Appendix B-4
Model BESS Scope Book

2025 Request for Proposals

for

Renewable and Storage Resources

for

Entergy Arkansas, LLC

Entergy Services, LLC
May 19, 2025

[BESS Project Name] PROJECT

EXHIBIT A – DEVELOPER SCOPE BOOK

EPC – Engineering, Procurement and Construction

Rev. 0

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ENTERGY

[BESS Project Name] PROJECT

EPC SPECIFICATION

EXHIBIT A – DEVELOPER SCOPE BOOK

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LIST OF APPENDICES

1.0 GENERAL REQUIREMENTS

1.1 General

Seller shall provide the Project, including a Battery Energy Storage System, or BESS, to Buyer at the Project Site in accordance with the terms of this Scope Book and the other terms of the Performance Standard. The Work requires Seller to provide, among other things, necessary design, engineering, procurement, construction, commissioning, start-up, testing, performance verification, and training of Buyer personnel with respect to the BESS and the Project. The Project shall be engineered according to industry standards using prudent utility practices and in compliance with the Performance Standard. The entire BESS facility shall be controlled by the BESS Supervisory Control and Data Acquisition (SCADA) System and Controller as specified in this Technical Specification.

This Scope Book is an exhibit to and part of the B-O-T Acquisition Agreement between Seller and Buyer (i.e., the Agreement) and is subject to its terms, including Article I thereof. An initially capitalized term used but not defined in this Scope Book shall have the meaning assigned to such term in the Agreement except to the extent otherwise provided in the Agreement or the context otherwise requires. The priority of documentation and terms forming part of the Agreement (including this Scope Book) and Ancillary Agreements are set forth in Section 1.3 of the main body of the Agreement. Seller is sometimes referenced in this Scope Book as "Developer" or "Contractor" and "Buyer" as "Owner." "Developer" and "Contractor" may be used interchangeably in this Scope Book to describe the entity developing the BESS Project under an EPC contract.[1]

Buyer desires a qualified bidder (Developer) to provide engineering, procurement, and construction services to develop a Battery Energy Storage System (BESS) Project proposed power and energy capacity at a proposed facility location determined by the Developer.

The entire BESS facility shall be controlled by the BESS Supervisory Control and Data Acquisition (SCADA) System and Controller. The Project includes, without limitation, all necessary project development, land acquisition, permitting, design, engineering, commissioning, start-up, testing, performance guarantees, and performance verification. Operations, maintenance and spare parts to support continuous facility operation shall be provided by Developer. Seller shall provide waste disposal plan that covers disposal methods during and post construction as well as develop a Decommissioning Plan or recycling plan for the facility at End of Life (EOL) per Section 6.5 below.

Refer to Appendix 8 for project location and Project Site Map.

The supply of the battery and its rack, Power Conversion System (PCS), Medium Voltage step-up transformer (MVT), BESS SCADA, and the fire Protection and detection system within the BESS equipment enclosures are included in the Developer's scope of supply.

Notwithstanding the foregoing, the installation, commissioning and testing at site of these components are within the scope of Contractor. Commissioning of and testing activities for the Project equipment shall be carried out with the support of each original equipment manufacturer (OEM).

The following referenced documents provide supplemental requirements to Contractor's scope of supply under this Scope Book:

[1] Buyer expects that the final version of the Scope Book will clarify language inconsistencies between this Scope Book and the Agreement.

Appendix I – [Reserved]

Appendix 2 – Owner Provided Information. A description of the Project functional and technical requirements is provided in Appendix 2. This Appendix will require input from Seller as part of its proposal.

Appendix 3 – Developer Provided Information. Appendix 3 provides information of physical characteristics of OEM equipment for Developer's design of the Project.

Error! Reference source not found. – Project Performance Tests and Liquidated Damages.

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Appendix 6 – Division of Responsibility (DOR).

Appendix 7 – Cyber Security Plan.

Appendix 8 - Project Site Map.

Appendix 9 – Collector Substation (if applicable).

Appendix 10 – NERC Requirements.

Appendix 11 – Project Controls Requirements.

Appendix 12 – High Voltage Transmission Line (if applicable).

Appendix 13 – Approved Supplier List.

As described in detail in this Scope Book and required as set forth in this Agreement, Contractor shall engineer, design, manufacture and deliver to Buyer at the Project Site the following equipment and services:

- Contractor's Scope of Supply per Section 2.0 of this Scope Book.
- Equipment Scope of Supply per Section **Error! Reference source not found.** of this Scope Book.
- Design Requirements per Section 4.0 of this Scope Book.
- Facility Requirements per Section 5.0 of this Scope Book.
- Engineering Services and Studies provided by Contractor per Section 6.0 of this Scope Book.
- Testing, Commissioning and Startup services provided by Contractor per Section 7.0 of this Scope Book.
- Maintenance services provided by Contractor per Section 8.0 of this Scope Book.
- Training and Tools for all Contractor-provided equipment per Section 9.0 of this Scope Book. The Project shall include full provisions for training, operation and maintenance of the Project and all associated equipment.
- Document Submittals provided by Contractor per Section 10.0 of this Scope Book

Refer to Appendix 6 – Division of Responsibility (DOR) for details. Contractor shall provide overall management during commissioning utilizing the support of OEM equipment technical advisors during commissioning.

1.2 Definitions and Abbreviations

Table 1 — Acronyms/Abbreviations

ºC	Celsius

°F	Fahrenheit
A	Ampere, unit of Electrical Current
AC	Alternating Current
AGC	Automatic Generation Control
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BESS	Battery Energy Storage System
BOL	Beginning of Life
BOM	Bill of Materials
CPT	Control power transformer
dBA	A-weighted decibels
DC	Direct Current
DOD	Depth of Discharge
Down Reserve	The capability of the BESS to inject AC power to the grid at the POI in response to remote commands, and/or frequency response
DNE	Data Network Engineering
DNO	Data Network Operations
EL	Electroluminescence
EN	European Standard
EOL	End of Life
EPC	Engineer-Procure-Construct as the primary or general Contractor
EPS	Electric Power System
Frequency Response	The capability of the BESS to provide response for frequency deviations above and below the frequency set point (or dead band) of the BESS, within the ramp rate limits for the Project
FRT	Frequency Ride-Through
GHS	Global Harmonized System
GHz	GigaHertz

HMI	Human Machine Interface
HV	High Voltage
HV_{AC}	High voltage alternating current
HVAC	Heating, Ventilation & Air Conditioning
Hz	Hertz, unit of electrical frequency
IEC	International Electrotechnical Commission
IED	Intelligent electronic device
IEEE	Institute of Electrical and Electronics Engineers
Inverter	All inverters in this specification refer to Four-Quadrant, Bidirectional, Smart Inverters.
ISO	Independent System Operator
kHz	Kilohertz
kW	Kilowatt
kWh	kilowatt-hour
kV	Kilovolt
LGIA	Large Generation Interconnection Agreement
LHFRT	Low and high frequency ride through
LHVRT	Low and high voltage ride through
Load Following	The ability of the BESS to provide real power response to a specific, metered electrical location (i.e., POI) based on the variations of real power demand at the specified location
LPS	Lightning protection system
LV	Low Voltage
MHz	Megahertz
Mil	Unit of measurement for length (thousandth of an inch)
MPT	Main Power Transformer
MTBF or MTTR	Mean time between failures or Mean time to repair
Ms	Millisecond
MV	Medium Voltage

