**Lithium-ion Battery Energy Storage System Technical Specifications**

**DISCLAIMER**

This technical specification is intended as a resource only. ***It is the responsibility of Government staff to ensure that all procurements follow all applicable federal requirements and agency-specific policies and procedures***. All procurement must be thoroughly reviewed by agency contracting and legal staff and should be modified to address each agency's unique acquisition process, agency-specific authorities, and project-specific characteristics.

**INSTRUCTIONS FOR USING THIS DOCUMENT**

This document is meant to be used as a customizable template for federal government agencies seeking to procure lithium-ion battery energy storage systems (BESS). Agencies are encouraged to add, remove, edit, and/or change any of the template language to fit the needs and requirements of the agency.

Sections that provide instructional language for the drafter are presented in (blue parentheses). Fill-in-the-blank areas are indicated in [red brackets].

**IMPORTANT:** The following items must be deleted from the template before solicitation:

* This title page and instructions for using this specification;
* All instructions, options, and background information within the template in blue or red font as well as any parentheses or brackets around instructions

**Lithium-ion Battery Energy Storage System Technical Specifications**

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# Abbreviations and Acronyms

A-E architectural and engineering

AC alternating current

AHJ Authority Having Jurisdiction

ANSI American National Standards Institute

ASCE American Society of Civil Engineers

BESS battery energy storage system

EPRI Electric Power Research Institute

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

IFC International Fire Code

kW kilowatt

kWh kilowatt-hour

NEC National Electrical Code

NEMA National Electrical Manufacturers Association

NFPA National Fire Protection Association

O&M Operations and Maintenance

SOW Statement of Work

UFC Unified Facilities Criteria

UL Underwriters Laboratories

UN United Nations

# Generally Applicable Requirements

## Install Battery Energy Storage System (BESS)

1. The Contractor shall design and build a minimum [Insert Battery Power (kilowatt [kW]) and Usable Capacity (kilowatt-hour [kWh]) here] behind-the-meter Lithium-ion Battery Energy Storage System (BESS). The Contractor shall provide all labor, material, equipment, engineering, maintenance, and capital to design, install, commission, and interconnect a BESS as required herein.
2. The BESS will [Describe project use cases here].
3. Electricity from the BESS must be provided at 60 Hertz and at the appropriate voltage for electrical interconnection to the Site at [specify the voltage service level and wiring] on the electrical distribution system. The BESS will interconnect at [specify interconnection location].
4. The BESS, and associated equipment, shall be provided in self-contained National Electrical Manufacturers Association (NEMA) enclosure(s) rated for the site conditions. BESS enclosures will be installed on a concrete pad or piers constructed by the Contractor at [specify location here]. Contractor provided thermal conditioning systems shall maintain ambient temperature within BESS warranty requirements.
5. BESS components and associated ancillary equipment shall have working space clearances required by local code, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of environment in compliance with the National Electric Code (NEC).
6. The Contractor shall prepare a written commissioning plan that provides a description of the means and methods necessary to document and verify that the system and its associated controls and safety systems are in proper working condition. The Contractor shall commission the BESS and provide a commissioning report documenting BESS performance during normal grid-tied operations [and during grid failure, if applicable]. Commissioning shall comply with the applicable local codes and standards—for example, National Fire Protection Association (NFPA) 855 or the International Fire Code.
7. The Contractor shall provide [X] year(s) of turnkey BESS operations and maintenance (O&M) and warranty service. [Identify whether the Contractor or a designated O&M provider will be responsible for BESS O&M. One year is the recommended minimum for contractor-provided O&M. BESS manufacturers may require O&M support for the life of the asset to maintain their warranty. The Contractor shall provide a bid for an O&M contract for the full project life].
8. The Contractor is responsible for all permits, approvals, environmental compliance, freight, financing, procurement, monitoring, site inspection, billing, and incidentals as necessary to design, construct, and interconnect the complete BESS, described hereinafter.
9. The Contractor shall provide and install all safety systems as required by the applicable local codes and standards, in addition to NFPA 855 and/or the International Fire Code. This includes but is not limited to explosion control system(s); fire, smoke, and gas detection system(s); and fire suppression systems where applicable.

## Existing Feasibility Studies and Engineering Studies Done by Others

The Contractor is responsible for ascertaining relevant site conditions to determine project feasibility and final BESS size, subject to the specified minimum size constraints, according to the terms of this solicitation. If any existing engineering studies or facility conditions reports are provided through this solicitation with the site information package or from an Agency representative, the Contractor shall independently verify all information provided.

