भारतीय प्रौद्योगिकी संस्थान मुंबई

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

Powai, Mumbai, 400 076

Detailed Technical Specification cum Scope of Work

Design, Supply, Integration, Development, Testing, Commissioning, Training, and Long-Term Support of SCADA, Monitoring, Control, and Data Acquisition Solution for Grid Integration Laboratory Infrastructure

The bids are invited from eligible and experienced bidders, system integrators, industrial automation solution providers, SCADA developers, and technology partners for the establishment of an advanced, scalable, research-oriented, and future-ready Supervisory Control and Data Acquisition (SCADA) and Monitoring & Control Solution for the Grid Integration Laboratory ecosystem.

This document contains broad technical, commercial, functional, operational, and contractual requirements prepared for enabling the bidder to understand the project scope and submit a comprehensive bid.

While every effort has been made to ensure the accuracy of information contained herein, IIT Bombay reserves the absolute right to modify, amend, expand, reduce, clarify, or withdraw complete or in any part of this tender document/technical specification/scope of work at any stage without assigning any reason whatsoever and without incurring any liability.

The bidder shall conduct its own assessment, technical due diligence, and independent analysis before submission of the bid. Submission of bid by the bidder shall be construed as complete acceptance of all terms, conditions, technical requirements, timelines, responsibilities, and contractual obligations contained but not limited to this technical document/tender document.

The Institute reserves the right to reject any or all bids without assigning any reason and may annul the bidding process at any time prior to contract award.

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1. INTRODUCTION

Indian Institute of Technology Bombay (IIT Bombay), through its Grid Integration Living Laboratory initiative, intends to establish an integrated, centralized, scalable, and research-oriented SCADA and Monitoring & Control infrastructure for multiple laboratories associated with various types energy storage systems, Solar PV and Wind turbine integration, power conversion system research, microgrid operation, electric mobility integration, inverter controls, energy management systems and distributed energy resource management.

The proposed solution shall support advanced real-time monitoring, control, automation, visualization, data acquisition, protocol integration, analytics, synchronization, data logging, event management, historical trending, remote access and operation, and interoperability across multiple laboratory environments.

The Institute seeks bids from competent and eligible bidders capable of delivering a complete end-to-end integrated solution comprising:

- Industrial-grade hardware
- SCADA software platform
- Communication infrastructure
- Embedded control systems
- Protocol integration
- Engineering services
- System integration
- Site Acceptance Testing (SAT)
- Commissioning
- Documentation
- Training
- Warranty and post-deployment support

The proposed solution must support both present operational requirements and future research expansion needs.

2. BACKGROUND AND PROJECT OVERVIEW

The Grid Integration Living Lab at IIT Bombay includes multiple interconnected research laboratories focused on:

- Battery Energy Storage Systems (BESS)
- Renewable Energy (RE) Integration
- Smart Grid Interactive House
- Centralised control Lab

The laboratory environment consists of heterogeneous equipment like simulators, inverters, inverter stacks, protection relays, electronic loads, EVs and EV Chargers, etc. sourced from multiple OEMs with different communication interfaces, operating philosophies, proprietary systems, and control methodologies.

The Institute intends to establish a unified architecture capable but not limited to:

- Centralized monitoring
- Real-time control

- Data synchronization
- Research-grade data acquisition
- Protocol interoperability
- Integration with AI/ML and analytics platforms
- Long-term maintainability

The proposed architecture shall include local node-level or lab level control and communication functionality along with centralized supervisory control or master control for communicating and controlling individual laboratory and data acquisition functionalities.

The bidder shall thoroughly understand the operational philosophy, research nature, flexibility requirements, interoperability needs, and future scalability requirements while designing the proposed solution.

3. OBJECTIVES OF THE BID(S)

The primary objectives for inviting bids are as follows:

3.1 Local-Level Control and Communication

Local-level control and communication is required for reliable, safe, and autonomous operation of each laboratory, asset, or subsystem. It shall monitor voltage, current, frequency, power flow, SOC, equipment status, protection signals, and alarms. The local control system shall support both inverter-level control, including control of power electronic switching as per required operating modes, and EMS-level control, including dispatch decision of devices and local power flow management among PV, wind, BESS, EV chargers, loads, and grid interface. It shall also allow user-defined control logics for R&D, while ensuring fault detection, interlocking, emergency shutdown, and safe operation even during loss of communication with the master controller.

3.2. Master-Level Control and Communication

Master-level control and communication is required for centralized monitoring, supervisory control, coordinated operation, data aggregation, and system-wide optimization of distributed laboratories or energy assets. The master controller shall receive data from local controllers and issue supervisory commands based on operating strategies, grid-support objectives, research needs, and safety limits. It shall support inverter-level supervisory control by providing high-level references or operating modes, while fast switching remains local, and EMS-level supervisory control for coordinated device scheduling, power allocation, charging/discharging decisions, and grid import/export management. It shall also support user-defined control logics for R&D, digital twin integration, remote experimentation, benchmarking, cybersecurity, and future scalability.

3.3 Realtime Control

To enable distributed intelligent control architecture capable of local autonomous operation while remaining synchronized with the central supervisory controller.

3.4 Real-Time Data Acquisition

To implement high-speed and reliable real-time data acquisition systems for but not limited to AC and DC measurements, inverter systems, battery systems, renewable energy sources, and grid simulators.

3.5 Research Flexibility

To provide a flexible and open research-oriented platform enabling researchers and students to implement, modify, and test custom algorithms, communication logic, control strategies, and experimental configurations.

3.6 Protocol Interoperability

To support interoperability with multiple industrial and research communication protocols including but not

limited to:

- MODBUS RTU
- MODBUS TCP/IP
- CAN Bus
- Ethernet/IP
- MQTT
- TCP/IP
- UDP

3.7 Long-Term Scalability

To ensure future scalability for additional laboratories, sensors, controllers, inverters, renewable energy assets, energy storage assets, and research nodes.

3.8 Cybersecurity and Reliability

To establish a secure, reliable, redundant, and resilient architecture suitable for academic research and industrial collaboration.

4. SCOPE OF WORK

The scope of work under this tender shall include, but shall not be limited to, the following:

4.1 System Engineering

The selected bidder shall perform complete system engineering activities including:

- Requirement analysis
- Detailed engineering
- Architecture development
- System sizing
- Hardware selection
- Communication engineering
- Network engineering
- Cybersecurity architecture
- Database engineering
- SAT procedures

4.2 Hardware Supply

Supply of all required hardware including:

- Industrial controllers
- Compact RIO FPGA-based controllers
- Data acquisition (DAQ) modules
- Power analyzers
- Industrial gateways

- Managed Ethernet switches
- Communication modules
- Protocol converters
- Sensors
- Signal conditioning units
- GPS time synchronization modules
- CAN interfaces
- RS-485 interfaces
- Fiber media converters if required
- Industrial enclosures
- Power supplies
- UPS systems
- Terminal blocks
- Relay modules
- Digital I/O modules
- Analog I/O modules

4.3 Software Supply

Supply and licensing of:

- All relevant software related to control, communication and monitoring
- Runtime licenses
- Engineering licenses
- Data analytics tools
- Communication drivers
- Dashboard and visualization tools
- Reporting tools
- API access tools
- Development environment access

4.4 Integration and Development

The selected bidder shall:

- Integrate all hardware and software components
- Configure communication interfaces
- Develop SCADA screens
- Configure alarms and events
- Configure trends and reports
- Implement user management
- Configure access controls
- Implement cybersecurity features

- Configure synchronization mechanisms
- Develop communication diagnostics
- Configure data backup systems

4.5 Commissioning

The selected bidder shall:

- Perform SAT
- Install and commission the system
- Conduct functional performance and interoperability testing
- Conduct communication testing
- Conduct cybersecurity verification
- Demonstrate complete functionality

4.6 Training

Comprehensive training shall be provided to:

- Faculty members
- Research staff
- Laboratory engineers
- Students and System administrators

Training shall include:

- Technical information complete system architecture
- Hardware and software maintenance
- System functionality and troubleshooting
- Protocol integration
- Data management
- Cybersecurity practices
- Backup and restoration
- Custom application development

5. LABORATORY-WISE REQUIREMENT UNDERSTANDING

5.1 Battery Storage Lab

The Battery Storage Laboratory requires comprehensive monitoring and control architecture supporting advanced research involving:

- Battery Energy Storage and Management Systems
- Li-ion battery systems
- Vanadium Redox Flow Batteries
- Supercapacitor systems

- Inverter systems
- Energy Management Systems
- Grid simulators
- V2H/V2G systems
- Battery Converter stacks
- Power analyzers
- Local and centralized controllers

5.2 Monitoring Requirements

The system shall support:

- DC voltage monitoring
- DC current monitoring
- AC three-phase voltage monitoring
- AC three-phase current monitoring
- Frequency monitoring
- Harmonic analysis
- Power quality monitoring
- Power factor monitoring
- Energy monitoring
- Temperature monitoring
- State of charge monitoring
- Battery health monitoring
- Health communication monitoring

The monitoring node must be compatible with both DC and AC signals within the specified ratings. It should enable signal observation via a PLC/PAC system. The system must support waveform monitoring and various signal processing functionalities through the supplied programming software.