MVT	Medium Voltage Transformer
MVA	Mega Volt Amp
MW	Megawatt
MW_{AC}	Megawatt alternating current
MWh	Megawatt-hours
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
O&M	Operation and maintenance
OEM	Original Equipment Manufacturer
Output Frequency Range	The range of frequency under which the Project will operate according to its specification
Output Voltage Range	The range of AC grid voltage under which the Project will operate according to its specification
Owner	Entergy Arkansas, LLC (Buyer)
P/T/Z	Pan/tilt/zoom
PCB	Polychlorinated biphenyl
PCC	Point of Common Coupling
PCS	Power Conversion System
Peak Shaving	The ability of the system to provide power to the grid above a threshold power demand level during peak demand periods to maintain net power demand at the substation below the threshold level.
PID	Proportional Integral Derivative loop control
PLC	Programmable Logic Controllers integrated with the BESS and SCADA System
POI	Point of Interconnection (or Electrical Interconnection Point), which shall be where the Project ties into the existing Transmission or Distribution Network
Project	BESS for grid support applications (without limiting the definition in the Agreement)

pu	per unit
PV	Photovoltaic
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QP	quasi-peak
Ramp Rate	The rate, expressed in Megawatts per minute, that a generator changes its power output.
RAS	Remedial Actions Scheme
Rated Apparent Power	The real or reactive power (leading/lagging) that the BESS can provide at the POI continuously without exceeding the operating limits of the BESS
Rated Continuous Charge Power	The rate at which the BESS can capture energy for the entire SOC range of the BESS
Rated Continuous Discharge Power	The rate at which the BESS can continuously deliver energy for the entire specified SOC range of the BESS
Rated Discharge Energy	Total energy the fully-charged BESS can deliver to the POI at the rated continuous discharge power without recharging.
Revenue Metering Point	There are two Revenue Metering Points: Project Totalizing meter at the POI; the Project BESS (low side of the transformer).
rms	root mean square
RSP	Remote Shutdown Panel
SCADA	Supervisory Control and Data Acquisition
SCCR	Short-circuit current rating
SGIA	Small Generator Interconnection Agreement
SOC	State of Charge, measured in % relative to the maximum possible amount of energy that can be stored by the system, with fully charged being 100% and fully discharged being 0%.
SOH	State of Health
SPCC	Spill Prevention Control and Countermeasures
SPD	Surge protection devices

Standby mode	BESS standby mode means that the battery is charged to the specified level and is not providing or receiving power from the grid
SWPPP	Storm Water Pollution Prevention Plan
System Round-Trip Efficiency	The ratio of the delivered output energy of the BESS to the absorbed input energy required to restore it to the initial SOC under specified conditions through the Design Life.
Total Response Time	Starting when the command is received at the BESS boundary and continuing until the BESS discharge power output reaches 100 +/- 2% of its rated power, measured at the POI
DOT	Department of Transportation
UL	Underwriters Laboratories, Inc.
Up Reserve	The capability of the BESS to absorb AC power from the POI in response to remote commands, and/or frequency response
UPS	Uninterruptible Power Supply
µV/m	microVolts per meter
V	Volt, unit of Voltage (Electric Potential)
VA	Volt-Ampere, unit of Apparent Power
V_{AC}	Volts alternating current
VAR	Volt-Ampere Reactive, unit of Reactive Power
V_{DC}	Volts direct current
VDE	Association for electrical, electronic, and information technologies
VESDA	Very Early Smoke Detection Apparatus
V_{OC}	Open Circuit Voltage
VRT	Voltage Ride-Through
W	Watt, unit of Real Power

1.3 Developer and Contractor Responsibilities

The Developer and Contractor shall provide:

- BESS Equipment specified in Section 3.1.

- BESS Inverters specified Section 3.3.
- BESS MV Transformers specified in Section 3.4.
- Power Plant Controller and SCADA Equipment specified in Section 3.5.
- System Documentation.
- Design and Engineering.
- Equipment to meet the requirements of these specifications and the project specific requirements specified in Appendix 2.
- Commissioning and startup on-site support.
- Site compliance certifications regarding work completion to applicable agencies (e.g., as-built certification of storm water management system, if required).
- Site Testing of all works.
- Maintenance plan and spare parts locations and list.
- Decommissioning Plan.

All as described herein, including all referenced appendices and standards, which will subsequently become a part of the Agreement.

For building or special built enclosures, which is not the Owner's preference, the Project consists of all the direct current (DC) components from the BESS modules through the PCS plus the MVT.

For containerized solutions, which is the Owner's strong preference, the Developer shall furnish a fully integrated energy storage system, including battery modules, battery management system, thermal management system, inverters, power electronics and inverters (as an AC block). Each battery module shall include an integrated inverter module for power conversion. The battery modules shall be connected in parallel to an internal AC bus, each with an AC power and communications output connections.

The BESS shall be "Utility Grade" (defined later in this Technical Specification). The balance of the Project (from the output of the PCS to the point of interconnection as defined in the Interconnection Agreement shall comply with this Technical Specification and be compatible with Owner standards specified herein. The balance of plant items includes but are not limited to:

- Wiring, conduit, trenches, and grounding.
- Thermal Management System.
- Safety Subsystems to include Remote Shutdown Panel (RSP) and any Fire Department Connections required either by the BESS equipment supplier or by the AHJ.
- Switchgear and current limiters.
- Transformers.
- Power poles.
- Equipment pads.
- Communications to Owner equipment.
- Special built building if required.

The Project shall be designed by the Contractor to maintain the guaranteed performance metrics presented in this Technical Specification. The Project shall include BESS equipment capable of exceeding the technical and operating requirements set forth in Appendix 2 and Appendix 3.

The Contractor shall provide construction services to complete the following:

- Earthworks
- Roads
- Foundations
- Electrical systems
- Control systems, monitoring systems, communications, and ancillary structures
- Storage facilities
- Security systems
- Fencing
- Safety markings and labeling
- Special built or building enclosures (if required).

Contractor shall also install and commission the OEM equipment provided by Owner in the locations and orientations set forth in the approved site layout drawing and in accordance with this specification, and all related specifications that relate thereto.

The Contractor shall be responsible for the design, engineering, procurement, supply, installation, commissioning and testing of the following equipment: Medium Voltage (MV) Switchgear, Auxiliary Transformers/Switchboards, Auxiliary AC and DC Power Supply System, and all associated Cables.

Refer to Appendix 6 Division of Responsibility for delineation of Contractor's scope of supply relative to the Owner's scope of supply.

1.4 BESS Availability

The Contractor shall design, engineer, and furnish equipment with the objective of producing a BESS system that will meet or exceed stated guaranteed energy availability performance, measured at the point of interconnection, based on expected equipment availability and degradation consistent with Contractor's bid and these specifications. Refer to Appendix 2 and Appendix 3 for Availability requirements.

1.5 Approved Supplier List

The Contractor shall provide equipment and material per the Appendix 13 Approved Supplier List.