## Codes, Standards, and Regulations

The Contractor shall be in compliance with one of the nationally recognized model building codes and with other applicable national, state, and local codes. The latest edition of the local and nationally recognized codes and any updated supplements in effect at the time of contract award shall be used throughout the project design and construction. Codes and standards applicable to the BESS project can be found below.

The BESS components must comply with all codes and standards relevant to the operation and installation of energy storage equipment. All installed equipment must be tested and approved by Underwriters Laboratories (UL) or another nationally recognized testing facility. Batteries, enclosures, inverters, and other balance of system components must be certified to comply with the latest version of the following requirements:

1. All work must follow current requirements:
   1. NFPA 70 - “National Electrical Code”
   2. NFPA 68 - “Standard on Explosion Protection by Deflagration Venting”
   3. NFPA 69 - “Standard on Explosion Prevention Systems”
   4. NFPA 72 - “National Fire Alarm and Signaling Codes”
   5. NFPA 855 - “Standard for the Installation of Stationary Energy Storage Systems”
   6. International Fire Code (IFC)
2. Battery cell:
   1. UL 1642 - “Standard for Lithium Batteries”
3. Battery module:
   1. UL 1973 - “Batteries for Use in Light Electric Rail Applications and Stationary Applications”
4. Battery system:
   1. UL 9540 - “Energy Storage Systems and Equipment”
   2. UL 9540A - “Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems”
5. Grid interconnection standards, as applicable to the project as a whole:
   1. Institute of Electrical and Electronics Engineers (IEEE) 1547 - “Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electrical Power System Interfaces”
   2. UL 1741 - “Standard for Static Inverters and Charge, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources,” including Supplement A and B (consider Supplement CRD in California)
   3. UL 62109-1 - “Safety of power converters for use in photovoltaic power systems – Part 1: General requirements”
6. Other codes and standards that will apply include:
   1. American National Standards Institute (ANSI) C12.1 (electricity metering)
   2. Seismic requirements consistent with American Society of Civil Engineers (ASCE) 7 Minimum Design Loads for Buildings and Other Structures
   3. IEEE 2030.2 – “Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure”
7. (Alternative International Electrotechnical Commission [IEC] standards where applicable:
   1. IEC 62619
   2. IEC 63056
   3. IEC 62933-5-2

## Interconnection to Electrical Distribution Systems

It is the sole responsibility of the Contractor to meet the [insert serving electric utility’s] interconnection requirements. The Contractor shall provide supporting documentation or drawings required by [insert serving electric utility]. Any local codes required by utility interconnection laws and regulations shall be followed by the Contractor.

Agency-Owned Electrical Distribution System Requirements:

1. Modifications or upgrades to the Agency-owned electrical system required to interconnect the BESS are the responsibility of the Contractor (e.g., service panel, generator coordination). The Contractor is responsible for the proper circuit sizing, overcurrent protection, and coordination of the circuit(s) beyond the point of interconnection to the Agency distribution system, including modifications to the site’s electrical equipment and circuits. (Agencies may require additional distribution system upgrades to support microgrid projects. These costs should be investigated prior to award. This will be less impactful in projects that only include behind-the-meter BESS installations). Any needed upgrades or modifications to existing Agency electrical distribution systems must be included in the review and approval process outlined in the submittal section herein.

Serving Utility Electrical Distribution Systems Interconnections:

1. The Contractor shall provide for interconnection of the behind-the-meter BESS with the Utility-owned electrical distribution system and take actions to ensure that the Agency- and Utility-owned systems are compatible. Modifications or upgrades to the Utility electrical system for interconnection are the responsibility of the Contractor. The Contractor will assume the costs of these modifications. Any modifications to the approved BESS design that would affect the electrical distribution system shall require the written approval of the Agency.
2. The Contractor is responsible for complying with all electric utility interconnection requirements, including upgrades, providing all necessary BESS details for the interconnection applications, and funding any required interconnection studies to be performed by or on behalf of the electric utility. The Contractor is responsible for gaining approval from the electric utility for interconnection and any electric utility-required upgrades.

## Work Planning

The Contractor shall notify the Agency of any Contractor-planned utility service interruption not later than [insert working days] prior to beginning the scheduled work that requires the utility service interruption. The Agency shall coordinate all utility outages and secure a final date when the outage may proceed. Every reasonable attempt shall be made to secure the Contractor’s requested date. Under no conditions shall the utility service be interrupted by the Contractor without prior written approval by the Agency.