The 3phase Power analyzer must be PLC/PAC-based and capable of measuring voltage, current, power, power factor, and harmonics directly, without the need for additional circuitry.

5.3 Control Requirements

The system shall support:

- Charging/discharging control
- Inverter control including Half-Bridge Digital Outputs, Sinking Digital Outputs, Contactor Control Digital Outputs, Sourcing Digital Inputs, LVTTL Digital I/O channels, Simultaneous Analog Inputs (16-bit, 100 kS/s), Scanned Analog Inputs, Scanned Analog Outputs
- Local and remote commands
- EMS integration
- FPGA-based control
- Power Analyzers shall provide advanced control options enabled by an RTOS processor and FPGA

hardware.

5.4 Communication Requirements

The system shall support:

- Modules Extension in PLC/PAC/MCU
- MODBUS RTU
- MODBUS TCP/IP
- CAN Bus
- Ethernet communication
- High-speed synchronization and GPS-based time synchronization

5.5 Local Master Controller Requirements

The local master controller shall:

- Operate autonomously
- Execute local control logic
- Synchronize with central SCADA
- Support custom algorithm deployment
- Support real-time execution
- Provide local data storage
- Enable future scalability

A high-end PLC/PAC/MCU controller shall serve as the primary control unit for the laboratory, capable of processing commands from the global master.

The local controller must support all node-specific controls and functionalities, provided each node is equipped accordingly.

It must facilitate the implementation of control algorithms, including those developed in MATLAB or other relevant platform available with IIT Bombay existing platforms.

Charging and discharging operations should be managed by a charge controller or inverter via RS-485, CAN, or LAN using digital or analogue signals.

MPPT or other algorithms must be implementable and controllable on PLC/PAC/MCU nodes included in the solution.

5.6 Renewable Energy (RE) Integration Lab

The Renewable Energy Integration Laboratory requires monitoring and control of:

5.6.1 System Overview

The above architecture represents an advanced Renewable Energy (RE) Integrated Hybrid Energy Storage and Smart Grid Interaction Platform designed for:

- Renewable energy integration
- Hybrid battery storage experimentation

- Advanced inverter and converter research
- Grid synchronization
- Vehicle-to-Grid (V2G) / Vehicle-to-Home (V2H) applications
- SCADA-based supervisory monitoring
- Real-time FPGA-based inverter control
- The platform integrates:
- Floating Solar PV generation
- Wind energy generation
- Lithium-Ion Battery Energy Storage System (BESS)
- Multi-inverter power conversion systems
- EMS and grid synchronization infrastructure
- Real-time plant control and SCADA architecture
- Grid simulator-based testing environment

Functional Overview:

- Monitor electrical generation parameters
- Regulate charging of the battery storage system
- Provide data acquisition and communication interfaces

The V, I to V Monitoring Node, 3Ø Power Analyzer, Inverter Gate Control, Additional Modules, and Local Master Control must incorporate hardware features similar to those used in the Battery Storage Lab. However, a software-defined approach is required to ensure flexibility for deployment in the RE Integration Lab or comparable environments.

5.6.2 Floating Solar PV Monitoring Requirements Floating Solar PV Integration Subsystem

A dedicated PLC/PAC/MCU-based embedded monitoring unit shall be provided for solar PV monitoring.

Mandatory Functional Requirements

The monitoring unit shall support:

- Monitoring of DC voltage for up to two PV strings
- Monitoring of DC current for up to two PV strings
- String-level diagnostics

Communication Requirements

The system shall include:

- Minimum one RS-485 communication output
- Additional RS-485 channels for integration of external sensors

External sensors may include:

- Irradiance sensors
- Temperature sensors
- Water level sensors

Ethernet Connectivity

The monitoring unit shall:

- Provide Ethernet-based communication
- Interface with the Local Control Unit
- Support data transfer using the supplied programming tool Supported protocols may include Modbus TCP/IP, OPC, MQTT

5.6.3 Wind Generator Monitoring Requirements

Electrical Monitoring

The system shall provide:

- Two channels of DC voltage monitoring
- Two channels of DC current monitoring
- Active power monitoring
- Reactive power monitoring
- Three-phase AC power monitoring

Waveform Analysis Capability

The system shall provide:

- Voltage waveform analysis
- Current waveform analysis
- THD measurement
- Frequency analysis
- Power quality monitoring

Additional Monitoring Interfaces

The system shall include:

- RS-485 communication nodes for additional parameter monitoring
- Expandable sensor integration capability
- An anemometer for wind speed measurement and associated signal conditioning interfaces

Ethernet-Based Data Availability

All wind monitoring data shall:

- Be accessible through Ethernet
- Interface with the Local Control Unit
- Use the supplied programming environment and software tools

6. FUNCTIONAL REQUIREMENTS

6.1 Battery Storage Laboratory Functional Requirements

The Battery Storage Laboratory solution shall support monitoring of:

- Battery DC voltage
- Battery DC current
- Cell voltage
- Battery temperature
- State of charge (SOC)
- State of health (SOH)
- Battery charging status
- Battery discharging status
- Inverter output parameters
- AC three-phase electrical parameters
- Power quality parameters
- Communication status

The Battery Storage Laboratory solution shall support control of:

- Battery charge/discharge control
- Inverter start/stop control
- Grid synchronization control
- Contactor control
- Digital output control
- Digital input acquisition
- Analog signal control
- FPGA-based inverter control
- Local and remote operation
- Emergency shutdown logic

6.2 Renewable Energy Integration Lab Functional Requirements

The RE Integration Lab shall support monitoring of:

- Solar PV generation electrical parameters
- Wind energy generation electrical parameters
- Inverter systems
- Grid simulator parameters
- EMS operation

- Power flow
- Grid synchronization status

6.3 Floating Solar PV Functional Requirements

The Solar PV subsystem shall support:

- Monitoring of PV string voltage
- Monitoring of PV string current
- String-level diagnostics
- Irradiance monitoring
- Module temperature monitoring
- Water level monitoring
- Ethernet-based data transmission
- RS-485 sensor integration
- Integration with Local Master Controller

7. TECHNICAL ARCHITECTURE REQUIREMENTS

The proposed solution shall adopt architecture comprising:

- Field-level monitoring and control nodes
- Laboratory-level supervisory control architecture including local autonomous controllers
- Centralized SCADA infrastructure
- High-speed industrial communication backbone
- Secure network and user access infrastructure
- Centralized data analytics and archival infrastructure
- Time-synchronized communication framework
- Open API-based interoperability framework
- Future expansion without major redesign
- Redundant ring topology where required

Every participating bidder shall submit proposed system architecture diagrams as part of its Technical Bid. These shall include, at a minimum, network, control, communication, synchronization, cybersecurity, data-flow, device-hierarchy, redundancy and integration architectures. The successful bidder shall submit detailed implementation-level drawings during detailed engineering for IIT Bombay's review and approval.

