based on continuous real-time data collection and analysis, will enable optimization of battery operating strategies, extension of service life, and improved reliability of BESS in decentralized renewable energy applications. The availability of standardized, field-validated datasets across multiple battery chemistries will further support comparative assessment of performance, degradation behaviour, operational flexibility, and system-level efficiency under similar usage profiles, thereby enabling evidence-based technology selection and deployment decisions. The insights generated are expected to contribute to the review and refinement of existing performance and reliability standards for BESS in India, while enhancing confidence and awareness among developers, utilities, and end users regarding the suitability of different battery technologies.

7. Scope of the Project

The Bidder shall be responsible for deployment of 3x 20 kWh BESS (LFP, SIB & VRF) at the National Institute of Solar Energy, Gurugram, Haryana - 122003, India. This includes the site survey, design, engineering, planning, single line diagram, manufacturing, supply, packaging, forwarding, transportation, unloading, handling, transit & storage insurance, material storage, construction, installation, erection, commissioning, earthing and lightning protection design, and testing of the BESS and its components. Additionally, it includes establishing grid connectivity for both grid and load points, associated civil and fabrication works, EMS system, SCADA system integration, the supply of mandatory spares, and technical support for the BESS for a contract period of 5 years.

The BESS configuration should allow safe access to all equipment for installation, operation, maintenance, and repair under any weather conditions. The bidder must include all materials and services necessary to complete the project, even if not explicitly listed in the specifications. The bidder will be responsible for identifying and

providing any and all equipment, components, and services necessary for a fully functional grid-connected BESS and its dedicated loads.

This includes detailed design, engineering, manufacturing, fabrication, supply, transport, assembly, installation, erection, commissioning, and testing (including pre-commissioning and commissioning) of all equipment and systems, including civil works. The bidder will deliver a fully functional BESS on a turnkey basis, which will include but not be limited to (*wherever applicable*):

- **Overall Responsibility and Turnkey Delivery**
  The Bidder shall be responsible for the complete turnkey execution of the Battery Energy Storage Systems, including detailed design, engineering, manufacturing, fabrication, supply, transportation, assembly, installation, erection, commissioning, testing, and handover of a fully functional grid connected BESS along with its dedicated loads, even if certain items or services are not explicitly listed in the specifications.

- **BESS Configuration and Accessibility**
  The BESS configuration shall allow safe and convenient access to all equipment for installation, operation, inspection, maintenance, and repair under all weather conditions. The Bidder shall ensure that the system layout, enclosures, and access provisions comply with applicable safety and maintenance standards.

- **Battery System and DC Infrastructure**
  The scope shall include supply and integration of LFP, SIB, and VRFB battery modules, battery racks, containers, rack control boxes, battery module connectors, DC combiner panels, DC cables, cable trays or trenches, cable terminations, and complete earthing systems suitable for the respective battery chemistries.

- **Power Conversion and AC Infrastructure**
  The Bidder shall supply and install the PCS, AC and DC cables, ACDB, DCDB, LT power cables, auxiliary power distribution boards, battery chargers, and all associated electrical infrastructure required for reliable parallel grid connected operation of all three BESS setups.

- **Battery Management, Energy Management, and Control Systems**
  The scope shall include complete provision of BMS, EMS, monitoring and control systems, communication systems, DAQ, and integration with SCADA, enabling real time monitoring, control, data logging, and analysis of the BESS. The EMS and PCS control architecture shall be configurable and accessible to NISE and its knowledge partners for testing different operating modes, control strategies, and grid support functions, subject to safety limits.

- **Cooling and Thermal Management System**
  The Bidder shall provide compatible and redundant liquid or air based cooling systems for the BESS, including indoor or outdoor units, controllers, ducts, piping, and associated accessories, designed for Indian climatic conditions and chemistry specific thermal requirements.

- **Fire Detection, Suppression, and Safety Systems**
  The scope shall include chemistry compatible fire detection and suppression systems, including smoke detectors, gas detectors, fire dampers, manual call points, fire controllers, emergency release switches, and full integration with battery trays, switches, and racks, compliant with applicable NFPA and relevant safety standards.

- **Temperature Monitoring and Scanning System**
  The Bidder shall provide a temperature scanning system including sensors, loggers, controllers, panels, and integration with battery modules, racks, and enclosures for continuous thermal monitoring and protection.