## Permits and Licensing

The Contractor shall be responsible for:

1. Preparing all permitting and licensing applications for the project
2. Paying all fees and complying with all requirements
3. Providing any supporting documentation, data, and information that may be required for permitting
4. Coordinating and acting as the primary liaison with permitting and licensing agencies.

## Local Authority Having Jurisdiction Involvement

The Contractor shall involve the local Authority Having Jurisdiction (AHJ), or organization responsible for fire protection to provide permitting (where locally required), and design review and approval. The Contractor shall submit all required construction documents, as stipulated in NFPA 855 and/or the IFC as applicable, for AHJ review. The installation shall not proceed until AHJ approval has been granted.

The Contractor shall coordinate emergency planning and training in accordance with NFPA 855 and/or the IFC. This may include inviting local firefighters as well as facility staff to an on-site training where attendees will be shown how the BESS works, be trained on BESS safety systems, and review the emergency operations plan and any agreed upon response procedures. The emergency operations plan shall be developed by the Contractor and made available for use by facility personnel, maintenance personnel, and first responders. The Contractor shall coordinate with the local fire department on BESS setback requirements, first responder training, and posted instructions for shutoffs.

## Federal, State, and Local Rebates and Incentives

The Contractor shall complete and submit in a timely manner all documentation required to qualify each system for available rebates and incentives. Tax incentive eligibility due diligence shall be the responsibility of the Contactor and not the Agency.

# Engineering and Construction

## BESS Project Description

1. The Contractor shall include BESS submittals in the proposal phase, including:
   1. A site plan showing the BESS footprint, including the location and layout diagram of the room or area in which the BESS is to be installed, including anchoring and/or structural support points (Agencies may require additional input and levels of review to include local emergency management officials)
   2. Electrical schematic diagrams (interconnection, system one-line diagrams)
   3. Usable energy storage capacity (kWh)
   4. Rated power (kW AC)
   5. Round trip efficiency (including auxiliary loads)
   6. Cycle life
   7. Annual degradation factor
   8. Ambient temperature control system
   9. Details on fire suppression, smoke or fire detection, gas detection, thermal management, ventilation, exhaust, and deflagration prevention and/or venting systems, if provided
   10. Alarm hierarchy, integration, and monitoring design as approved by the AHJ
   11. Location and content of required signage
   12. Manufacturer’s specifications, ratings, and listings of BESS and associated equipment
   13. Fire and explosion testing data, hazard mitigation analysis (HMA), and calculations or modeling data to determine adequacy of explosion control, where required by applicable codes and standards
   14. Equipment manufacturers and product names
   15. Battery Management System provider and sequence of operations
   16. Maintenance requirements
   17. Commissioning and decommissioning plans (Consider requiring recycling of BESS components where practicable and that the site will be restored to its previous condition).
2. The Contractor shall identify an appropriate location for the balance of system enclosure(s), and related components and environmental control systems that will meet the following criteria:
   * Ease of maintenance and monitoring
   * Efficient operation
   * Low operating losses
   * Secured location and hardware
   * Compatibility with existing facilities
   * Minimum vegetative and landscape impact
   * Minimum clearances around BESS and balance of system.
3. All balance of systems (wiring, component, conduits, and connections) shall be suited for conditions for which they are to be installed.

## Performance

## (Incorporate use cases listed as items 1-3 below)

1. Grid outage scenario: Integrate the BESS with [specify any existing PV/generator nameplate capacity in kW, specify generator model name if available] and automatic transfer switch (ATS) [Include ATS model name and specifications]. Install a microgrid control system and modify the existing ATS as necessary to provide electricity to the building upon grid failure. (Optional language) [The Contractor shall include the creation of a critical power circuit, including rewiring of the critical loads and installation of critical power switchgear, in the scope of work. Critical loads to be served are included below]: [Insert list of critical loads, including their peak and average consumption.] (e.g., 1 MW peak, 800 kW average consumption) (Agencies may require a site-level power system study and site-level Sequence of Operations (SoO) to ensure there are no loads that could overload the BESS on start-up or when energized, like large transformers).