- Network architecture
- Control architecture
- Communication architecture
- Synchronization architecture

- Cybersecurity architecture
- Data flow architecture
- Device hierarchy architecture
- Redundancy architecture
- Integration architecture

7.1 Local Laboratory Control Layer

Each laboratory shall include a Local Lab level Controller architecture. The Local Controller shall:

- Operate autonomously during central controller's or master controller's unavailability
- Execute local EMS and control algorithms
- Support FPGA-assisted control execution
- Support real-time operating system-based execution
- Support MATLAB and custom algorithm deployment
- Execute converter control algorithms
- Support MPPT implementation
- Execute battery charge/discharge logic
- Provide communication diagnostics
- Synchronize with central SCADA

7.2 Central or Master Controller Layer

The centralized SCADA system shall:

- Monitor all laboratory assets
- Support centralized visualization
- Provide alarm and event management
- Provide trend analysis
- Support centralized command execution
- Support user and role management
- Support analytics and reporting
- Provide synchronization monitoring
- Support API integration
- Support future cloud-independent expansion The SCADA platform shall support:
- Multi-user operation
- Web-based dashboards
- Thin-client access
- Multi-protocol communication
- Data export capability
- Remote diagnostics

- Audit logging
- Node failure detection

7.3 Time Synchronization Architecture

The entire system architecture shall support synchronized operation. The synchronization architecture shall include:

- GPS-based synchronization modules
- IEEE 1588 Precision Time Protocol (PTP)
- Sub-microsecond synchronization capability
- Time-synchronized event logging

Synchronization accuracy across distributed nodes shall be less than 1 microsecond wherever specified

7.4 Data Architecture Requirements

The proposed solution shall implement a centralized and distributed hybrid data architecture.

The architecture shall support:

- Real-time and simultaneous data acquisition
- High-speed streaming
- Historical data storage
- Event data storage and archival
- Configuration archival
- Time-series data with millisecond-resolution timestamps
- Redundant storage capability
- Automated archival
- Query and retrieval tools
- CSV and open-format export
- API-based access
- Packet loss diagnostics

The bidder shall ensure that:

- No proprietary lock-in exists for historical data access
- IIT Bombay retains complete ownership of all data
- External analytics platforms can be integrated without restriction

8. HARDWARE REQUIREMENTS

Sr	Description and key specification	Specification limits	Qty
1	**Stand-alone 3 Phase Inst. Waveform Viewer / Analyser**		6

Sr	Description and key specification	Specification limits	Qty
	I. Operating system	Linux Real-Time	
	II. No of core	≥2	
	III. Ethernet no of port	≥1	
	IV. Network Interface	10Base-T, 100Base-TX, and 1000Base-T Ethernet	
	V. Network Timing and Synchronization	IEEE 802.1AS-2011 IEEE 1588-2008	
	VI. RAM	DRAM, 500MB or better	
	VII. Built-in FPGA	Yes, programmable	
	VIII. Operating Temperature	-10 to 70 Deg C	
	IX. Voltage Range	400 V RMS L-N, 800 V RMS L-L	
	X. Current Range	≥50 A RMS	
	XI. Resolution	≥24 bits	
	XII. Sampling mode	Simultaneous	
	XIII. Sampling rate	≥50 kS/s	
	XIV. Standards	IEC 61010-1, C37.90 and C37.60, IEC 60255-22-(1:7), IEC 60255-1, C37.188 Class M and P, EMC section of IEC 60870, EMC sections of IEC 61850, IEC 61000-4-30 Class S, and IEC 61000-4-7.	
	XV. Relay control extension	≥8 channel	
	XVI. Programming API support	Python, LabVIEW	
2	**Inverter control Unit for Rapid prototyping**		
	I. Controller type	Stand-alone with FPGA support	4
	II. Operating System	Linux Real-Time	
	III. Storage	≥4GB, 1GB RAM	
	IV. IO Channels	≥100+ channels, including DIO, AIO with simultaneous sampling	
	V. Communication Ports	Gigabit Ethernet, CANbus, RS-232 Serial, USB 2.0	

3	**Temperature Measurement support**		
	I. Channels	≥16 thermocouple channels, 1 internal autozero channel	4
	II. ADC	Delta-Sigma, 24bit	
	III. Range	±78.125 mV	
	IV. Temperature measurement ranges	NIST (J, K, T, E, N, B, R, S thermocouple types)	
4	**GPS Timing Synchronization support**		
	I. Signal type	L1 frequency; GPS C/A code	4
	II. RF GPS signal frequency	1575.42 MHz	
	III. MTBF	2,234,702 h at 25 °C	
	IV. PPS accuracy	±100 ns, > 99% typical	
	V. Antenna	SMA female, +5 V operated with 30 mA max	
5	**RS422 / RS485 Channels extension**		
	I. Channel Count	≥4 port	6
	II. Protocol Support	RS422 / RS485	
	III. Baud rate	3.6864 Mbps max	
	IV. MTBF	514,016 hours at 25 °C	
	V. Cable	Yes, to be included	
6	**CAN Channel extension**		
	I. Channel	≥2 port	4
	II. Max Speed	≥1 Mbps	
7	**Signal Conditioning and Interface support**		
	I. Analog Input	≥112 channel	2
	II. Analog Input range	±200mV to ±10V	
	III. Sampling	Multiplexed, 250KS/s	
	IV. DC Voltage	±1000V to ±5V, 18 channel	
	V. DC Current	±200A to ±5V, 18 channel	
	VI. AC Voltage	±1000V to ±5V, 21 channel	
	VII. AC Current	±100A to ±5V, 32 channel	
	VIII. DC Voltage	150V to 10V, 11 Channel	
	IX. DC Current	300A to 10V, 11 Channel	

8	**High-performance, customizable embedded controller for EMS and local Cor-ordination with accessories**		
	I. Controller Type	Stand-alone with Linux OS and built FPGA – programmable	4
	II. Onboard Interfaces	≥2 Ethernet port, GigE vision Support, RS232, RS-485	
	III. Network synchronization accuracy	<1 µs	
	IV. On-board memory interface support	Yes	
	V. DRAM	4 GB with 12.8 GB/s	
	VI. Memory	4 GB / SSD	
	VII. IO Extension support	Supported up to 4 units	
	VIII. Programming API support	Python, LabVIEW	
9	**Rugged, High-performance controller for Non-local Co-ordination with accessories**		
	I. Controller Type	Stand-alone with Linux OS and built FPGA – programmable, Quad Core	2
	II. Onboard Interfaces	Gigabit Ethernet, USB 3.1, USB 2.0, RS232, and RS485 ports, HMI Interface support	
	III. Network synchronization accuracy	<1 µs	
	IV. On-board memory interface support	Yes	
	V. DRAM	4 GB with 12.8 GB/s with additional FPGA RAM	
	VI. Memory	16 GB / SSD	
	VII. IO Extension support	Supported up to 8 units	
	VIII. Programming API support	Python, LabVIEW	

8.1 Redundancy and Reliability Requirements

The architecture shall support high availability and reliability. The successful bidder shall provide:

- Industrial-grade hardware
- Redundant communication paths as requested by the IIT Bombay
- Automatic reconnection mechanisms
- Local autonomous operation during network failure
- Automatic synchronization after restoration
- UPS-backed critical infrastructure
- Surge protection and industrial grounding

All Local Master Controllers, EMS controllers, FPGA controllers, inverter controllers, and DAQ systems shall support:

- Gigabit Ethernet communication
- RS-232 communication
- RS-485 communication
- CAN Bus communication
- Synchronization communication
- Real-time controller-to-controller communication

The architecture shall support:

- Peer-to-peer communication
- Hierarchical supervisory communication
- Time-stamped event logging
- Notification mechanisms

9. SOFTWARE AND SCADA REQUIREMENTS

The SCADA architecture shall support:

- Multi-screen advanced graphical dashboards
- Real-time analysis and visualization
- Dynamic waveform visualization
- Device health monitoring
- Communication diagnostics visualization
- Energy flow visualization
- Battery state visualization
- Renewable generation visualization
- Power quality dashboards
- Trend visualization
- User-defined dashboards

The visualization system shall support:

- Operator dashboards
- Remote browser access
- Custom report generation
- Multi-user concurrent sessions

- KPI and analytics dashboards

9.1 Reporting Requirements

The SCADA platform shall support:

- Automated report generation
- Scheduled reports
- Event reports
- Energy reports
- Export to PDF, CSV, and Excel formats
- User-defined report templates

10. CYBERSECURITY AND DATA INTEGRITY REQUIREMENTS

The successful bidder shall ensure implementation of industry-standard cybersecurity mechanisms including:

- User authentication
- Role-based access control
- Password policies
- Network segmentation
- Secure remote access
- Encrypted communication
- Backup and restoration mechanisms
- Antivirus compatibility
- Security hardening
- Protection against data corruption
- No unauthorized external communication exists
- No hidden cloud dependency exists unless explicitly approved
- No data is transmitted outside approved networks
- All firmware and software are genuine and licensed supported with documentation

11. INTEGRATION REQUIREMENTS

The successful bidder shall integrate the SCADA platform with:

- Existing laboratory infrastructure
- Existing controllers
- Existing EMS systems
- Existing inverter systems
- Existing power analyzers
- Existing battery systems
- Renewable energy systems
- Future systems planned by IIT Bombay

The bidder shall undertake due diligence regarding interfaces and interoperability before bid submission. The successful bidder shall remain responsible for delivering the interoperability expressly included in its accepted Technical Bid and the Contract. Any interface limitation, dependency or exclusion known or reasonably discoverable before bid submission shall be disclosed in the Technical Bid; undisclosed limitations shall not be accepted as grounds for additional cost or delay.