- **Protection, Earthing, and Auxiliary Systems**
  The scope shall include protection systems, earthing systems, auxiliary power supply systems including UPS where required, auxiliary power distribution boards, and all interlocks necessary for safe and reliable operation of the BESS.

- **Civil, Structural, and Fabrication Works**
  The Bidder shall execute all associated civil, structural, and fabrication works required for installation of the BESS, including foundations, mounting structures, enclosures, trenches, cable routing arrangements, and access infrastructure.

- **Grid and Load Connectivity**
  The Bidder shall establish grid connectivity and connectivity to dedicated loads, including coordination with the local utility, provision of interface and protection systems, and compliance with applicable grid interconnection standards. Compliance with applicable Indian grid codes, CEA technical standards, and relevant IEC/IEEE standards for inverter-based resources shall be ensured.

- **Testing, Commissioning, and Trial Operation**
  The scope shall include completion of type tests, routine tests, and acceptance tests, preparation of a detailed test acceptance plan, Factory Acceptance Testing, Site Acceptance Testing, and successful trial operation of the BESS for a minimum period of seven days from the commissioning date. Reliability and functional guarantee tests shall be conducted, and all relevant test reports shall be submitted.

- **Warranty**
  The Bidder shall provide adequate warranty of at least 3 years for the complete BESS and all its components, including bought out items, covering manufacturing defects, material failures, performance non-compliance, premature degradation beyond specified limits, and safety related failures, with chemistry specific warranty terms clearly defined.

- **Operation, Maintenance, and Spares**
  The scope shall include operation and maintenance support for a period of five years, along with supply of major spares for the same period. Pricing for spares shall be provided separately in the price bid.

- **Training and Knowledge Transfer**
  The Bidder shall provide comprehensive training to NISE engineers and operators covering system operation, control functions, safety procedures, maintenance practices, and emergency handling.
- **Documentation and Deliverables**
  The Bidder shall provide complete project documentation in English, including operation and maintenance manuals, as built drawings, block diagrams, single line diagrams, system architecture, system configuration details, equipment technical specifications, test reports, and bidder contact information.
- Design of the entire setup and BoQ shall be approved by NISE and its associated technical knowledge partners before its deployment at NISE.

8. Design features of BESS for each individual testbed:

The general design specifications of testbed facility are as following

Table 6: General Specifications (for all test beds)

Parameter	**Requirement**
Energy Capacity	20 kWh minimum usable for each technology
Voltage Range	48–600 V (chemistry dependent)
Max Current	≥ 200 A continuous
Power Rating	1. LFP/SIB: ≥ 10 kW 2. VRFB: ≥ 5kW
Cycler Modes	CC, CV, CP, CCCV, pulse, dynamic
DAQ Sampling Rate	≥ 1 Hz for electrical and thermal parameters
Communication	CAN, Ethernet, Modbus, RS485
Data Storage	Minimum 5 years of historical data storage
Cooling	Forced air / liquid (VRF)
Fire Suppression	Novec 1230 / Clean Agent

The specific design features/ requirement of each individual technology testbed are as following:

Table 7: Detailed Design features of each technology testbed

Sr. No.	**Parameter**	**Remark**
1.	BESS output voltage under grid connection and islanded mode	415 V ±15%, 3 phase, 50 Hz
2.	BESS dedicated load connectivity voltage	415 V±15%
3.	BESS Type	Indoor / containerized system with corrosion protection minimum **C3** as per ISO 12944