* Consider the following site-specific parameters in the system design. [Specify site-specific operating conditions: provide electric load interval data, required ramp rates for existing generators, additional information on the types of loads to be served and required modes of operation. Provide detail on existing control and monitoring systems. Configure BESS to provide seamless transition between utility power and microgrid. Optimize system to minimize generator use to conserve fuel.]
* The BESS shall be demonstrated to perform on a recurring basis to ensure the Agency’s desired site resilience and energy assurance. This interval testing frequency shall occur approximately every 12 months following final acceptance to ensure provision of power to the site in the event of a utility-provided power outage or interruption. This activity requires precoordination with the serving electric utility in accordance with the approved interconnection agreement, and that coordination shall be led by the Contractor in consultation with the Agency’s facilities management staff. This periodic demonstration shall stagger months, seasons, load, time of day, and weather variabilities, but shall be conducted at least every 12 months. Periodic testing will be the responsibility of [Specify entity responsible for O&M]. In the event of an actual utility power interruption exceeding [insert specified duration], the BESS’s performance will satisfy this requested demonstration, thereby resetting the interval to 12 months prior to the next required demonstration. Any deficiencies or anomalies beyond expected design parameters, in an actual event or demonstration event, are to be reported to the Agency within 48 hours in writing, with recommended remediation or corrective steps to prevent recurrence.

1. Demand control scenario: Integrate the BESS to provide grid electricity usage and demand control/peak shaving to limit demand (kW) to programmed setting. Current site monthly peak demand is [insert monthly peak kW demand here], and average load is [insert average demand in kW here]. Limit grid demand by [specify the required demand reduction in kW here.]. (The calculation of your utility billing demand can vary dramatically depending on your serving utility. Carefully review your utility tariff to understand how your billing demand is established. Common clauses that could affect savings include contractual minimum billing demand, billing ratchets/lookbacks (e.g., 80% of highest annual demand), and standby service charges.) The BESS shall have a method for forecasting the peak load and automatically dispatching the battery or scheduling the charge/discharge in advance (Note that a site-level Energy Management System may also be utilized for this functionality).
   1. Time of Use Charge Reduction: Integrate the BESS to discharge during on-peak hours in accordance with the site’s rate tariff.
   2. A BESS-level control system shall be provided to control the charging and discharging of the equipment. The BESS control system shall be field programmable by connecting with a laptop and viewing/editing on a locally hosted web browser. (Remote sites without internet access may not wish to require remotely programmable capability.) Programming instructions and setpoints shall be shared with Agency staff.
   3. BESS shall maintain a round-trip efficiency greater than 70% AC-in to AC-out (confirmable by operation over a single round-trip cycle from 0% state of charge to 100%, and back to 0% at standard conditions specified by the manufacturer), including thermal losses and auxiliary loads, over 10 years.
   4. The Contractor shall guarantee annual BESS savings as established in the proposal. (Potential Language) [Savings will be generated by discharging the battery during on-peak periods, as well as during peak billing demand periods. The Contractor shall propose a methodology to calculate optimal savings, subject to review by the Agency, and guarantee (define percentage) of optimal savings.]
2. Solar-plus-Storage (optional language)
   1. (If the solar-plus storage will be privately-owned) The awarded Contractor may be eligible for tax incentives associated with the PV and BESS. Tax incentive eligibility due diligence is the responsibility of the Contractor, not the Agency.

## Thermal Management

The Contractor shall provide all components to operate the BESS within acceptable operating temperatures. Provide any thermal management systems and operating strategies required to maintain the BESS and inverter temperatures within manufacturer’s recommendations at all times, including during shipment and prior to commissioning.

## Arc Flash and Coordination Studies

The Contractor will perform arc flash and coordination studies of the system to ensure safety during operation in parallel with the grid. (If pursuing an islandable system, add the following:) [The Contractor will also perform arc flash and coordination studies of the system during islanded operations.]

## Professional Engineer and Licensed Design Professionals

All architectural and engineering (A-E) services shall be performed by design professionals licensed in the state in which the project is being built with responsible control for each respective design discipline.

## Registration Seals

Each submitted final design drawing, calculation document, and specification manual shall be signed and dated by, bear the seal of, and show the State Certificate Number of the Architect or Engineer who prepared the document and is responsible for its preparation.

## Coordination of Professional Services

The Contractor shall be responsible for the professional quality, technical accuracy, and coordination of all investigations, evaluations, drawings, testing, cost estimates, submittals, written reports, construction, operations, and all deliverables, as required by this document or as required to complete the work of this contract.