12. TESTING AND VALIDATION REQUIREMENTS

The selected bidder shall conduct:

- Site Acceptance Testing (SAT)
- Functional testing
- Communication testing
- Redundancy testing
- Alarm/ Notification testing
- Cybersecurity testing
- Load testing
- Integration testing
- Failover testing

The successful bidder shall submit complete test reports and compliance reports upon execution of the respective project milestones and before the corresponding milestone is presented for acceptance.

13. DOCUMENTATION REQUIREMENTS

The successful bidder shall submit comprehensive documentation including:

- Architecture documents
- Bill of materials
- Datasheets
- Wiring diagrams
- Network diagrams
- I/O lists
- SAT reports
- Configuration manuals
- User manuals
- Maintenance manuals
- Backup procedures
- Cybersecurity procedures
- Software source files where applicable
- License and warranty certificates
- QA/QC Reports

All project-specific documentation, drawings, configurations, reports, data, custom-developed software and other deliverables created specifically under the Contract shall vest in IIT Bombay, subject to applicable third-party and pre-existing intellectual property rights expressly disclosed in the bid and approved by IIT Bombay.

14. TRAINING AND KNOWLEDGE TRANSFER

The successful bidder shall provide comprehensive training programs covering:

- Hardware operation
- Hardware maintenance
- SCADA operation
- Troubleshooting
- Protocol integration
- Database handling
- Historian usage

- Alarm management
- FPGA development overview
- RTOS environment overview
- System backup and restoration Training shall include:
- Classroom sessions
- Hands-on sessions
- Lab demonstrations
- Documentation
- Recorded material where applicable

15. WARRANTY, SUPPORT, AND AMC REQUIREMENTS

15.1 Warranty

The minimum comprehensive warranty period shall be twenty-four (24) months from the date of successful commissioning and written acceptance by IIT Bombay. The warranty shall include:

- Hardware replacement
- Software support
- Firmware updates
- Bug fixes
- Remote support
- Onsite support

15.2 Support Requirements

The bidder shall provide:

- Dedicated support engineer
- Escalation matrix
- Defined response times
- Emergency support
- Spare support

15.3 AMC Requirements

The bidder shall quote for the comprehensive AMC support for twenty-four (24) months immediately following expiry of the comprehensive warranty.

16. VENDOR PRE-QUALIFICATION CRITERIA

The bidder must satisfy the following minimum eligibility requirements:

16.1 Legal Requirements

- The bidder must be a legally registered entity in India. Submit Certificate of Incorporation / Registration Certificate
- The bidder must have a minimum of 4 years of operational experience or Memorandum of Understanding (MoU) for 3 similar projects. Submit similar documents.
- Consortiums may be permitted subject to Institute approval.

16.2 Financial Requirements

- Bidder’s average annual turnover should be minimum INR 75 lakhs during last three financial years. (Submit CA certified turnover certificate)
- OEM’s average annual turnover should be minimum INR 6 crores during last three financial years. (Submit CA certified turnover certificate)

- Positive net worth during the last three financial years from F.Y. 2022-23 onwards.
- Audited balance sheets shall be submitted.

16.3 Technical Requirements

The bidder shall demonstrate relevant experience in the following areas by submitting documentary evidence with the Technical Bid. The prescribed technical presentation and supporting material shall be submitted or presented at the stage specified in the Evaluation Methodology:

- Industrial SCADA systems
- Power system automation
- Renewable energy monitoring
- Battery energy storage integration
- Industrial communication protocols
- FPGA/RTOS-based industrial controllers
- Industrial data acquisition systems

16.4 Project Experience

The bidder shall provide documentary evidence of successful completion of the following projects. Evidence shall include the relevant work order or purchase order and completion/performance certificate issued by the client, or other verifiable documentary evidence accepted by IIT Bombay:

- Three similar SCADA projects in energy/power domain
- One project involving distributed control architecture
- One project involving renewable energy or battery systems

16.5 OEM Authorization

Bidders shall submit:

- OEM authorization certificates
- Support commitment letters from OEM for minimum 24 months
- Warranty commitment letters from OEM for minimum 24 months

17. BID SUBMISSION GUIDELINES

Technical Bid

The technical bid shall include:

- Company profile
- Technical compliance matrix
- Proposed architecture
- Methodology
- Project execution plan
- Team structure
- Resource deployment plan
- Support model
- Training plan
- Risk mitigation plan
- Project timelines
- Annexures as per scope of work and tender document
- Formats as per tender document

Financial Bid

Financial prices shall be submitted only through the designated IIT Bombay's SRM/e-procurement portal in the prescribed BOQ or financial bid format. No price, rate, commercial quotation or price breakup shall be included in the Technical Bid or technical presentation. IIT Bombay may seek an item wised price breakup or supporting price justification from the bidder at the appropriate stage, in accordance with applicable procurement procedures.

Please note that, bidder has to submit the price break-up information after financial bid opening upon request from IIT Bombay.

The price break-up shall include:

- Item-wise OEM pricing
- License costs
- Integration costs
- Development costs
- Training costs
- Support costs
- AMC costs
- Taxes and duties
- Optional items

18. TECHNICAL PROPOSAL REQUIREMENTS

The bidder shall submit a detailed technical proposal including all supporting documents containing:

- Detailed system architecture
- Functional compliance matrix
- Hardware architecture
- Software architecture
- Cybersecurity architecture
- Communication architecture
- Device integration plan
- Data flow diagrams
- Database architecture
- SAT procedures
- Quality assurance procedures
- Risk mitigation procedures

The bidder shall clearly identify any deviations. Failure to disclose deviations shall not relieve the bidder of contractual obligations.

19. Project Deliverables and Payment Milestones

Sl. No.	Delivery period	Key deliverables / activities	Payment milestone
1	Within 15 days from PO	Submission and acceptance, approval of Project Execution Plan, detailed Gantt chart, project organization chart, resource deployment plan, detailed BoM, system architecture, network diagrams and engineering/design documents.	10%
2	Within 60 days from PO	Completion of procurement and submission of hardware/software details, OEM datasheets, inspection reports and readiness for dispatch.	20%

Sl. No.	Delivery period	Key deliverables / activities	Payment milestone
3	Within 90 days from PO	Delivery of all hardware, equipment, accessories, software licenses and associated components at IIT Bombay, along with delivery challans, inspection certificates and relevant documentation.	30%
4	Within 120 days from PO	Completion of installation, hardware configuration, software development/configuration, communication setup and integration with existing infrastructure.	15%
5	Within 150 days from PO	Successful completion of Site Acceptance Testing (SAT), communication testing, integration testing, performance testing and rectification of identified deficiencies.	10%
6	Within 180 days from PO	Successful commissioning and acceptance, user and technical training, submission of operation and maintenance manuals, as-built drawings, configuration/source files (where applicable), warranty documents and.	10%
7	Within 210 days from PO	Final project handover	5%
Total			100%

20.1 Supporting Documents for Milestone Verification

Sl. No.	Milestone	Documents / evidence required
1	Project planning	Project Execution Plan, Gantt Chart, BoM, system architecture, network diagrams and responsibility matrix.
2	Engineering and procurement	Approved technical drawings, finalized BoM, OEM datasheets, purchase/procurement status and manufacturing/inspection reports.
3	Equipment delivery	Delivery challans, equipment-wise checklist, OEM warranty certificates, inspection reports, software licenses and accessories list.
4	Installation and integration	Installation completion report, hardware/software configuration documents, communication test reports and integration reports.
5	Testing and validation	SAT reports, performance test reports, communication test results, defect rectification report and acceptance test records.
6	Final commissioning and handover	Commissioning certificate, as-built drawings, operation and maintenance manuals, training completion report, source/configuration files wherever applicable and final handover report.