1.6 Codes and Standards

Contractor shall, to the maximum extent feasible, 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:

All work must follow current National Electrical Code requirements as well as:

- NFPA 855, “Standard for the Installation of Stationary Energy Storage Systems”

Other general codes are:

- ANSI C2 National Electrical Safety Code
- IFC International Fire Code
- NFPA 70 National Electrical Code
- IEEE 979 Guide for Substation Fire Protection
- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 68 Standard on Explosion Protection by Deflagration Venting
- NFPA 69 Standard on Explosion Prevention Systems
- NFPA 72 National Fire Alarm and Signaling Code
- IBC International Building Code
- ASHRAE 169 Climatic Data for Building Design Standards
- ASCE 7 Minimum Design Loads
- ACI 318 Building Code Requirements for Structural Concrete

Battery cell:

- UL 1642 “Standard for Lithium Batteries”

Battery module:

- UL 1973 “Batteries for Use in Light Electric Rail Applications and Stationary Applications”

Battery system:

- UL 9540 “Energy Storage Systems and Equipment”
- UL 9540A “Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems”

Grid interconnection standards, as applicable to the project as a whole:

- Institute of Electrical and Electronics Engineers (IEEE) 1547
- UL 1741, “Standard for Static Inverters and Charge, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources”
- UL 62109-1 “Safety of power converters for use in photovoltaic power systems – Part 1: General requirements”

Other codes and standards that will apply include:

- UN 38.3 “Certification for Lithium Batteries” (Transportation)
- American National Standards Institute (ANSI) C12.1 (electricity metering)

- American Society of Civil Engineers (ASCE)-7 Minimum Design Loads for Buildings and Other Structures
- IEEE 2030.2, Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure

Alternative International Electrotechnical Commission [IEC] standards where applicable:

- IEC 62619
- IEC 63056
- IEC 62933-5-2

HVAC, Thermal Management and Fire Protection

- NFPA 90A Standard for the Installation of Air Conditioning
- ASHRAE 183 Peak Cooling and Heating Load Calculations in Buildings Except Low-rise Res. Buildings
- ASHRAE 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings
- NFPA 855 Standard for the Installation of Energy Storage Systems
- NFPA 13 Standard for the Installation of Sprinkler Systems

Arresters, Circuit Breakers, and Disconnect Switches

- IEEE C62 Standards Collection: Guides for Surge Protection
- IEEE C62.11 IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits
- NEMA LA 1 Surge Arresters
- IEEE C37 Standards Collection: Circuit Breakers, Switchgear, Relays, Substations, and Fuses
- IEEE C37.37 IEEE Standard Loading Guide for AC High Voltage Switches (in excess of 1000 Volts)
- NEMA SG 6 Fuses
- IEEE C37.46 Specifications for Power Fuses and Fuse Disconnection Switches
- IEEE C37.47 Specifications for Distribution Fuse Disconnecting Switches
- NEMA FU 1 Low Voltage Cartridge Fuses

Protection

- IEEE C37.91 IEEE Guide for Protective Relay Applications to Power Transformers
- IEEE C37.99 Guide for Protection of Shunt Power Capacitors
- IEEE C37.90 IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus
- IEEE C37.90.1 IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays
- IEEE 242 Recommended Practice for Protection and Coordination of Power Systems
- IEEE 141 Recommended Practice for Electric Power Distribution for Industrial Plants
- IEC 255-5 Electric Relays. P5: Insulation Tests for Electric Relays
- IEC 255-22 Electric Relays. Part 22: Electrical Disturbance Tests for Measuring Relays

Control Equipment

- ANSI/IPC D30OG Printed Board Dimensions and Tolerances
- ANSI/IPC A610B Acceptability of Printed Boards

SCADA

- IEEE C37.90.1, “Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus”
- NFPA 70: National Electrical Code UL 50, “Cabinets and Boxes”
- UL 508, “Industrial Control Equipment”
- UL 1449, “Surge Protective Devices” (SPD) ANSI/ISA 99, “Control System Security” NERC/CIP:007-3R2, “Ports and Services”

Harmonics, Grounding and Seismic

- IEEE 519 IEEE Guide for Harmonic Control and Reactive Compensation
- IEEE 80 Guide for Safety in AC Substation Grounding
- IEEE 693 IEEE Recommended Practice for Seismic Design of Substations

Codes and Standards will comply with the following codes and standards at a minimum.

- Aluminum Association (“AA”)
- American Association of State Highway and Transportation Officials (“AASHTO”)
- American Concrete Institute (“ACI”)
- American Institute of Steel Construction (“AISC”)
- Association of Iron and Steel Engineers (“AISE”)
- American National Standards Institute (“ANSI”)
- American Society of Civil Engineers (“ASCE”)
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (“ASHRAE”)
- American Society of Mechanical Engineers (“ASME”)
- American Society of Nondestructive Testing (“ASNT”)
- American Society of Testing and Materials (“ASTM”)
- American Water Works Association (“AWWA”)
- American Welding Society (“AWS”)
- Applicable state requirements, including State Department of Transportation and Environmental Protection
- Avian Power Line Interaction Committee (“APLIC”)
- Code of Federal Regulations (“CFR”)
- Concrete Reinforcing Steel Institute (“CRSI”)
- Crane Manufacturer Association of America (“CMAA”)
- United States Environmental Protection Agency (“EPA”)
- Federal Aviation Agency, Department of Transportation (“FAA”)
- Federal Energy Regulatory Commission (“FERC”).

- Federal Highway Administration (“FHWA”)
- IAPMO Uniform Plumbing Code
- Illuminating Engineering Society (“IES”)
- Institute of Electrical and Electronic Engineers (“IEEE”)
- Instrumentation Society of America (“ISA”)
- Insulated Cable Engineering Association (“ICEA”)
- International Building Code (“IBC”)
- International Code Council (“ICC”)
- International Electrotechnical Commission (“IEC”)
- Modular Energy Storage Architecture (“MESA”)
- National Electric Code (“NEC”)
- National Electrical Contractors Association (“NECA”)
- National Electric Safety Code (“NESC”)
- National Electrical Manufacturers Association (“NEMA”)
- National Electrical Testing Association (“NETA”)
- National Fire Protection Association (“NFPA”)
- National Safety Council (“NSC”)
- North American Electric Reliability Corporation (NERC)
- Occupational Safety and Health Administration (“OSHA”)
- Post-Tensioning Institute (“PTI”)
- Scientific Apparatus Makers Association (“SAMA”)
- Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)
- Society for Protective Coatings (“SPC”)
- Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)
- Underwriter’s Laboratories (“UL”)
- Uniform Building Code (“UBC”)

2.0 DEVELOPER OR CONTRACTOR SCOPE OF SUPPLY

2.1 General Requirements

The Developer or Contractor’s scope of work includes permitting, design, engineering, procurement, installation, commissioning, start-up, and performance verification of the Project systems for the commercial operation of the Project.

The Developer or Contractor scope of Supply is detailed in Appendix 6 – Division of Responsibility (DOR),

The Project design shall comply with all current local, state, and federal regulations, codes, and applicable standards.

All equipment supplied shall be designed to ensure satisfactory operation under the specified site temperature conditions and other atmospheric and environmental conditions prevailing at the site.

All equipment, components, and materials shall be new and free of defects in material or workmanship.

The Developer or Contractor shall verify all information provided by Owner, by OEMs, and third-party suppliers prior to incorporating the information into Contractor's design.

The plant 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. In the case where standards have conflicting requirements, Contractor must notify Owner in writing.

The Developer or Contractor shall be responsible for executing and completing the work with a high degree of professionalism, employing personnel who are experienced, qualified, and properly licensed in their respective fields, regardless of any omission in this Scope Book or the Agreement. Where feasible, components shall be manufactured to standard dimensions to facilitate cost-effective replacements and repairs when required.