## Coordination of Subcontractors’ Credentials

The Contractor shall ultimately be responsible for the completeness, accuracy, coordination, and submission of all submittals described above. Contractor may delegate the preparation of submittals to subcontractors or suppliers as long as the intent of Sections 2.5, 2.6, and 2.7 of this specification is met.

## Modifications and Alterations of Government Property

Modifications, alterations, and/or additions to existing facilities shall be designed and certified to satisfy applicable requirements of this Statement of Work (SOW) document and the governing codes and standards referenced in this SOW document. The Agency shall coordinate with building occupants and approve all modifications, alterations, and/or additions prior to completion of design.

## Grounding

A suitable equipment grounding system shall be designed and installed for the BESS. The grounding system shall provide personnel protection for step and touch potential in accordance with IEEE 80. The system also shall be adequate for the detection and clearing of ground faults within the BESS. The system should be grounded in [list all anticipated operating modes, e.g., grid-tied and islanded] operating modes.

## Structural

The vendor shall furnish the design for the structural components of the BESS, concrete pads/foundations as required, and conduit required for the complete BESS. All final (Issued for Construction) drawings, specifications, and calculations shall be stamped by a state-licensed Civil/Structural Professional Engineer. The vendor is responsible for Geotechnical surveying if required.

## Conduit and Preventing Water Intrusion

Conduit routing and fittings must be selected to prevent water intrusion into inverter enclosures, combiner boxes, switchgear, and transformers. Conduits are to provide fittings to allow water to drain prior to entering the electrical enclosure. Any exterior PVC conduit must be Schedule 80.

## Locating Equipment

Major electrical components, including the inverter, isolation transformer, and metering, shall be installed in code-compliant enclosures. BESS location shall be above the [insert year] flood plain and surge levels and shall be elevated higher than any pull vaults and conduit not sloped toward any BESS electrical component to prevent equipment flooding. BESS shall include a thermally conditioned enclosure. Site design should include egress for staff or other people onsite and access for emergency responders.

## Expected Service Life

Unless noted otherwise, all materials furnished for the project shall have an expected service life of at least 10 years.

## Site Service Conditions

Materials shall be designed to withstand the year-round temperatures and conditions to which they are exposed (sunlight, heat, humidity, rain, wind, sand/dust, seismic activity, salt air, fog, marine corrosiveness, etc.). (The agency can specify the wind rating and any other site conditions here.)

## New Equipment

The Agency shall not accept used, reconditioned, after-market, or grey-market products or equipment. Any offeror supplying used, reconditioned, after-market, or grey-market products may be held responsible for damages to the Agency.

## Markings (Labeling)

Strict conformance to system marking requirements of BESS and their components is crucial for the safety of operators, service personnel, emergency responders, and others. Include all required and desired labeling language in the design drawings for Agency review. Provide all required markings per NFPA 70, NFPA 855, and the IFC, including but not limited to:

1. Electrical equipment and components used in BESS shall have markings that identify the manufacturer, size, type, ratings, hazard warnings, and other specifications.
2. Labelling shall include posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.
3. All disconnects shall be clearly labelled, indicating operating system voltage, current, and system rating.
4. Equipment markings should never be removed and should be able to withstand the environmental conditions in which the equipment is installed (e.g., “UV rated” for outdoor labels, or on an embossed steel placard, designed for outdoor use and fastened with adhesive and rivets).
5. Markings must be visible or easily accessible during and after installation. The Contractor shall be responsible for all field-applied markings as required by local, state, and federal codes.

## Battery Warranties

The Contractor shall provide the following limited and performance warranties:

* 1. Battery pack performance warranty for at least 10 years after the date of successful completion of commissioning. Battery pack shall retain at least 70% of nominal energy capacity for the earlier of either 10 years after commissioning or after a minimum energy throughput of [insert cumulative throughput] kWh energy.
  2. Power conversion system warranty of at least 10 years from successful completion of the commissioning.
  3. Full turnkey system warranty for one year from successful completion of the commissioning. The Contractor shall respond within three days if maintenance is required. (Agencies should specify the following: Definition of Contractor response, minimum system availability, allowable outage hours/year for preventive maintenance, penalties for non-performance).