4.	BESS capacity (minimum usable)	LFP: 20kWh SIB: 20 kWh VRFB: 20kWh
5.	BESS Cycles per day	Min 2 full cycles per day under standard operation
6.	Guaranteed complete charge and discharge cycles	1. **LFP**: >3,000 cycles 2. **SIB**: > 5,000 cycles 3. **VRFB**: >10,000 cycles
7.	BMS Type	Hardware and Software
8.	Remote BMS (RBMS)	Highly desired wherever available
9.	BMS/RBMS communication	Should Support CAN/RS485/LAN Communication Interface: Ethernet
10.	Depth of Discharge	3. LFP/SIB: 80% 4. VRFB: 100%
11.	Positive and Negative Ramp Rate	BESS Shall have suitable for fast ramp up/down capability to support BESS Operation in Grid Connected and islanded mode
12.	Environmental condition requirement for Site	• Ambient temperature -0℃~50℃ • Ambient Humidity ≤ 95%RH, no condensation is allowed • Protection level IP55 (Battery compartment)
13.	Firefighting methods	Chemistry-compatible system; aerosol or equivalent approved solution
14.	LV Cable efficiency between Battery to PCS, PCS to LT panel (grid and load side)	>99.5% or better
15.	PCS/ Hybrid inverter efficiency	> 97 % or better
16.	Round Trip Efficiency	1. LFP: > 90% or better 2. SIB: >90% or better 3. VRFB: > 70% or better
17.	Protection Systems	Over/under voltage, over/under frequency, overcurrent, ground fault, insulation monitoring
18.	Earthing and Lightning Protection	As per CEA and applicable IEC standards
19.	Safety Interlocks	Door interlocks, emergency stop, fire interlocks, PCS shutdown logic

20.	Battery Cooling System	**LFP/SIB:** Air or liquid cooling with redundancy; **VRFB:** Electrolyte temperature control and pump redundancy
21.	Auxiliary Power Supply	UPS for BMS, EMS, and communication systems
22.	Research Access Provision	EMS and PCS parameters configurable by NISE within defined safety limits for R&D purpose

***The above mentioned design and specifications are based on the requirement predictions and the actual design and specification are in the bidder scope for the completion of the project**

Vendors shall provide the assumptions considered while calculating the total battery capacity, including the following details:

- Battery module capacity (kWh)
- Number of modules/racks
- Installed capacity per rack
- Number of Modules / battery racks
- Total installed capacity (kWh)
- One-way conversion efficiency considered
- Battery rack operating voltage (Vdc)
- Auxiliary power consumption
- BOP for VRFB
- C-rating

Vendors shall also provide a 10-year capacity availability calculation, considering 80% Depth of Discharge (DoD), standard operating conditions at 25°C, and full load. The calculation should include the following information:

- Year
- Number of cycles
- Degradation in % State of Health (SoH)
- Rated/Installed kWh
- DC usable kWh
- Available capacity (kWh) at POC, including auxiliary consumption
- Available capacity (kWh) at POC, excluding auxiliary consumption

***Cycle Definition:**

A complete charge cycle is defined as the discharge of an amount equivalent to 100% of the battery's

capacity, though not necessarily from a single charge. For example, if 75% of the battery's capacity is used one day and fully recharged overnight, and then 25% of the capacity is used the next day, the total of 100% discharged capacity over the two days will count as one full charge cycle.

9. Safety Standards

The BESS shall comply with the following Codes and Standards or equivalent Indian Standards, as applicable.

Table 8: BESS safety standard

Standard	Description	Certification Requirements
UL 1642 or UL 1973, Appendix E (cell) or	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial	Required for Cell
UL 1973 (battery) or (IEC 62619 (battery) + IEC 63056 (battery))	Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications / Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications	Either UL 1642 or UL1973 or (IEC 62619 + IEC 63056) for the Battery level
IEC 62281 / UN 38.3	Safety of primary and secondary lithium cells and batteries during transport: Applicable for storage systems using Lithium-Ion chemistries	Required for both Battery and pack or module.
IEC 61850/ DNP3	Communications networks and management systems. (BESS control system communication)	
UL 9540 or (IEC TS 62933-5-1 + IEC 62933-5-2)	Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems – General specification / Standard for Energy Storage Systems and Equipment	Either UL9540 or (IEC 62933-5-1 + IEC 62933-5-2) is required for BESS system level

Battery Safety	Fire Safety	Chemical & Environmental	TESTING & PERFORMANCE STANDARDS
IEC 62619 (LFP) IEC 62620 (SIB) IEC 62932 (VRF) IEC 62133-2 (Li-ion) ISO 12405 (Performance testing)	NFPA 70 NFPA 2001 ISO 14520	ISO 11114 (chemical containers) IEC 60068 (environmental testing)	IEC 62053 – Power measurement IEC 62586 – Power quality IEC 61850 – Data communication IEEE 1679 – Battery performance ASTM E1049 – Fatigue/cycle analysis IEC 62933-5-2 – Sodium-based energy storage IEC 62932 – Flow battery standards