The Project design shall adhere to the requirements outlined herein. All equipment, materials, and components shall meet the standards set forth in this Scope Book All equipment supplied and Work by Contractor shall be designed to ensure satisfactory and reliable operation under the full range of seismic and ambient conditions and under all Plant operating conditions and variation ranges specified. The Contractor shall provide sufficient access around all equipment in accordance with good industry practices and OSHA regulations to allow for safe and effective operation, monitoring, maintenance, and removal.

The Developer or Contractor shall apply for and obtain all permits and authorizations necessary for construction of the Project. Copies of all applicable permits shall be provided to Owner within five business days after they are obtained or completed. Contractor shall provide a permit matrix to Owner for approval.

The Developer or Contractor's scope includes but is not limited to providing the following:

- All site preparation including any necessary civil work
- Site Storm Water Pollution Prevention Plan (SWPPP)
- Supports and foundations for all buildings, enclosures, structures, transformers, switchgear, conduit, and overhead cabling
- All the Balance of Plant components
- DC system with voltage sources and panel boards for communications networks and relay protection equipment
- If UPS is not furnished by the BESS OEM, the Contractor shall provide a redundant, industrial grade uninterruptible power supply (UPS) system for Project control and protection systems and communication equipment. UPS system shall allow for minimum of 10 hours power supply for ventilation for explosion prevention system. UPS system shall also supply power for 24 hours for alarms, strobes, and other protection in standby.
- Project related medium voltage (MV) terminations, duct banks and cable routing and collection bus connections including but not limited to AC panel boards, circuit protection, and backup distribution sources with necessary isolation/step-down transformers.
- The codes and standards to be complied with can be found in Section 1.6.

- Contractor shall provide comprehensive safety data sheets (formerly called MSDS) in the new Global Harmonized System (GHS) format as a written chemical inventory of every hazardous chemical in the Project to which employees are exposed.
- Should any of the components within the Project require an operating environment less severe than the site environment, the Project shall provide appropriate conditioning of the enclosed space.
- All portions of the Project must be sufficiently hospitable to installation, inspection, and service personnel to not restrict the performance of those duties. The Project is to be automated with no operator presence required. Contractor to provide solution for remote monitoring of BESS.

The Developer or Contractor shall furnish a construction schedule, in a format acceptable to Owner as part of the bid package and in accordance with the project schedule. Upon approval by Owner, the construction schedule shall become part of the Contract and may be revised only with written approval of Owner in the form of a contract change order.

The Developer or Contractor shall provide a material management plan for all procured items, consumables and construction, installation, and commission works.

The Developer or Contractor shall provide overall project administration and management for the Project. The Contractor's management team shall be technically competent, shall be adequately trained, shall have a minimum of four (4) years of experience (unless otherwise mutually agreed) in the construction and startup of BESS Equipment. The Contractor's team shall be present onsite during all construction and commissioning work and shall instruct the Contractor's construction and commissioning personnel in the proper construction, initial operation, and maintenance of the BESS equipment consistent with Prudent Utility Practice.

2.2 Permitting Services

The Developer or Contractor shall apply for and obtain all permits and authorizations necessary for construction of the Project. Copies of all applicable permits shall be provided to Owner within five business days after they are obtained or completed. Contractor shall provide a permit matrix to Owner for approval.

The Developer or Contractor will also be required to prepare and submit all site compliance certifications regarding work completion to applicable agencies (e.g., as-built certification of storm water management system, if required). Federal permits shall be submitted by Owner.

2.3 Engineering Services

- Contractor shall design and engineer the Project in accordance with prudent utility practices for grid-connected BESS projects for electric utilities in the United States.
- The design must conform to the requirements and conditions of all applicable permits and laws and be in compliance with the operating guidelines and meet Owner specifications.
- Contractor is responsible for all engineering of the Project. All design drawings, specifications, and calculations shall be signed by a professional engineer-of-record registered in the state or jurisdiction of the project. Contractor shall submit to Owner all completed design drawings, data, and documents for review and comment. These engineered design drawings, data, and documents must be submitted to Owner for review and comment before construction is to begin.
- Contractor is responsible for ensuring that all components are installed above the 100-year flood plain (battery system, PCS, SCADA system, Security System, control building, transformers, etc.).

- Any third-party study or independent engineering reviews (such as the geotechnical study) shall be provided to Owner for review.

Contractor's design requirements are further specified in Section 4.0.

2.4 Construction Services

Prior to beginning construction and not later than 30 days prior initial site mobilization. The Developer or Contractor shall provide the following to the Owner:

- A comprehensive onsite construction management plan in accordance with all applicable laws and policies
- Health, Safety, and Environmental Plan.
- Emergency and Fire response plan coordinated with responding AHJ consistent with NFPA-855
- Contractor shall also provide Owner with an evaluation and appropriate documentation of the safety record for any licensed Subcontractor that will be performing work on the Project.
- The Contractor should also provide reference projects where the above plans and actions have been taken. When the above plans and actions have been taken, the Contractor will establish goals for the project, during the project the Contractor will report back to the owner on deviations and near misses. Contractor and subcontractors must register with and be approved by ISNetworld.

The Developer or Contractor shall provide the following under these specifications:

- Contractor shall assemble, construct, and install with its own labor forces and/or with Subcontractors labor, tools, and equipment necessary to complete the Project, including but not limited to the following Works:
- Site preparation, site grading, site improvements, stormwater management facilities and removal of excess debris.
- DC cabling and junction boxes.
- AC trenching and cabling.
- Inverters, switchgear, and transformers and accompanying supports and/or concrete pads.
- Perimeter security fencing (described in Section 4.5.3).
- Security lighting.
- Installation of the monitoring system and revenue grade metering provided by Owner).
- Remote Shutdown Panel (described in Section 4.5.1).
- Setting of BESS enclosures including providing any special lifting equipment and lift/rigging procedures.

2.5 Temporary Construction Facilities

The Developer or Contractor shall provide all temporary power needed for construction, commissioning, and testing of the Project or performance of the Work in each case or any portion thereof.

The Developer or Contractor shall provide all utility interconnections needed for construction, commissioning, and testing of the Project or performance of the Work in each case or any portion thereof (e.g., offices, security, parking, potable and non-potable water, wastewater, sanitation (including sewage), temporary power, telecommunications, broadband internet, and fuel). The Developer or Contractor shall provide a Facilities Plan to define all temporary construction facilities for Owner review.

2.6 Quality Assurance/Quality Control Requirements

The Developer or Contractor shall submit a Quality Assurance/Quality Control (QA/QC) Plan for the proposed project delivery. The QA/QC Plan shall define the systems and procedures which will be used by Contractor to ensure that the Project will comply with the requirements detailed in this Technical Specification in addition to any other standards and policies determined by Owner.

The Developer or Contractor shall submit to Owner a copy of its QA/QC Plan for review not later than 45 days after contract execution for Owner review and comment. The Project shall be managed in accordance with the program.

The Developer or Contractor shall notify Owner of Factory Acceptance Testing 14 days (domestic) and 28 days (international) before testing. Owner shall have right to elect to witness such testing or have representatives witness testing.