## Operations and Maintenance

[The Contractor or designated O&M provider] shall conduct annual O&M and continuous monitoring to verify that the BESS is performing as intended per the proposed battery storage strategy and manufacturer recommendations and submit an annual report to the Agency. The Contractor shall perform all required maintenance to the BESS to ensure that the system is performing as expected. Additionally, the Contractor shall:

1. Provide O&M training and supporting manuals to Agency personnel
2. Perform updates to the BESS control system dispatch strategy if required due to rate tariff or major site load profile changes
3. Ensure that all system firmware is up to date and meets Agency cybersecurity requirements.
4. Provide an annual O&M Report, including:
   * Use case performance
   * Battery outages with root cause summary and start and end time periods
   * Summary of all O&M operations; repair and replacements
   * Summary of safety incidents, causes, and resolutions.

## Data Acquisition and Monitoring

The Contractor shall provide a turnkey data acquisition and display system that allows the Agency to monitor, diagnose, and track the charging, discharging, and operating data of the BESS. A minimum requirement is the provision of a web-based monitoring and tracking system. The Contractor shall provide an internet connection to the BESS, distinct from Agency internet. (Agency requirements may vary, ensure that data acquisition and monitoring solution is compliant with agency cybersecurity requirements. Remote sites without internet access may not wish to require remotely programmable capability.) Monitoring and tracking systems shall include a historical database and real time data portal capturing the data in 15-minute intervals. A minimum of 36 months of data shall be stored by the Contractor and be made available for Agency download via the web portal. (Agency may consider requiring machine learning-based predictive maintenance based upon installed data collection and retention components, as well as the incorporation of control algorithms that minimize overcharging and aggressive cycling). The data shall, at a minimum, comprise the following information and frequency of collection:

* Date, time
* Apparent power (kVA)/phase, real power (kW) and Volts on each phase; recorded in 15-minute intervals
* BESS state of charge
* BESS temperature, hourly average at hourly intervals
* The web-based monitoring system shall report actual system performance and an estimate of expected performance
* [Wind speed at the BESS, at hourly intervals] (This is optional, not required for performance assessment)

The system shall allow the Contractor to interact with the BESS control system to update settings and modify setpoints. Updates should be incorporated into the monitoring system throughout the contract term.

## BESS Safety

1. The BESS shall have a data acquisition/monitoring/alarm system. The system shall be described in the offeror’s proposal and shall include:

* Full monitoring of electrical power and related operational data, including voltage, current, and system temperature
* Visual and audible alarm if potential safety hazard exists
* Notification when preventive maintenance is needed
* System level alerts shall be provided by the manufacturer over customer interface.

1. The BESS shall contain protective relays, circuit breakers, or fuses which self-protect the BESS in the case of internal electrical faults.Set and adjust circuit protection devices according to a short circuit and coordination study.
2. A detailed plan surrounding battery cell thermal runaway detection and mitigation systems in the BESS will be included in the submittal process. (Agency should consider requiring temperature monitors and smoke detection equipment, and gas monitoring equipment capable of detecting thermal runaway)
3. A visible disconnect will be installed that isolates BESS in accordance with utility interconnection requirements.
4. All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified. Markings shall reference the same designations called out in the final design drawings.
5. Develop posted instructions for tasks that site staff may need to perform, such as system shutdown during an emergency.
6. Ensure site design is informed by an emergency preparedness strategy coordinated with local emergency management officials. (Consider incorporating site emergency preparedness officials into the site design approval chain. Also, consider including contract language regarding Contractor-led training and coordination exercises for battery system operators, supervisors, and emergency responders.)
7. Contractor shall perform a safety risk assessment to include inverters, battery management systems, and energy management systems. This risk assessment shall include guides for ventilation and thermal management; for installation, maintenance, and operations; and for managing electrical, fire, and shock hazards.

## Severe Weather

(The appropriate clauses should be included based on site location and extreme weather risks.)

1. **Earthquake Mitigation—**Comply with Unified Facilities Criteria (UFC) 3-301-01 for requirements related to the foundation, soil stability, and seismic analysis.
2. **Flooding/Other Water Intrusion Considerations**
   1. Use NEMA 3R rated or better enclosures (In severe weather locations, NEMA 4 ratings are recommended. In coastal areas with severe weather, NEMA 4X should be considered if funding is available to support the additional cost.)
   2. Develop a comprehensive site stormwater management and drainage plan that encompasses location of BESS out of the path of stormwater flows.
   3. In addition to code requirements, design shall prevent scour of soils in and around BESS to prevent loss of foundation integrity.
3. **Wildfire—**The Contractor is responsible for removing any vegetation adjacent to the BESS. Areas within 10 ft (3 m) on each side of an outdoor BESS shall be cleared of combustible vegetation and combustible growth. To limit the risk of wildfire damage, ensure the system is set back from flammable objects (trees, buildings) and ensure that a fire defensible perimeter is maintained. Coordinate vegetation management plan and defensible perimeter with the local AHJ to ensure adequate setbacks and mitigate fire risk.