**Note:- ***Additional applicable standards suitable in Indian Conditions also needs to be included

10. Requirements for SCADA Server at NISE

SCADA application software shall include but not be limited to the following inherent features:

- Online state of SCADA server/communication front ends, and data acquisition services.
- Real time connection status of all the RTU, PLC, BMS, PCS, EMS, and field devices. station.
- Connection status of all equipment at substation station.
- Equipment-level connectivity and health status for all battery, inverter, protection, and auxiliary systems.
- Data analysis (Comparison between last day value with present value) and recording all parameters for time interval of 5 min, 15 min configurable as per user requirement
- Reporting (Power consumption, Input & output electric consumption and electric parameter phase wise (A, V, KVA, KW, PF, KVAH, Hz, and other derived indicators)
- Facility to define certain warnings and alarms with audible sound to attract the attention of the operator as per user requirement for CMD control, PF control, tripping and malfunctioning of breaker etc.
- SQL-based data base for storage of real-time, historical, and event data.
- Asset Management and visualization through a unified single-screen or dashboard-based interface.
- Scalability to add new parameters, tags, devices, and screens in future with minimal configuration changes.
- This should allow export/import of Tag Configuration Data and Configuration data for all, Visualization /Reporting / Monitoring component as well as connector utility and device configuration data for all sites. This should be in either of CSV / Excel/ XML format.
- There should not be any limit on the number of tags and screens to be configured in the system and the number of users to be allowed in the system.
- Note: - Bidder has to be ensure for minimum 3 years of technical support for SCADA system.
- All the associated software for configuration, troubleshooting or modification the program in future with respective license key

- Specifications of SCADA Workstation / operator console Hardware (01 Set)

Table 9: SCADA specifications

Sl. No.	Component	Minimum Technical Specification
1	**Processor (CPU)**	Latest-generation high-performance desktop processor with minimum 16 physical cores and 32 threads. Architecture suitable for sustained compute-intensive workloads. Compatible with DDR5 memory and PCIe Gen-5 platforms.
2	**Motherboard**	High-end motherboard compatible with the specified processor. Must support DDR5 memory, PCIe Gen-5 expansion, multiple NVMe SSD slots, integrated Gigabit or higher LAN, integrated Wi-Fi, and sufficient USB 3.x ports.
3	**System Memory (RAM)**	Minimum 64 GB DDR5 RAM, minimum speed 5200 MHz, configured in dual-channel or better. System should be expandable for future upgrades.
4	**Primary Storage**	Minimum 1 TB NVMe Solid State Drive, PCIe Gen-4 or higher interface, high read/write performance suitable for professional and data-intensive workloads.
5	**Graphics Processing Unit (GPU)**	Dedicated RTX-class discrete graphics card or equivalent, with minimum 8 GB GDDR6 video memory. Must support GPU-accelerated computing, AI/ML workloads, rendering, and multi-monitor high-resolution display output.
6	**Power Supply Unit (PSU)**	Minimum 850 W power supply with 80 Plus Gold efficiency rating or higher. Fully modular or semi-modular design. Adequate headroom for high-end GPU operation.
7	**Cabinet / Chassis**	ATX-compatible mid-tower or full-tower cabinet with high-airflow design. Must support large graphics cards and liquid cooling solutions. Easy access and cable management preferred.
8	**CPU Cooling Solution**	High-performance closed-loop liquid cooling system or equivalent air/liquid solution suitable for continuous high-load operation of the processor.
9	**Monitor**	Minimum 27-inch display, 4K UHD resolution (3840 × 2160), professional-grade panel technology. Must include digital inputs such as HDMI and/or DisplayPort.

10	**Keyboard & Mouse**	Professional-grade keyboard and mouse (wired or wireless). Multi-device support preferred.
11	**Operating System Compatibility**	Hardware must be compatible with latest 64-bit desktop operating systems commonly used for professional and scientific workloads.
12	**Printer**	A3+ Size Leser jet printer for cost-conscious users, complete.
12	**Warranty**	Minimum 3 years onsite warranty for CPU, motherboard, RAM, PSU, storage, and monitor. Minimum 1 year warranty for accessories and cooling solution.