IIT Bombay may, at the appropriate stage and in accordance with applicable procurement procedures, seek documentary price justification, including relevant OEM quotations or invoices, for hardware and software components. Such information shall be provided confidentially and shall not alter the quoted bid price.

21. GENERAL TERMS AND CONDITIONS

21.1 Compliance Responsibility

The bidder shall be solely responsible for ensuring compliance with:

- Applicable Indian laws
- Safety regulations
- Electrical standards

- Cybersecurity standards
- Licensing regulations and Environmental regulations

21.2 Completeness of Supply

The bidder shall be responsible for complete supply, integration, testing, commissioning, and successful operation of the system.

Any item omitted but required for complete functionality shall be deemed included within the scope.

No additional claims shall be entertained.

22. SPECIAL TERMS AND CONDITIONS

22.1 Research Environment Compliance

The selected bidder shall recognize that the system is intended for a dynamic research environment.

The solution shall therefore:

- Support experimentation
- Support reconfiguration
- Support future protocol integration
- Support third-party interoperability

22.2 Open Architecture Requirement

The Institute strongly prefers open and interoperable architecture. Vendor lock-in shall not be acceptable.

The bidder shall provide:

- Open APIs
- Development access
- Configuration access
- Database access
- Export capability

22.3 Intellectual Property Restrictions

The bidder shall not impose any restrictions preventing IIT Bombay from:

- Modifying the system
- Expanding the system
- Integrating third-party systems
- Developing custom applications
- Accessing historical data

23. SERVICE LEVEL REQUIREMENTS

The bidder shall comply with the following minimum service levels:

Parameter	Requirement
Remote response time	Within 4 hours
Onsite response time	Within 48 hours

Parameter	Requirement
Critical issue resolution	Within 72 hours
System uptime	Minimum 99%
Spare availability	Minimum 5 years

Failure to meet service levels may attract penalties of 0.2% of tender value against each parameter for each instance.

24. PENALTY AND LIQUIDATED DAMAGES

24.1 Performance Failure

If the supplied system fails to meet functional, operational, communication, cybersecurity, interoperability, or performance requirements, IIT Bombay reserves the right to:

- Reject the system (part or in whole) at any point in time during or after the project execution
- Demand replacement
- Withhold payment
- Invoke performance security
- Terminate the Work order in whole or in part

24.2 Revenue/Performance Misrepresentation

Any technical, commercial, or capability misrepresentation by the bidder shall lead to:

- Immediate disqualification
- Debarment
- Forfeiture of security deposit
- Appropriate legal action

24.3 Variation Beyond Declared Technical Capability

Any deviation between committed capability and actual delivered capability exceeding 10% of declared performance parameters may lead to:

- Rejection of equipment
- Mandatory replacement at vendor cost
- Recovery of damages
- Legal and contractual Action
- Forfeiture of Performance Security

25. CONFIDENTIALITY AND INTELLECTUAL PROPERTY

The selected bidder shall:

- Maintain strict confidentiality
- Not disclose research data
- Not disclose architecture details
- Not disclose experimental results
- Not use Institute information without written approval

All project-related data, reports, configurations, software customizations, engineering deliverables, drawings, and research-related outputs generated under this project shall remain exclusive property of IIT Bombay only.

26. RISK, LIABILITY, AND INDEMNIFICATION

The selected bidder shall indemnify IIT Bombay against:

- Third-party claims
- IP infringement
- Licensing violations
- Data breaches
- Cybersecurity incidents caused by vendor negligence
- Hardware failures caused by design defects
- Regulatory non-compliance

The vendor shall remain fully liable for damages arising due to:

- Negligence
- Improper engineering
- Improper integration
- Non-compliance
- Hidden dependencies
- Unauthorized software

27. PAYMENT, INSPECTION AND ACCEPTANCE

i. Payments shall be processed against the milestones and percentages expressly stated in the Project Deliverables and Payment Milestones table, subject to completion and written acceptance by IIT Bombay of the corresponding deliverables, submission of the applicable milestone evidence, a valid invoice and compliance with statutory requirements. No payment shall be construed as acceptance of defective, incomplete or non-conforming work.

ii. IIT Bombay may inspect and test the goods, software, services and deliverables at the manufacturer's premises, during delivery, installation, integration and commissioning, and during the warranty period where relevant. Inspection, payment or use shall not waive the Contractor's obligations or IIT Bombay's right to reject non-conforming deliverables.

iii. The Contractor shall promptly, at its own cost, repair, replace or re-perform any rejected or non-conforming item or service within the period specified by IIT Bombay. Risk of loss or damage shall remain with the Contractor until delivery at the designated site and shall thereafter remain with the Contractor to the extent attributable to its acts, omissions, installation or commissioning activities.

iv. Any advance payment, if approved by the competent authority and expressly stated in the Purchase Order, shall be released only against an unconditional and irrevocable advance bank guarantee of equivalent amount, in a form and validity acceptable to IIT Bombay. No advance payment shall be presumed from this tender unless expressly approved and stated in the Purchase Order.

28. TERMINATION CONDITIONS

IIT Bombay reserves the right to terminate the contract under, but not limited to the following conditions:

- Delay in execution
- Poor performance
- Non-compliance

- Misrepresentation
- Bankruptcy or insolvency
- Breach of confidentiality
- Failure to achieve milestones
- Cybersecurity non-compliance
- Repeated service failures Upon termination:
- All Institute data shall be returned immediately
- All source files shall be handed over
- Access credentials shall be transferred
- Institute shall retain rights over completed work

29. FORCE MAJEURE

i. Neither party shall be liable for failure or delay in performing an obligation to the extent such failure or delay is directly caused by an event beyond its reasonable control, which could not reasonably have been prevented or overcome. Such events may include natural disasters, war, acts of terrorism, epidemic/pandemic restrictions imposed by competent authorities, or other events recognized as force majeure under applicable law. Financial inability, shortage of funds, ordinary market fluctuations, or failure of a subcontractor or supplier shall not, by themselves, constitute force majeure.

ii. The affected party shall notify the other party in writing promptly, and in any event within seven (7) calendar days of becoming aware of the event, providing details, expected duration, impact and mitigation measures. The affected party shall use reasonable efforts to mitigate the effects and resume performance. IIT Bombay may require supporting evidence.

30. DISPUTE RESOLUTION AND JURISDICTION

i. The parties shall first endeavor to resolve any dispute arising out of or in connection with the tender or Contract through good-faith discussions between their authorised representatives. If the dispute is not resolved within thirty (30) days of written notice of dispute, either party may pursue remedies available under applicable law and the Contract.

ii. The Contract shall be governed by the laws of India. Subject to applicable law and any statutory dispute-resolution mechanism binding on IIT Bombay, courts of competent jurisdiction at Mumbai, Maharashtra shall have jurisdiction over disputes arising out of or in connection with the Contract.

31. DETAILED ANNEXURES

ANNEXURE A – TECHNICAL COMPLIANCE MATRIX

Tender No: _____ Date: _____

To,

Dy. Registrar (MM),

Indian Institute of Technology Bombay,

Powai, Mumbai - 400076

Sub: - Technical Compliance Matrix

Instructions to Bidder

1. The bidder shall mandatorily fill all fields in the compliance matrix.
2. Merely stating “Comply” shall not be sufficient.
3. Bidders shall provide detailed remarks, model numbers, specifications, and supporting document references.
4. Any deviation shall be explicitly highlighted.
5. Failure to disclose deviations shall not absolve the bidder from meeting requirements.
6. IIT Bombay reserves the right to seek technical clarifications.
7. In case of conflict between bidder datasheets and compliance matrix, IIT Bombay’s interpretation shall prevail.