# Inspections and Commissioning

## Commissioning

Contractor shall coordinate with a third-party Commissioning Agent on the following tasks. (NOTE: The Federal Emergency Management Program strongly recommends the use of a third-party commissioning agent to support the project from design through final acceptance. The Commissioning Agent should be involved throughout the project, from the design and programming phase through to the acceptance phase. If an agency is unable to procure a third-party commissioning agent, the section below may be modified to place commissioning responsibility upon the Contractor.) All documents shall be provided from the Contractor to the Agency and the third-party Commissioning Agent. A commissioning plan shall be provided by the Contractor and approved by the Agency prior to proceeding with inspection and commissioning:

1. After the Agency’s electric utility provides permission (interim for testing) to operate in parallel with the grid, the Contractor shall complete commissioning in accordance with Agency safety and Commissioning Agent’s commissioning plans, its own quality control plan, manufacturer's recommendations, and franchise utility interconnection requirements. The Contractor shall work with the Commissioning Agent to document all performance measurements.
2. The Contractor shall perform all work required for testing, start-up, and commissioning, under Commissioning Agent review and supervision.
3. The BESS shall be commissioned per the Electric Power Research Institute’s (EPRI) “ESIC Energy Storage Commissioning Guide,” or by a similar standard reviewed and approved by the Agency.
4. The Contractor shall give the Agency and Commissioning Agent 10 business days’ advance notice prior to starting commissioning. An Agency manager or representative may request to be present during any or all phases of the start-up, commissioning, and testing activities (It is strongly recommended that an Agency representative witness all start-up, commissioning, and testing activities.).
5. All subsystems and components shall undergo functional performance tests to demonstrate correct installation and operation.
6. The system shall be started-up and tested in accordance with the regulations of the applicable interconnection standards. All anticipated modes of operation shall be tested.
7. The Contractor shall request and coordinate system acceptance testing with the utility and Agency for acceptance and certification of the BESS and permission to operate, after commissioning and final inspections are complete.
8. Commissioning shall include the Contractor’s data acquisition system, fire alarm system testing, gas detection/ventilation system testing, testing any system interconnections, and enclosure thermal conditioning system testing.
9. A commissioning report shall be provided to the Agency and AHJ prior to final inspection and approval.

## Inspections

1. The third-party Commissioning Agent is responsible for verifying that the BESS is installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent and local codes and regulations. The Contracting Officer or the delegated Contracting Officer’s Representative may inspect the systems at any time during construction or after the systems have been put in operation. The Contractor may be ordered to stop work or shut the systems down if unsafe conditions or code violations are noted.
2. An initial inspection for Substantial Completion will be made when the work is complete to the point that the Commissioning Agent is ready to begin starting, testing, and commissioning the system. Following this inspection, the Agency will provide the Contractor with a punch list describing any incomplete work that must be complete prior to the Contractor’s request for final inspection.
3. The Contractor shall give the Contracting Officer ten (10) business days’ advance notice, in writing, of the date the work will be ready for initial inspection.
4. A final inspection of all systems shall be made only when all construction is complete in accordance with the terms and conditions set forth in the Contract and all punch list items identified in the initial inspection are complete. If, upon examination by the Contracting Officer and/or Agency inspection personnel, the project is determined not sufficiently completed to have warranted a final inspection, the Contractor may be charged for any additional cost of re-inspection.
5. The Contractor shall give the Contracting Officer ten (10) business days’ advance notice, in writing, of the date the work will be fully completed and ready for final inspection.
6. The Contractor’s request for final inspection will not be approved unless documentation below, at a minimum, has been provided to, and accepted by, the Contracting Officer, in addition to all other contract requirements:

* Final as‑built drawings (record drawings), meeting as-built requirements
* Preventive maintenance work schedules and procedures
* Operations and maintenance manuals (electronic and hardcopy)
* Training manuals (electronic and hardcopy)
* Equipment documentation and spare parts lists
* Certificates of Authority Having Jurisdiction (AHJ) inspections