11. Supply Installation and Commissioning

Supply, installation, testing, and commissioning (SITC) of complete battery monitoring system including BMS, inverter, SCADA integration, cabling, racks, safety devices, and mounting accessories. Includes fixing, wiring, Calibration & configuration, performance testing, safety compliance, and handover with all essential accessories and documentation.

i)Essential Accessories (Included with Supply):-

- DC busbars, MCCBs, fuses, isolators.
- Cabling & connectors (DC/AC rated).
- Civil enclosure, mounting frames.
- Fire safety components (Clean Agent).

ii) Installation Scope:-

- Placement & mounting of all battery modules on suitable racks/cabinets.
- Wiring of DC, control, and communication circuits (RS485/CAN/Ethernet).
- Integration of BMS, Inverter & PQ Analyzer with SCADA/DAQ system.
- Electrical panel wiring (busbars, protection devices, isolators).
- Setup of cooling, safety, smoke & fire suppression sensors.

iii) Testing, Configuration & Calibration:-

- Module-wise SAT (Site Acceptance Test).
- BMS configuration — SoC, SoH, data threshold & alarm allocation.
- Inverter setup for load cycling, grid-connect & charge modes.
- Accuracy and calibration of PQ analyser (THD, harmonics, PF).
- Verification of communication (RS485, Ethernet, Modbus TCP/IP).
- Functional testing with SCADA dashboard, real-time logging.

iv) Commissioning & Demonstration:-

- End-to-End system integration.
- Live testing under different charge/discharge conditions.

- Real-time SCADA alarm, trend & historical data validation.
- Safety checks — thermal, voltage, fire, isolation tests.
- Submission of commissioning checklist & validation report.

v) Training & Documentation: -

- O&M Manuals for Battery, BMS, Inverter, PQ Analyzer.
- Test Log Sheets, Performance Diagrams, SCADA Reports.
- Calibration Certificates & SAT Documents.
- Installation Layout, Wiring Diagram & Protocol Sheets.
- Operator & Admin Training Session.

Earthing to poles/lightening arrestor /GOD switch complete with galvanised steel earth plate electrode 60 cm x 60 cm x 6 mm thick buried directly in ground (earth pit not less than 2.25 m below normal ground level) with top edge of the plate at a depth not less than 1.5 m below ground level, the earth electrode surrounded by adequate quantity of charcoal dust and salt to a packed thickness of 15 cm on all sides, connected to galvanized earth lead 4.00mm dia up to 7.50 metre, including nuts, bolts, check nuts & washers of galvanized iron or steel and riveted to earth plate at one end and connecting to running earth wire/overhead line conductor along pole at the other end, GI wire encased in and including 15mm bore GI light grade pipe with all fittings fixed with and including 25 x 3mm flat iron clamps, bolts, nuts and washer and also including providing watering pipe 20mm bore GI pipe light grade and incl funnel, wire mesh, copper lugs etc from bottom of earth pit to top of electrode complete with earth pit in PCC 1:3:6 type C-1 using 20mm graded crushed stone aggregate(including PCC pit cover) and RCC 1:2:4 type B-1 cover complete all specified and shown in electrical plate No 3 of SSR Pt-I connecting earth electrode to test point with and including earthing lead including necessary excavation and earthwork in any type of soil, returning, filling in approved soil and disposal of surplus soil to a distance n.exc 50m and taking out old material all as specified and directed by Engineer-in-Charge.

Annual **c**omprehensive maintenance including supply and replacement of unserviceable spare of SCADA system along with RTU, Server and all connected components after completion of defect liability period of contract agreement which include routine, preventive & break down maintenance for period of including Program as specified and directed by Engineer-in-charge

12. Payment Terms

- 70% after delivery & installation
- 30% after successful commissioning & training
- AMC payment will be done on half yearly post completion basis

Additional Terms & Conditions: -

- No deviations in the specifications of any of the above items will be accepted. The Bidder should clearly declare in the BOQ Compliance that all items meet all the specifications as required. Point by Point

Compliance should be submitted rather than blanket statements like – "all specifications met"/"no deviations". This compliance must be given on OEM Letter Head.

- Make in India (MII) Is compulsory (Class1 /Class2). The same needs to be submitted on OEM letterhead.
- All the Certificates mentioned in the individual items should be submitted as additional documents in the bid.