The QA/QC Plan shall include, but is not limited to, such procedures and systems as the following:

- Road construction and compaction.
- Reinforcing steel and conduit placement.
- Concrete placement and testing.
- All wire insulation testing—Megger testing or very low frequency testing.
- Fuse tests.
- Terminations pull testing
- All visual inspections
- Factory Acceptance Test reports
- Grounding continuity testing
- Earth-ground resistivity testing
- Metering and instrumentation calibration testing
- SCADA indication, control, and operator interface verification
- Weld testing for transformer support including other anchorage
- Weld testing for racking supports
- If required, weld testing for:
    - BESS containers
    - Inverters if not included with the BESS container

- MV Transformers if not supplied with the BESS container

- Inverter phase rotation and matching with utility
- Protective relay settings
- Verification of security camera system operations, including device points, sequences, and communications
- Other Contractor-prescribed procedures

All onsite QA/QC testing procedures shall be witnessed and documented by a qualified representative of Contractor. Owner shall observe and witness QA/QC as necessary and at its discretion. A qualified engineer of Contractor shall date and sign documentation indicating completion and acceptance of each onsite QA/QC test procedure.

2.7 Environmental, Health and Safety Program

The Developer or Contractor shall provide a comprehensive project specific Environmental, Health and Safety Program in accordance with all applicable laws and policies.

2.8 Storage of Materials and Equipment

Prior to the arrival of equipment and materials at the Site, The Developer or Contractor shall install a fenced, secured area and provide security for the storage of such equipment and materials. Construction storage and laydown shall be sufficiently drained and elevated above the flood plain. Contractor shall notify Owner of the location and layout of intended staging areas, parking areas, storage areas, office areas, workshops, and other temporary facilities. Temporary construction roads and staging areas not converted to permanent roads (if any) shall be restored in accordance with all permit requirements.

The Developer or Contractor shall be responsible for receiving, protecting, moving, and storing all material at the Site in a secure manner and a manner that maintains temperature control for battery cells and modules required under warrantees. OEM recommended requirements to guarantee temperature controls are maintained for BESS including the battery cells so that warrantees are not violated if needed climate-controlled facilities should be constructed before BESS including the battery cells arrive on site as well. BESS module staging during construction shall be separated to limit fire propagation between units consistent with final placement analysis. Laydown area vegetation height should be managed to reduce wildfire potential.

3.0 EQUIPMENT REQUIREMENTS

3.1 General BESS Requirements

3.1.1 Mechanical Design

All mechanical design shall be in accordance with the International Mechanical Code and the International Fire Code, the additional documents incorporated by reference and the additional requirements herein. All mechanical design shall be performed by or done under the direction of a Professional Engineer registered in the state. All Life Safety requirements shall meet all national, state, and local codes, as well as agree with the local Authority Having Jurisdiction.

In accordance with State and Local Laws, all final (Issued for Construction) drawings, specifications, and calculations shall be wet stamped by a Registered Mechanical Engineer in the state where the project is located.

The BESS components shall be fully contained in weatherproof, environmentally conditioned enclosures or building. The BESS shall have complete and failsafe battery and PCS thermal management systems.

Seller shall provide heating, ventilation and/or space conditioning for the BESS components, as required, to meet the equipment manufacturers' recommendations over the range of site conditions and over the full operating range. Seller shall provide documentation and design calculations supporting the adequacy of the BESS heating, ventilation and/or space conditioning.

Ventilation and space conditioning equipment controls shall be interlocked with the fire protection and if provided suppression systems to operate appropriately in the event of fire.

Ventilation system fans shall be provided with non-return, motor operated dampers. Forced ventilation air streams shall not impinge directly on electrical equipment. Inlet and outlet enclosure dampers shall be of a design that prevents wind driven water and dust intrusion. If required, ventilation systems shall be provided with an interlocked and automatic temperature control system, including appropriate alarming, for each Project building or enclosure.

Space site ambient temperature conditioning as required for the Project enclosure equipment provided shall be provided as complete systems with all accessory items required for proper operation. Consideration shall be given primarily to requirements for efficient conditioning of the installed BESS equipment except in normally occupied areas such as the control room. Normally occupied areas or areas requiring access for local operation shall consider operator comfort in addition to requirements for equipment conditioning. Space air conditioning equipment shall be designed for the loss of one unit without derating of the Project. Where heating or cooling is provided, the equipment shall have a minimum EER, IEER, SEER rating in accordance with the Energy Codes. Space air conditioning shall be provided with an automatic temperature control system, including appropriate alarming, for each Project operational enclosure.

All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified according the international/local standards and regulations. Markings shall reference the same designations called out in the final design drawings.

3.1.2 HVAC / Thermal Management

The Seller shall provide all components to operate the BESS within acceptable operating temperatures of the projects described in Appendix 2. If necessary, provide any thermal management systems and operating strategies required to maintain the BESS and inverter temperatures within manufacturer's recommendations at all times. Cooling systems shall be redundant.

3.1.3 Fire Protection and Suppression

Fire detection and suppression system shall be provided by applicable code or as described in this document for property preservation. Detailed of the fire detection/suppression system to be provided to the owner prior to construction.

The BESS / SCADA shall have a system including current/history of data and alarms. System shall be described in the Seller's proposal and shall include:

- System and alarm status, unit voltages, temperatures, and other necessary system details
    - Trouble notification when preventive maintenance is needed.
    - System level alerts shall be provided by the manufacturer over customer interface.
    - Remote Shutdown capability that shall include:

- Strobe lights and audible alarm – at least one for each of the following:
  - Fire Alarm
  - High Gas Alarm
- Physical panel that is located outside of the fence line at the gate entry that is accessible to emergency responders. Panel shall include contact information for remote operations facility.
- Fire alarm control panel
- Electrical remote shutdown for associated equipment on site to be safely shutdown during emergency situations.

The BESS shall include:

- Protective relays.
- Circuit breakers 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.
- Battery cell thermal runaway detection including testing performed and mitigation methods used in the BESS will be included in the submittal process.
- A visible and lockable via padlock disconnect will be installed that isolates BESS in accordance with utility interconnection requirements.

Seller shall develop posted instructions for tasks that site staff and local fire department may need to perform, such as system shutdown during an emergency.

The major equipment items shall include a battery, four-quadrant bi-directional PCS, MV step-up transformer, and local, remote control/monitoring equipment, container cooling system, and integrated explosion protection systems. Additional equipment shall include battery monitoring system (BMS), rack management system (RMS, if applicable), Energy Management System (EMS) harmonic filters, HVAC system, fire suppression system, auxiliary cooling systems, wiring, connectors, protective devices, grounding, junction boxes, enclosures, instrumentation, and all other items needed for a fully functional, utility-interactive BESS, installed to meet the requirements set forth in this Technical Specification.

The standby power of the BESS should be compliance with NFPA 855.

The BESS shall be designed to produce low-cost power capacity, with low-cost energy storage as a significant secondary factor. Costs include initial cost as well as overall BESS efficiency, cell life, disposal and replacement cost, maintenance costs and other contributors to life-cycle energy cost. The BESS shall also be designed to have high reliability, Design Life as listed in Appendix 2, Table 1, and designed for unattended operation with 24-hour remote monitoring and control by Operator in addition to Owner's SCADA system.

The BESS shall be "Utility Grade." This means that all equipment shall be expected to last through the Design Life with only typical routine maintenance and planned consumable goods.

3.1.1 BESS Performance Requirements

The overall objective of this Project is to meet the use cases called out in Appendix 2, Table 1 and optimize the priority of the system operation for revenue and grid requirements as shown in Appendix 2.