Sl. No	Requirement Category	Detailed Requirement	Compliance (Yes/No)	Bidder Remark	Proposed Make/Model	Datasheet Reference
1	SCADA Software	Industrial-grade SCADA platform				
2	SCADA Software	Web-based monitoring capability				
3	SCADA Software	Historian support				
4	Communication	MODBUS RTU support				
5	Communication	MODBUS TCP/IP support				
6	Communication	CAN Bus support				

Sl. No	Requirement Category	Detailed Requirement	Compliance (Yes/No)	Bidder Remark	Proposed Make/Model	Datasheet Reference
7	Communication	OPC-UA support				
8	Hardware	FPGA-enabled controller				
9	Hardware	RTOS support				
11	Power Monitoring	Harmonic analysis capability				
12	Cybersecurity	Role-based access control				
13	Cybersecurity	Audit logging				
14	Training	Onsite training provision				
15	Warranty	Minimum 24 months warranty				

Additional rows may be added by the bidder wherever necessary.

Yours faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE B – BILL OF MATERIALS FORMAT

Tender No: _____ Date: _____

To,
Dy. Registrar (MM),
Indian Institute of Technology Bombay,
Powai, Mumbai - 400076.

Sub: - Bill of Materials Format

The bidder shall provide complete BOM including:

- Make
- Model
- Quantity
- Technical specifications
- Country of origin
- Warranty details
- OEM support details

BOM Template

Sr.	Category	Description	Make	Model	Qty	Country of Origin	Warranty	Remarks
1	Controller	RTOS/FPGA Controller						
2	DAQ	Analog Input Module						
3	DAQ	Digital Input Module						
4	DAQ	Digital Output Module						
5	Communication	CAN Interface Module						
6	Communication	RS-485 Interface						
7	Communication	Managed Ethernet Switch						
8	SCADA	License						

Additional rows may be added by the bidder wherever necessary.

Yours faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE C – PROJECT EXECUTION SCHEDULE

Tender No: _____ Date: _____

To,
Dy. Registrar (MM),
Indian Institute of Technology Bombay,
Powai, Mumbai - 400076.

Sub: - Project Execution Schedule

The bidder shall submit a detailed project execution schedule clearly indicating:

- Engineering timelines
- Procurement timelines
- Manufacturing timelines
- Delivery timelines
- Installation timelines
- SAT timelines
- Training timelines
- Final acceptance timelines

Execution Schedule Template

Sr	Activity	Duration	Start Date	End Date	Dependency	Remarks
1	Project Kickoff					
2	Requirement Finalization					
3	Detailed Engineering					
4	Hardware Procurement					
5	Software Development					
6	Site Delivery					
7	Installation					
8	SAT					
9	Commissioning					
10	Training					
11	Final Handover					

Additional rows may be added by the bidder wherever necessary.

Yours faithfully,
(Signature of the Bidder, with Official Seal)

ANNEXURE D – WARRANTY COMPLIANCE FORMAT

Tender No: _____ Date: _____

To,
Dy. Registrar (MM),
Indian Institute of Technology Bombay,
Powai, Mumbai - 400076.

Sub: - Warranty Compliance Format

The bidder hereby declares and confirms that:

1. All supplied hardware shall carry a minimum warranty of 24 months.
2. All supplied software shall include software support and update entitlement.
3. All defective hardware shall be repaired/replaced at no additional cost.
4. All software defects shall be rectified during warranty period at no additional cost.
5. Warranty shall include onsite support.
6. Warranty shall include remote support.
7. Warranty shall include firmware support.
8. Warranty shall include cybersecurity patch support.

Warranty Support Matrix

Item	Warranty Duration	Support Type	Response Time	Resolution Time
Hardware				
Software				
Communication Modules				
Controllers				
SCADA				

Additional rows may be added by the bidder wherever necessary.

Yours faithfully,

(Signature of the Bidder, with Official Seal)

ANNEXURE E – SERVICE SUPPORT DECLARATION

Tender No: _____ Date: _____

To,
Dy. Registrar (MM),
Indian Institute of Technology Bombay,
Powai, Mumbai - 400076.

Sub: - Service Support Declaration

Declaration

The bidder hereby confirms:

- Availability of trained service engineers
- Availability of spare parts
- Availability of remote support
- Availability of onsite support
- Availability of escalation mechanism
- Availability of cybersecurity support
- Availability of software upgrade support

Service Infrastructure Details

Parameter	Details
Number of Service Engineers	
Local Support Office	
Spare Availability Duration	
Support Helpline	
Escalation Email	
Escalation Contact	

Additional rows may be added by the bidder wherever necessary.

Yours faithfully,
(Signature of the Bidder, with Official Seal)

ANNEXURE F – NON-DISCLOSURE AGREEMENT FORMAT

This Non-Disclosure Agreement (the "Agreement") is made and entered into as on [Date], by and between:

Indian Institute of Technology Bombay (IITB)
IIT Powai, Mumbai – 400076. ("Disclosing Party")

and

“Bidder Name”
Address: [Bidder Address] ("Receiving Party")

i. Purpose: The Disclosing Party intends to disclose certain confidential and proprietary information (“Confidential Information”) to the Receiving Party for the purpose of Design, Supply, Integration, Development, Testing, Commissioning, Training, and Long-Term Support of SCADA, Monitoring, Control, and Data Acquisition Solution for Grid Integration Laboratory Infrastructure.

ii. “Confidential Information” means and includes any and all information disclosed by the Disclosing Party, whether in written, oral, electronic, visual, or any other form, and whether marked or unmarked as confidential, including but not limited to:

- Academic data, research findings, and unpublished materials;
- Technical, scientific, and technological information;
- Financial data and commercial information;
- Details of clients, stakeholders, and institutional operations;
- Any proprietary or sensitive information relating to the Disclosing Party’s projects, activities, processes, or affairs;
- Any derivatives, analyses, compilations, or materials prepared based on the above information.

iii. Obligations of Receiving Party

The Receiving Party agrees to:

- Maintain strict confidentiality of all Confidential Information
- Not disclose any Confidential Information to third parties without prior written consent of the Disclosing Party
- Use the Confidential Information solely for the purpose stated in this Agreement
- Take all reasonable measures to prevent unauthorized access, misuse, or disclosure

iv. Exclusions from Confidential Information

Confidential Information shall not include information which the Receiving Party can demonstrate:

- Is or becomes publicly available without breach of this Agreement; or
- Was already in possession of the Receiving Party prior to disclosure without restriction; or
- Was independently developed without use of Confidential Information; or

- Is approved for release in writing by the Disclosing Party

v. Term

This Agreement shall commence on the date first written above and shall remain valid for a period of five (5) years, unless terminated earlier by either Party with written notice of 30 days prior to such termination.

vi. Return or Destruction of Materials

Upon termination of this Agreement, the Receiving Party shall promptly return or destroy all materials containing Confidential Information, as directed by the Disclosing Party.

vii. No Rights Granted

Nothing contained in this Agreement shall be construed as granting the Receiving Party any rights, title, or interest in the Confidential Information, except as expressly provided herein.

viii. Governing Law

This Agreement shall be governed by and construed in accordance with the laws of India.

ix. Entire Agreement

This Agreement constitutes the entire understanding between the Parties regarding the subject matter herein and supersedes all prior discussions or agreements. Any amendment shall be valid only if made in writing and signed by both Parties.

x. Execution

IN WITNESS WHEREOF, the parties hereto have executed this Non-Disclosure Agreement as of the date first above written.

Indian Institute of Technology Bombay	Bidder's Firm Name
Signature:	Signature:
Name:	Name:
Designation:	Designation:

ANNEXURE G – DEVIATIONS STATEMENT

Instructions

The bidder shall explicitly disclose all deviations.

Deviations Template

Sr.	Scope of work Clause Reference	Require ment	Bidder Deviation	Technical Impact	Commercial Impact
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Authorized Signatory:

ANNEXURE H – SITE ACCEPTANCE TEST FORMAT

(To be submitted by successful bidder only)

SAT Objective

To verify successful installation, integration, commissioning, interoperability, communication reliability, functionality, and operational performance.