13.Financial Evaluation

The broad criteria for evaluation of the bids would be a Quality cum Cost Based System (QCBS) as follows:

Table 10: Quality cum Cost Based System (QCBS)

Sr. No.	**Item**	**Percentage (weightage)**
1	Technical Evaluation	70%
2	Financial Evaluation	30%
Total		100%

The methodology for the technical evaluation is as follows:

Table 11: Quality cum Cost Based System (QCBS) technical marking

SN	**Criteria**	**Criteria Details**	**Supporting Documents**	**Max Marks**	**Cut off marks**
1	**Project Experience**	Creation/ Establishment of multiple or single technology Battery Energy Storage Experience in design, supply, installation & commissioning of BESS projects ≥ 20kWh (10 marks per project)	Work Order and Certificate of completion of the work for clients / Client satisfaction Certificates	**30**	**10**
2	**Technology Coverage & Capability**	• Data fetching /extraction capabilities, from the sensors, IoT's and electronic device	Work Order and Certificate of completion of the work for clients/ Client satisfaction Certificates or User Acceptance Testing (UAT) Certificate	**30**	**20**

		• Integration of BMS, PCS, EMS, SCADA • Capability to test performance, safety, degradation & lifecycle parameters (10 marks per bullet point)			
3	**Proposed Technical Approach & Methodology**	• Understanding of project objectives and NISE testbed requirements • Proposed testbed architecture, layout, scalability & future expansion • Any other information bidder desires to provide • Safety, fire protection, standards compliance (IEC, UL, IEEE)	Evaluation on the basis of technical presentation to the selection committee	**40**	**20**
Total marks				**100**	**50**

The bidder should score a technical score of more than or equal to 25 out of 50 in the technical bid evaluation process to be qualified for commercial evaluation. Further, the bidder should also clear the minimum cut-off score in each of the technical parameters to be eligible for commercial evaluation.

After opening and evaluating the financial proposals of technically qualified bidders, a final combined score shall be arrived based on the weightage mentioned in **Table 10**. The "Technical Score" & "Commercial Score "will be calculated using the formula, given below:

$$\text{Technical Score (T)} = \frac{\text{Bidder's Technical score}}{\text{Highest Technical Score}} \times 100$$

$$\text{Commercial Score (C)} = \frac{\text{Lowest Commercial Price}}{\text{Bidder's Commercial Price}} \times 100$$

The Final Score for a bidder will be calculated using the formula, given below:

Final Score (F) = (Technical Score x 0.7) + (Commercial score x 0.3)

14. Bidder needs to provide the following details with the technical bid.

Table 12:

Sl. No.	Description	To be Furnished by the Tenderer
A	**Battery**	
1	Make/Manufacturer	
2	Type / Chemistry	
3	Design capacity of battery in terms of KWh	
4	Self-Discharge rate	
5	DOD	
6	Life cycle of battery	
7	Round trip efficiency	
8	Dimensions and weight of battery	
9	Test certificate available for battery cell/module (IEC Standards / NABL accredited labs / CPRI labs/ERDA/ BIS Standards)	
10	Number of series & parallel connected cells and modules	
11	Power/energy rating cells and modules	
12	BESS favorable operating temperature	
B	**Power Conditioning Unit**	
1	Make/manufacturer	
2	Type of charge controller(DC-DC converter)	
3	Efficiency of charge controller(DC-DC converter)	
4	Inverter- power rating & efficiency	
5	Inverter minimum response time	
6	Test certificate available (IEC Standards / NABL Accredited labs / CPRI labs/ERDA /BIS Standards)	
C	**Lighting Arrestor**	
1.	Type of Lighting Arrestor and make	
2	Type of Earthing	
D	Earthing	
1	Type of Earthing, make and capacity	
2	No of Earthing	
E	**Connecting cables/wire**	
1	Material and size& specifications	
2	Details of Switches	
F	Measurement & control devices	
1	Sensors	
	Type/make	
	Accuracy/precision	
	Sensitivity	
2	Transducers	
	Type/make	

	Accuracy/precision	
	Sensitivity	

15. Financial Bid

1. Price of Lithium Iron Phosphate Battery (LFP) (20 kWh minimum usable)
2. Price of Sodium-Ion Battery (SIB) (20 kWh minimum usable)
3. Price of Vanadium Redox Flow Battery (VRFB) (20 kWh minimum usable)
4. Price of Installation and Commissioning of Complete set up
5. Price of AMC