3.1.2 BESS Augmentation

Seller will manage augmentation needs to account for degradation. Seller shall prepare a strategy for future augmentation, including the following requirements:

Current and future design must allow for future augmentations in proposed site layouts and electrical designs for purposes of developing firm cost proposals. This includes allowing for additional site area that may be required and allowing for additional MV circuits to be connected into the substation switchgear as examples.

Augmentation plan shall also account for obsolescence of products and provide solution with available technology.

Seller will manage augmentation needs to account for degradation. Seller shall prepare a strategy for future augmentation, including the requirements specified in Appendix 2.

DC augmentation will not be accepted.

3.2 Battery Energy Storage System (BESS)

The Battery Energy Storage System scope of supply is specified in Appendix 6 – Division of Responsibility (DOR).

3.2.1 BESS Enclosure

A BESS Enclosure, if utilized, shall be one of the following three options:

1. ISO Container
2. Special Built Enclosure
3. Building

All options require the exterior of the structure to be built to a bullet resistant standard of UL 752 Level 4.

Battery enclosures or structures shall comply with the guidance of NFPA-855 with the following special requirements apply to each enclosure type.

Enclosure and/or enclosure assets shall be no more than the lesser of fifty-percent total capacity or 20.0 MWh capacity will be lost due to an event.

- Container shall be constructed per International Standard ISO 1496-1 or similar standards.
- Access to the batteries modules shall be from external swing doors.
- Hydrogen, Li-ion Tamer, or similar UL listed early off gas detection shall be included
- Fire detection per NFPA-72
- HVAC shall go into purge mode on receipt of early off gas detection.
- Container environmental sample tube routed to exterior of container for FD air sampling.
- Deflagration vents to exterior sized for structure integrity
- Provide a manual open head sprinkler typical of NFPA 13 riser(s) internal the container, supplied by a dry FDC connection exterior the container. No releasing or alarm hardware required.

<u>Special Built Enclosure no more than 10 MWh in size</u>

- Access to the batteries modules shall be from external swing doors.

- Hydrogen, Li-ion Tamer, or similar UL listed early off gas detection shall be included
- Fire detection per NFPA-72
- Deflagration vents to exterior sized for structure integrity
- HVAC shall go into purge mode on receipt of early off gas detection
- Container environmental sample tube routed to exterior of container for FD air sampling.
- Provide a manual closed head sprinkler typical of NFPA 13 riser(s) internal the container, supplied by a dry FDC connection exterior the container. No releasing or alarm hardware required.

Building

- The building is expected to be Tilt-Up style on a pre-stressed slab floor
- Two hour fire walls shall separate the energy storage system into no more than the lesser of fifty-percent total capacity or 20.0 MWh capacity will be lost due to an event.
- Deflagration vents to exterior sized for structure integrity
- Compartment environmental sample tube routed to exterior of container for FD air sampling.
- Hydrogen, Li-ion Tamer, or similar UL listed early off gas detection shall be included
- Fire Detection per NFPA-72 HVAC shall go into purge mode on receipt of early off gas detection
- NFPA 13 or NFPA 15 automatic suppression shall be provided in each fire zone. An acceptable water supply shall be provided.

3.2.2 Building Design

Structural Framing:

Design primary and secondary structural members and exterior covering materials for applicable loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practice Manual" Structural Steel: For design of structural steel members, comply with the requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

Light Gauge Steel: For design of light gauge steel members, comply with requirements of the American Iron and Steel Institute's (AISI) "Specifications for the Design of Cold Formed Steel Structural Members" and "Design of Light Gauge Steel Diaphragms" for design requirements and allowable stresses.

Welded Connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for Welding procedures.

Basic Design Loads:

All loads shall be based on the site-specific conditions and latest IBC, ASCE 7, state, and local codes.

All structures on the Site need to be designed using environmental loads as specified in the American Society of Civil Engineers (ASCE) 7 code book Minimum Design Loads for Buildings and Other Structures and the applicable state building code if more stringent requirements. These include wind loads, snow loads, rain loads, ice loads, and earthquake loads. Each structure on Site shall be grouped in Risk Category III as defined in ASCE 7. The corresponding importance factor shall be used for each load determination.

Live Load shall be based be in accordance with IBC and the state local code.

Auxiliary Loads:

Include dynamic live loads such as those generated by suspended ceilings, sprinkler systems, electrical or mechanical systems or any suspended HVAC units, and exterior frames and doors.

Design:

Each member shall be designed to withstand stresses resulting from the combination of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual".

Table 2 — Site Dimensions

A	Fence line to Battery	100 ft	Minimum distance or must maintain distance so that <1psi shall be felt at fence on explosion
B	Distance between BESS units or other equipment	20 ft	Minimum Distance required between BESS units unless an NFPA 80A exposure protection Thermal Flux Calculation demonstrates acceptable separation with no fire service intervention.

3.2.3 Shipping Container or Metal Enclosure

If containers are proposed, it shall be in accordance with the International Standard ISO 1496-1 or similar standards.

3.2.4 BESS Operation Requirements

Seller shall specify, for the type of battery proposed, the method used to determine the point where further discharge or charge is no longer practical or safe. Examples of common methods to identify above are discharge cutoff voltage or the maximum amp-hour capacity that can be reliably discharged. Throughout this Technical Specification, the term discharge limit shall be used to mean Seller specified methodology.

The BESS operating functions shall be programmed in a programming language defined by the owner in Appendix 2 and made available to Owner so that software modifications can be made, or new functions can be added if the need arises at some point in the future. Any required supporting software such as compilers and linkers shall also be made available to Owner.

The operating functions described below will be limited and confirmed with the battery vendor by the charge and discharge limit to prevent damage to the battery. Termination of any operating scenario by the discharge limit, without reaching rated capacity discharge, will be deemed a failure for the purposes of calculating availability.

The following sections discuss common inverter control functions that shall be implemented in the BESS as part of the local and remote automatic BESS controls.

3.2.5 Real Power Controls

- Direct Charge/Discharge Storage – This is a basic function that can be used to discharge or recharge the BESS to a specified state of charge (SOC) and at a specified rate.
- No-Grid-Charging Mode – System should accommodate programming times and conditions under which grid charging will not be active.

- RPS: Real Power Smoothing – This is a real power control mode function for the BESS that could monitor the potential hybrid renewable energy plant real time power output for fluctuations. Although this functionality is a lesser priority, the BESS should be capable of responding to smooth out the renewable systems fluctuations and mitigate any power quality issues due to renewable systems output variability. The BESS response shall be capable of smoothing the net power output from the combined renewable systems and BESS while also preserving the BESS available stored energy.

3.2.6 Reactive Power Controls

If reactive power is for the Facility, it will be based on the point of interconnection agreement and the BESS services agreement identified by Entergy Transmission. Below are examples of what may be required under this section:

- Direct Voltage Control – In this function the BESS shall output VARs to control the POI voltage to a specified setpoint voltage and a specified droop, and with a specified maximum and minimum kVAR range which shall not be exceeded. The BESS shall be normally operated with voltage control enabled.
- Watt-Var Function – In this function the BESS shall actively control its reactive power output as a function of the real power output. The reactive power output follows a user defined Watt-Var or P-Q curve. The Watt-Var curve is a piece-wise linear user defined curve entered as X,Y point pairs where the x-axis is the power output and the y-axis is the corresponding VAR output.
- Function CV: Constant VARs – This function allows the BESS to produce a constant VAR output at a specified level.
- Fixed Power Factor Function – This function allows the BESS to produce or absorb power with a user entered constant power factor. The power factor range is +/- 0.00 to 1.00.
- Watt Power Factor Function – In this function the BESS actively controls the BESS power factor as a function of the real power output of the BESS. This function utilizes a piece-wise linear curve defined by X, Y point pairs, to determine the power factor of the BESS output at any BESS real power output.