SAT Checklist

Sl. No.	Test Description	Acceptance Criteria	Status	Remarks
1	Hardware Installation and Operational verification	Verify all supplied hardware as per approved design		
2	SCADA Communication Verification	All devices communicating		
3	Historian Verification	Data logging and Data recovery verification. Verify successful acquisition, timestamp synchronization, archival storage, trend visualization, alarm/event recording, report generation, backup/restore capability, and export of historical data from all integrated laboratory assets without data loss.		
4	Control Verification	Remote control operational		
5	Cybersecurity Verification	User access validated		
6	Synchronization Verification	Time synchronization successful		
7	Reporting Verification	Reports generated successfully		
8	High-speed sampling verification	Sampling rate achieved		
9	Backup Verification	Backup and restore validated		

SAT Signoff

Vendor Representative: IIT Bombay Representative:

Date:

ANNEXURE I – CYBERSECURITY COMPLIANCE DECLARATION

(To be submitted by successful bidder only)

Cybersecurity Declaration

The bidder hereby confirms that:

1. All supplied systems are free from malware.
2. No unauthorized remote access mechanism exists.
3. No hidden cloud communication exists.
4. Role-based access control is implemented.
5. Password policy enforcement is available.
6. Audit logging is available.
7. Firmware authenticity is guaranteed.
8. Security patches shall be provided.
9. Data privacy shall be maintained.
10. The system shall comply with applicable cybersecurity practices.

Cybersecurity Compliance Matrix

Requirement	Compliance	Remarks
User Authentication		
Audit Logging		
Password Policy		
Access Control		
Secure Communication		
Backup Mechanism		
Antivirus Compatibility		
Patch Management		
Secure Remote Access		

Authorized Seal & Signatory:

ANNEXURE J – ADDITIONAL TERMS AND CONDITIONS

(Supply, Delivery, Installation, Commissioning, Warranty, Liability and After-Sales Support)

The following terms and conditions shall form an integral and binding part of the Purchase Order ("PO") issued by the IIT Bombay to the Contractor and shall be read in conjunction with the technical specifications, commercial terms, warranty conditions, and other contractual documents forming part of the Purchase Order.

1. Scope of Supply and Completion of Vendor Obligations

1.1 The Contractor shall be responsible for the complete supply, delivery, unloading, installation, testing, commissioning, operational demonstration, and successful handover of the equipment/system covered under the Purchase Order.

1.2 The Contractor's obligations shall not be deemed complete merely upon dispatch or physical delivery of the equipment/system at the IIT Bombay's premises. Completion of supply shall be deemed to have occurred only upon successful installation, commissioning, demonstration, and formal written acceptance by the IIT Bombay.

1.3 The Contractor warrants that the supplied equipment/system shall conform to the specifications, performance requirements, technical standards, and operational

requirements specified under the Purchase Order and shall be fit for the intended purpose.

2. Installation, Commissioning and Demonstration

2.1 Installation, testing, commissioning, operational demonstration, and user familiarization/training, shall form an integral part of the Contractor's scope of supply and should be at no additional cost.

2.2 The Contractor shall, at its own cost and expense, depute qualified and authorized technical personnel/representatives to the IIT Bombay's site for carrying out installation, commissioning, demonstration, training and related activities.

2.3 No additional charges including installation charges, commissioning fees, service charges, travel expenses, lodging, boarding, or incidental expenses shall be payable by the IIT Bombay unless specifically approved in writing.

2.4 In the event the Contractor proposes installation and commissioning through remote/online mode, the Contractor shall continue to remain fully responsible for providing complete guidance, supervision, operational instructions, related outcomes, results, and technical support for successful installation, commissioning, and operation of the equipment/system.

2.5 The Contractor shall remain solely responsible for the adequacy, correctness, safety, performance, and successful operation of the equipment/system during and after installation and commissioning activities until formal written acceptance by the IIT Bombay.

2.6 Any assistance, supervision, or support provided by the IIT Bombay or its personnel during installation or commissioning shall not relieve, reduce, waive, or otherwise affect the Contractor's obligations, liabilities, warranties, or responsibilities.

3. Submission of Documents, Certifications and Compliance Records

3.1 The Contractor shall, as an essential and inseparable part of supply, provide all applicable technical documents, statutory approvals, certificates, manuals, reports, and compliance records relating to the supplied equipment/system.

3.2 Such documentation shall include, without limitation:

a) Factory test certificates and inspection reports

b) Quality assurance and conformity certificates

c) Safety compliance certificates and statutory approvals

d) Warranty certificates/documents

e) Installation, operation, maintenance, and user manuals

f) Calibration certificates, wherever applicable

g) Material Safety Data Sheets, wherever applicable

h) Electrical safety, fire safety, environmental compliance, and regulatory approval records, wherever applicable and

i) Any other technical or statutory documentation reasonably required by the IIT Bombay.

3.3 Submission of complete and accurate documentation shall constitute a material obligation of the Contractor.

3.4 The IIT Bombay shall have the right to withhold inspection clearance, commissioning approval, acceptance, and/or payment in the event of incomplete, deficient, or delayed submission of documents.

4. Delivery Schedule and Timelines

4.1 The successful bidder shall complete the project in accordance with the delivery and implementation milestones set out in Section 21. The milestone schedule, including final handover, shall govern the overall completion period unless a revised schedule is expressly approved in writing by IIT Bombay.

4.2 Any anticipated delay shall be immediately communicated by the Contractor to the IIT Bombay along with detailed reasons and proposed mitigation measures. However, such communication shall not automatically entitle the Contractor to extension of time.

5. Delay, Liquidated Damages and Risk Purchase

5.1 In the event of delay in delivery, installation, commissioning, operational handover, replacement obligations, or submission of mandatory documents attributable to the Contractor, the IIT Bombay shall be entitled to recover liquidated damages/penalty as per the General Terms & Conditions of the Purchase Order.

5.1.1 In the event that the Contractor fails to complete the delivery, installation, and commissioning of the goods/services within the delivery schedule specified in the Purchase Order ("PO"), and such delay exceeds Thirty (30) calendar days beyond the agreed delivery date, the IIT Bombay shall have the right, without prejudice to any other rights or remedies available under the contract or applicable law, to initiate appropriate contractual, legal, or equitable proceedings against the Contractor and seek recovery of any

losses, damages, costs, or expenses arising from such delay, including but not limited to cancellation of the Purchase Order, blacklisting/debarment and any other remedies available under applicable law.

5.2 In the event of unreasonable or prolonged delay, the IIT Bombay reserves the right to cancel the Purchase Order wholly or partially and procure the goods/services from alternate sources at the risk and cost of the Contractor.

6. Warranty, Defect Rectification and Replacement Obligations

6.1 The Contractor warrants that all goods supplied shall be new, unused, free from defects in design, material, workmanship, safety, and performance.

6.2 The warranty period shall commence from the date of successful installation and commissioning accepted by the IIT Bombay.

6.3 The Contractor shall acknowledge any defect, malfunction, or issue reported by the IIT Bombay within forty-eight (48) hours of receipt of written intimation and shall initiate corrective action within three (3) working days.

6.4 The Contractor shall ensure complete rectification/resolution of the reported issue within fifteen (15) days from the date of intimation unless otherwise agreed in writing by the IIT Bombay.

6.5 In the event the defect, malfunction, or failure cannot be rectified within the stipulated period, the Contractor shall replace the defective equipment/component entirely at its own cost and expense within thirty (30) days from the date of written intimation by the IIT Bombay.

6.6 All repair, rectification, replacement, logistics, labor, transportation, and associated expenses shall be borne solely by the Contractor without any financial or operational burden on the IIT Bombay.

6.7 In the event the Contractor fails to replace the defective equipment within the stipulated timeline, the IIT Bombay shall be entitled to recover penalty/liquidated damages as specified under the Purchase Order, without prejudice to other contractual or legal remedies available to the IIT Bombay.

7. After-Sales Support and Technical Assistance

7.1 The Contractor shall provide comprehensive after-sales support and technical assistance during the warranty period at no additional cost to the IIT Bombay.

7.2 Such support shall include, without limitation:

a) Technical troubleshooting assistance

b) Remote support through telephone, email, video conferencing, or other electronic means

c) Software/firmware support and updates, wherever applicable

d) On-site support visits whenever reasonably required for resolution of technical or operational issues; and

e) Guidance relating to operation, maintenance, and safe handling of the equipment/system.

7.3 The Contractor shall maintain adequate technical capability and responsiveness to ensure minimum operational downtime.

8. Liability and Indemnity

8.1 The Contractor hereby accepts sole, absolute, and unconditional responsibility and liability for any defect, malfunction, failure, damage, safety incident, or non-performance arising out of or in connection with the supplied equipment/system, including installation, commissioning, demonstration, and operational use during the warranty period.