1. After commissioning is complete, the Contractor shall instruct and train Agency designated personnel on normal system operation and how to shut down the system in the event of an emergency. The Agency may reasonably request additional training, and the Contractor will conduct such training at the Contractor’s expense. Training may take place over multiple sessions to accommodate Agency’s staff availability. The training session(s) may be recorded.
2. As soon as practicable, following final inspection, the Contracting Officer will inform the Contractor, in writing, of any discrepancies and/or omissions noted at the final inspection. The Contracting Officer shall also state the time allowable for replacement of material and performance or re-performance of any unsatisfactory work necessary before written notification of system acceptance testing.
3. Upon written notification that all deficiencies identified during the final inspection have been corrected, the Contracting Officer may schedule a follow up inspection to confirm all corrected work is acceptable. The Contractor shall then coordinate with the Commissioning Agent, utility, Agency, and AHJ to schedule system acceptance testing.

## Summary of Process

In summary, inspections and commissioning will follow the following sequence:

* Initial inspection for Substantial Completion of construction.
* Pending successful initial inspection, commissioning may begin.
* Final inspection may be scheduled following completion of commissioning and approval of all documents shown in Section 3.2(6) of this specification.
* The Contractor will be responsible for completing any re-work identified in the Final inspection prior to scheduling system acceptance testing.

# Final Acceptance

1. The Contractor shall notify the Commissioning Agent and Agency not less than ten (10) business days prior to the anticipated date of system acceptance testing. The Agency shall have the right, but not the obligation, to be present at and observe the system acceptance testing, at the Agency’s sole cost. (It is strongly recommended that an Agency representative witness all testing activities.).
2. The system acceptance testing shall be witnessed by the electric utility if required for interconnection approval, and the Contractor shall meet the utility’s test notification requirements.
3. In addition to utility and Agency system acceptance test standards, the test shall include, at a minimum, the following:
   1. While connected to grid power, start up the BESS until it achieves the minimum specified performance requirements. The acceptable productive power output will be measured in kW (AC) at the building electrical interconnection point and must be consistent with the specifications for the system.
   2. The Contractor shall demonstrate the operation of one full charge/discharge cycle of the BESS and report on system performance.
   3. Ensure that all subsystems and components work under foreseeable operating conditions.
   4. Review a complete record of all pre-functional tests, equipment startups, and functional performance verification tests.
4. Approvals as required by the local AHJ and local electric utility will be a pre-requisite for acceptance and for authorization to energize the system(s).

Upon successful completion of system acceptance testing, the Contractor shall send a Completion Notice and a copy of the system acceptance test report to the Contracting Officer so that the Agency can complete their final acceptance. The Agency and Commissioning Agent shall have ten (10) Business Days after receipt of the Completion Notice to review the system acceptance testing results and verify that the system installation is complete, safe, aesthetically acceptable, functional, constructed to all code requirements, does not interfere with Agency or tenant operations, and otherwise meets all other requirements. The Contracting Officer will notify the Contractor in writing of Final Acceptance.

If any of these requirements are not met, then the Agency shall provide the Contractor with a detailed notice of such failure (a "Rejection Notice") within the ten (10) business day period, with details regarding the required remedy (including repetition of either partial or full system acceptance testing, if appropriate, at the discretion of the Contracting Officer or Contracting Officer’s Representative, and the time allowed to complete remedy. The Contractor shall promptly remedy, at Contractor’s cost, the items identified in the Rejection Notice and conduct any additionally required system acceptance testing (if required by the Rejection Notice) until the system acceptance testing indicates that the system meets the contract requirements. In each such case, the Contractor shall send a new Completion Notice to the Agency with a copy of the results of the new system acceptance testing as provided above and the foregoing procedures shall be repeated.

Written acceptance shall be final and conclusive except as regards latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Agency’s right under any warranty or guarantee, subject to the system performance warranty.

In summary, the following requirements must be fulfilled before final acceptance:

* System acceptance testing has been completed, with the system and all subsystems and components having operated at specified performance for one full charge/discharge cycle with power production levels consistent with proposed system’s estimated production with 100% system availability, measured with applicable instruments and meters.
* The system has been approved for interconnected operation by the electric utility (with signed interconnection agreement).
* Submission of as-built drawings and all documents required prior to final inspection described in Section 3.2 of this specification.
* Training fulfillment documentation.
* Commissioning report provided to Agency.