3.2.7 Miscellaneous and Support Functions

- Scheduling Function – This function is used to perform the real and reactive control functions via a time-based schedule and/or a load-based schedule. The Schedule function can define when different X-Y curves become active and what the ramp rate will be when transitioning between scheduled functions. When more than one function is active for Real Power or Reactive Power control then the schedule shall define a priority order for the functions.
- Event Logging and Reporting Function – this function shall be used to record any protection events triggered by the inverters including but not limited to i.e. over current, over voltage, over temperature, sequence of event reporting (SER), etc.
- Status Monitoring Function – this function shall include voltages, SOC, Inverter Status, Usable Energy, BESS rack and module temperature, Present Operating Mode, Inverter Active and Reactive Power output, power factor, present line frequency, Connect/Disconnect Status, Operating Time, Connected Time, and possibly other BESS information.
- Function Connect/Disconnect – This function shall be implemented by two sets of commands, one being a virtual command and the other being a physical command. The virtual Disconnect command

sets the real and reactive output of the BESS to zero. A physical Disconnect provides galvanic isolation between the inverter and the grid. Additional details regarding Shutdown, Disconnect, and Operate modes are provided in the Sections 3.2.11, 3.2.12, and 3.2.13 below.

- LHVRT Function – This function shall be used to specify the low and high voltage ride through characteristics of the BESS. This function will be used to specify the trip, suspend and normal operation ride through voltage characteristics as per IEEE P1547, and IEEE 2800 protection coordination studies, and Owner policies.
- Local/Remote Mode Function – This function when in Local Mode shall block commands by offsite sources to enable safe local maintenance and diagnostics and provide a means for secure on-site management. This function shall also allow the return to remote control.
- Automatic/Manual Mode – This function shall enable and disable the BESS from performing any of the automated control functions for real and reactive power. When switching from automatic to manual mode the BESS real and reactive outputs shall ramp down to zero at a specified ramp rate.

3.2.8 VAR Support

The BESS may be required to provide VAR support for voltage regulation under steady state and contingency operating conditions as described below. The BESS shall be capable of up to full rated output, when operating within the normal sustained voltage and frequency ranges specified in Appendix 2, or as determined by Seller's system studies. The voltage regulator controls shall not be affected by changes in system frequency. The voltage regulator controls shall include Owner selectable setpoint and droop characteristic and shall be capable of setting by Owner's SCADA system or by a local control interface.

Nothing in this section shall be construed as limiting the ability of the BESS to operate in other modes as described in these Technical Specifications. The VAR output of the BESS may be limited based on remaining inverter capacity used for real power output unless supplemented as described above. The final VAR requirements will be provided to the successful Seller at a later date.

3.2.9 Charging

Seller shall specify charging requirements.

Seller shall design the charging system to ramp up from zero to the maximum capacity at an Owner selectable ramp rate as described elsewhere in these Technical Specifications to avoid shocking the system and allow generation to follow load easily. Seller shall provide a curve showing how demand from Owner's system varies with time throughout the charging cycle. The BESS control system shall allow Owner's dispatcher to initiate remotely Seller-specified/programmed charge cycle. The maximum demand required by the charging cycle shall be Owner selectable but shall not exceed Seller specified charge rate. Seller shall provide data showing how the recharge period varies as maximum demand decreases.

Seller shall also specify restrictions, if any, on operation of the BESS during any portion of the charge cycle. Seller shall provide a curve or table and data showing the state of charge of the battery as a function of time.

Automatic or programmed charge cycles shall be implemented to prevent SOC going below the battery vendor specified SOC limits whenever possible.

3.2.10 Charge Rate

There will be times when the BESS may be directed use overload charging capability (if any) exceeding the normal maximum charging rate for a short duration. Seller shall provide, a curve showing the inherent overload capability (if any) of the proposed BESS as a function of time. It is not a requirement to design specific overload capability into the BESS. Overload charging will not be allowed if the batteries are charged above the Seller specified maximum charge level. When the BESS is nearing the Seller specified maximum charge level, the BESS charging shall ramp down linearly to zero at an Owner selectable ramp rate.

Seller shall provide adequate energy storage capacity and level of charge to accommodate the number of charge/discharge occurrences and total energy requirements described elsewhere in this Technical Specification.

3.2.11 Shutdown

The shutdown state shall be defined as battery DC contactor/breakers and PCS AC breaker open; non-critical power supplies de-energized; control system power may remain energized. This mode includes both normal shutdown and system trips requiring reset.

The control system shall initiate shutdown under the following conditions and remain in the shutdown state until a reset signal, either local or remote, is initiated:

- Emergency trip operation.
- AC circuit breaker trips (either main or PCS breaker) that isolate the BESS.
- Door interlock – initiate shutdown when the door to the PCS is opened. A “defeat” feature shall allow for maintenance. Interlocks shall be self-resetting.
- Smoke/fire alarm.
- Fire Suppression operation.
- Control logic trouble.
- DC ground fault – field adjustable setting.
- Failure to restart from disconnect state after automatic restart attempts.
- Remote disable (no reset required).

3.2.12 Disconnect

The disconnect state shall be defined as balance of plant (BOP) DC contactors/breakers and battery DC contactors/breakers and PCS AC breaker open; non-critical power and control system power energized.

Some faults or failures are expected to be transient in nature. The control system shall open contactors upon fault occurrence and may be manually started-up after an operational Seller determined manual reset or operational procedures agreed upon with the Owner. The control system shall go to the disconnect state under the following conditions:

- Synchronization Error – The PCS is unable to synchronize with the utility grid.
- Grid transient conditions (i.e., line switching or reclosure action).
- Utility voltage out of emergency operating range as defined in this Technical Specification.
- Utility line frequency out of emergency operating range as defined in this Technical Specification (field adjustable in 0.1 Hertz increments).
- Over-temperature on the battery, PCS, controls or other equipment.

- Excess explosive gas level.
- Owner and grid operator requested outages.

3.2.13 Start Operate

The Operate state shall be defined as all contactors/breakers closed and power available to flow to or from the BESS, PCS and transformer system to the utility system. Normal operation shall include all operating scenarios as described herein and discharge and charge modes. It also may include additional modes and sequences deemed necessary by Seller.

3.2.14 Specific Operational Requirements

Seller will indicate any required rest (neither charging nor discharging of the BESS) periods, their duration and what event they must follow or precede.

The BESS shall have appropriate functionality to accept an emergency disconnect input. Once the emergency disconnect is activated, the BESS project must immediately cease operation.

During manual operation of the BESS project, the system must indicate which, if any, autonomous functions are disabled.

Owner may impose rest intervals, such as charging off-peak and discharging on-peak. If no other tasking is done, this will create a rest period between each half cycle. This shall not adversely affect BESS performance and shall be included in capacity calculations. Provide the maximum rest period allowed (days, weeks, months).

If another condition requires special action for a string or the battery bank, describe this condition, how often it occurs, what event triggers the need for it, what it takes to correct it, whether the string/BESS remains available during this period to be approved by the Owner on a case-by-case basis. Examples are some type of reconditioning (holding at 100 percent DOD) or charge equalization (holding at 100 percent SOC).