8.2 Such liability shall include, without limitation:

a) Fire, explosion, electrical hazards, battery failure, or safety incidents;

b) Injury, death, or harm to persons;

c) Damage to the IIT Bombay's premises, infrastructure, utilities, connected systems, or equipment

8.3 The Contractor shall indemnify, defend, and hold harmless the IIT Bombay, its officers, employees, representatives, and affiliates against any and all claims, losses, damages, liabilities, penalties, costs, and expenses arising out of or in connection with:

a) Defective equipment or components

b) Failure of installation, commissioning, or operational performance

c) Breach of statutory, regulatory, or contractual obligations or

d) Any act, omission, negligence, or default attributable to the Contractor.

9. No Limitation of Liability

9.1 The obligations, liabilities, warranties, and responsibilities of the Contractor under these terms shall be in addition to and not in substitution of any obligations under the General terms & Conditions of Purchase Order.

9.2 Any limitation of liability, disclaimer, exclusion clause, or restrictive condition proposed by the Contractor shall not apply unless expressly accepted by the IIT Bombay in writing.

10. Binding Effect and Survival

10.1 These terms and conditions shall be legally binding and enforceable upon the Contractor and shall remain valid till completion of delivery, installation, commissioning, demonstration, payment, warranty period or expiry of the Purchase Order.

ANNEXURE K – LIST OF DOCUMENTS TO BE SUBMITTED BY THE BIDDER

Instructions: The bidder shall use this consolidated checklist to identify the documents required under the tender. The clause references below are indicative references to the corresponding subject sections and shall be cross-checked against the final clause numbering before publication. Wherever documents are not applicable, bidder should mention the same in Remark/Document Reference column.

Sr	Category	Document / Information Required	Submission Stage	Tender Clause Reference	Bidder Compliance (Yes/No/NA)	Remarks / Document Reference
A	Legal & Statutory	Certificate of Incorporation / Registration or equivalent constitution document	Bid submission	16.1		
A	Legal & Statutory	PAN card / PAN details	Bid submission	17		
A	Legal & Statutory	GST registration certificate or applicable tax registration details	Bid submission	17		
A	Legal & Statutory	Registered office address and contact details	Bid submission	17		
A	Legal & Statutory	Consortium / joint venture agreement and member authorisations, if consortium bidding is expressly permitted	Bid submission	16.1		
B	Financial Qualification	CA-certified average annual turnover certificate for the specified three financial years	Bid submission	16.2		
B	Financial Qualification	Audited financial statements, including balance sheet and profit and loss account, for the specified financial years	Bid submission	16.2		
B	Financial Qualification	Net-worth certificate / supporting audited statement for the specified financial years	Bid submission	16.2		
B	Financial Qualification	OEM turnover certificate and audited financial statements, where OEM turnover criterion applies	Bid submission	16.2		
C	Technical Qualification & Experience	Company profile and relevant technical capability statement	Bid submission	16.3		
C	Technical Qualification & Experience	List of similar SCADA / energy / power / distributed control / renewable energy / BESS projects	Bid submission	16.3–16.4		
C	Technical Qualification & Experience	Relevant work orders / purchase orders for claimed projects	Bid submission	16.4		
C	Technical Qualification & Experience	Completion certificates, performance certificates or other verifiable client evidence	Bid submission	16.4		
C	Technical Qualification & Experience	OEM authorization for proposed products and support commitment	Bid submission	16.5; Annexure G		

Sr	Category	Document / Information Required	Submission Stage	Tender Clause Reference	Bidder Compliance (Yes/No/NA)	Remarks / Document Reference
C	Technical Qualification & Experience	OEM warranty commitment for minimum 24 months	Bid submission	15; Annexure G		
D	Technical Bid	Clause-wise technical compliance matrix, with detailed remarks and datasheet references	Bid submission	17–18; Annexure A		
D	Technical Bid	Proposed system architecture diagrams covering network, control, communication, synchronisation, cybersecurity, data flow, device hierarchy, redundancy and integration	Bid submission	7		
D	Technical Bid	Technical proposal covering hardware, software, communication, database and integration architecture	Bid submission	18		
D	Technical Bid	Detailed Bill of Materials identifying make, model, quantity, specifications, country of origin, warranty and OEM support	Bid submission	18; Annexure C		
D	Technical Bid	OEM datasheets, product catalogues, technical specifications and relevant certifications / test reports	Bid submission	8; 18		
D	Technical Bid	Functional compliance and protocol support evidence, including supported interfaces and APIs	Bid submission	3; 5–12; Annexure A		
D	Technical Bid	Cybersecurity architecture, access-control methodology, encryption, backup, incident response and recovery details	Bid submission	10; Annexure L		
D	Technical Bid	Integration methodology and interface / dependency / exclusion statement	Bid submission	11; 18		
D	Technical Bid	Project implementation methodology, Gantt chart, milestone schedule and resource deployment plan	Bid submission	17–20; Annexure D		
D	Technical Bid	Project organisation chart, key personnel details and responsibility allocation matrix	Bid submission	17–20		
D	Technical Bid	Testing, validation, SAT strategy and proposed acceptance test plan	Bid submission	12; Annexure K		
D	Technical Bid	Warranty, support, service response, escalation and spare	Bid submission	15; 23; Annexures E and F		

Sr	Category	Document / Information Required	Submission Stage	Tender Clause Reference	Bidder Compliance (Yes/No/NA)	Remarks / Document Reference
		availability details				
D	Technical Bid	Training, knowledge-transfer and documentation plan	Bid submission	13–14		
D	Technical Bid	Technical presentation and supporting material, when invited / required under evaluation procedure	Evaluation stage	19		
E	Declarations & Undertakings	Acceptance of tender terms and conditions	Bid submission	17		
E	Declarations & Undertakings	Declaration of no blacklisting / debarment from any IIT	Bid submission	-		
E	Declarations & Undertakings	Make in India / local content declaration, where applicable to this procurement	Bid submission	Applicable GOI policy		
E	Declarations & Undertakings	Declaration under restrictions on procurement from certain countries, where applicable	Bid submission	Applicable GOI policy		
E	Declarations & Undertakings	Deviation statement identifying all technical and commercial deviations	Bid submission	18; Annexure J		
E	Declarations & Undertakings	Non-disclosure agreement executed by bidder, if required before access to confidential information / site details	Bid submission / before disclosure	Annexure H		
F	Post-award / Contract Execution	Performance Bank Guarantee in approved amount, format and validity	Post-award	24A; Annexure I		
F	Post-award / Contract Execution	Final project execution plan, approved Gantt chart, resource deployment and responsibility matrix	Post-award	20; Annexure D		
F	Post-award / Contract Execution	Detailed implementation-level architecture, engineering drawings, network diagrams, I/O lists and final BoM	Post-award / detailed engineering	7; 13		
F	Execution / Milestone Evidence	Procurement status, OEM datasheets, inspection / QA reports and readiness-for-dispatch evidence	Relevant milestone	20		
F	Execution / Milestone Evidence	Delivery challans, equipment-wise delivery checklist, inspection certificates, licence documents and warranty certificates	Delivery milestone	20; 13		
F	Execution / Milestone Evidence	Installation, configuration, communication and integration completion reports	Installation milestone	12–13; 20		
F	Execution /	SAT reports / test results	Testing milestone	12;		

Sr	Category	Document / Information Required	Submission Stage	Tender Clause Reference	Bidder Compliance (Yes/No/NA)	Remarks / Document Reference
	Milestone Evidence			Annexure K		
F	Execution / Milestone Evidence	Defect list, corrective action and closure reports	Testing / acceptance	12; 20		
F	Execution / Milestone Evidence	Commissioning certificate, O&M manuals, as-built drawings, backup / restoration procedures and cybersecurity documentation	Commissioning / handover	13; 20		
F	Execution / Milestone Evidence	Software licences, configuration files, source files / custom code where applicable, credentials and data handover records	Final handover	13; 22; 25		
F	Execution / Milestone Evidence	Training materials, attendance and training completion report	Training milestone	14; 20		
F	Execution / Milestone Evidence	Warranty commencement certificate, support escalation matrix and service contact details	Commissioning / handover	15; Annexures E and F		