The cells within a battery module shall either be self-balancing, or their periodic balancing be handled automatically by battery module management electronics. Similarly, the modules within a string shall either be self-balancing or periodic balancing handled automatically by string/bank management electronics.

The BESS SCADA system shall store historic performance data metrics which describe the quality of system performance for each function over the last 168 hours minimum. Seller to ensure interface with Owner to offload reports at an agreed interval. Historical performance data metrics shall be stored for performance analysis and warranties.

The design must include prudent provisions for technology improvement. Battery modules shall allow for upgrade or replacement with higher performance cells to the extent practical. Where such changes are made to a battery module, all modules in that battery string must also be upgraded before the upgraded modules are placed into service.

3.2.15 BESS Long-Term Services Agreement (LTSA)

As a part of their RFP bid response, Developer is required to propose a Long-Term Service Agreement (LTSA) for the BESS equipment provided for the Project.

Whether Developer is awarded the LTSA contract or not, the BESS will require 24-hour control and oversight. All equipment warranties shall be negotiated so that they can be assigned to Owner upon project acceptance. LTSA shall provide for the following guarantees:

- Energy
- Capacity
- Availability
- RTE

If part of the O&M agreement, a detailed annual report shall be provided by the Developer every year with the first one dated one year after of the commercial date of operations including the degradation of the BESS for the commercial date prior. This report shall be used for commercial and warrantee purposes during the operational phase.

3.3 Power Conversion System (PCS)

The PCS is the interface between the DC battery system and the AC system and provides for charging and discharging of the battery and may consist of one or more parallel units.

The PCS scope of supply is specified in Appendix 6 – Division of Responsibility (DOR).

3.3.1 PCS Requirements

The PCS shall be a smart static device (charger and inverter) using solid-state electronic switch arrays in a self-commutated circuit topology. Line-commutated systems or systems that require the presence of utility voltage or current to develop an AC output are not acceptable.

The PCS, in conjunction with the BESS Master Controller, shall be capable of completely automatic unattended operation, including self-protection, synchronizing and paralleling with the utility, and disconnect functions.

The control of the PCS shall be integrated with the overall BESS Master Controller. A proven and established combined instrumentation and control system shall be provided for the BESS SCADA System. Each SCADA system shall feed into a central controller that shall be the primary interface with the Owner's controls and shall be compatible with the utility's existing SCADA system.

The PCS also shall include all necessary self-protective features and self-diagnostic features to protect itself from damage in the event of component failure or from parameters beyond safe range due to internal or external causes. The self-protective features shall not allow the PCS to be operated in a manner that may be unsafe or damaging.

Therefore, Seller shall design the PCS, including its controls, power supplies and connections to sensors, to be from utility system voltage and/or frequency transients and similar events. Further, the PCS shall be capable of operating continuously at rated output under the normal voltage and frequency ranges and providing full output for the required operating modes specified.

All PCS components shall be designed to withstand the stresses associated with steady state operation, transient operation and overload conditions as implied by this Technical Specification. Seller shall be responsible to demonstrate that all relevant aspects of overvoltage stresses have been considered.

The PCS shall have provisions to prevent moisture condensation and entrance of rodents, insects, and/or similar material into air intake/exhaust ports or any required structure penetration.

The PCS system shall include provisions for disconnection on both the AC and DC terminal, for maintenance work. It is preferred that conductor separation must be clearly visible. These disconnects shall be capable of being

locked open for maintenance work. PCS capacitors shall be provided with bleeder resistors or other such means of discharging capacitors to less than 50 V within one minute of de-energization.

An interlock system shall be provided for access to the PCS or enclosures if live parts are exposed when opened. A disconnect switch or draw-out breaker and grounding devices shall be provided for maintenance of the PCS equipment. It is preferred that the PCS has a switchgear for disconnect and provide ground connection. The interlock system shall prevent access to the PCS equipment until the AC and DC circuit breakers or disconnect switches are open and the PCS bus is grounded.

3.3.2 Interference and Harmonic Suppression

The PCS shall not produce Electromagnetic Interference that will cause interference with instrumentation, communication, or similar electronic equipment within the Project or on Owner's system. The PCS shall be designed in accordance with the applicable IEEE standards to suppress Electromagnetic Interference effects.

The BESS must meet the harmonic specifications of IEEE 519 and Owner's power quality standards. Harmonic suppression may be included with the PCS or at the Project AC system level. However, Seller shall design the Project electrical system to preclude unacceptable harmonic levels in the Project auxiliary power system.

Seller shall perform studies to determine required AC harmonic filter types and ratings if filters are required to meet the harmonic specifications. In addition, these studies shall be used to demonstrate that the AC filters do not cause any resonance with Owner's power system and that the harmonic distortion limits can be met by the filters designed by Seller. Seller shall design the Project to be completely compatible with and their associated controls. Owner will not be required to change or modify the existing system to accommodate the Project. However, actual compliance will be based on field measurements after commissioning.

3.3.3 PCS Cooling System

The purpose of the PCS cooling system is to remove the heat produced by the PCS operation and transfer this heat to the outside ambient air or to be used as auxiliary heat for the building or enclosures as appropriate.

Either water cooled or air-cooled systems are allowed. However, the final rejection of waste heat shall be to the outside ambient air. No discharge of cooling system water shall be allowed. Seller shall provide the failure rates of a year related to the cooling system.

The cooling circuit for water cooling systems shall be a closed loop de-ionized water or water/glycol mixture recirculating system. If a water/glycol system is proposed, Seller shall prepare a Spill Prevention Control and Countermeasures plan and provide secondary containment for accidental discharges of the mixture.

The high purity (high resistivity) water (if used) in the closed loop system shall be circulated through the heat producing electrical equipment at a constant flow rate. A purifying loop to maintain the high purity in the closed system shall be provided. Freeze prevention equipment / plan shall be provided by Seller.

Non-recirculating (once-through) or recirculating air systems may be proposed, depending on the requirements of the PCS selected by Seller. If a recirculated air system is used, a heat exchanger shall be provided. If a non-recirculated (once-through) air system is used, a two-stage air filtering system shall be provided. The air handling systems shall include filtering which is adequate to keep dust from the interior of the PCS system.

Seller is encouraged to provide the most efficient HVAC systems, including auxiliary heat recovery subsystems

3.4 Medium Voltage Step-Up Transformers

If not provided by the OEM, the Contractor shall provide Medium Voltage Transformers per the following requirements.

Transformers shall meet transformer efficiency standards. A transformer shall be provided by the MV Step-Up Voltage to match POI transmission voltage with the secondary voltage of the PCS.

The transformer may be configured with any specified winding configuration. If a grounding transformer is required due to the provided step- up transformer design, the grounding transformer shall be designed, provided, and installed by the Contractor.

Transformers shall be rated for 115% of the inverter source operation and the environment in which they will operate. The transformer shall be supplied with a no-load tap changer with high voltage taps capable of operating at 2.5 and 5 percent above and below nominal voltage at full rating. The transformer shall be supplied with a disconnect switch on the transformer high-voltage side to isolate the transformer once de-energized. Transformer shall have in the high side voltage a disconnect switch with fuses or switchgear. It is preferred to have a switchgear for disconnect and provide ground connection. The switch/transformer configuration shall be designed for loop feed. Transformers shall be either dry-type, or oil filled, FR3 or equivalent is not acceptable. Enclosure finish shall be a top powder coat that is designed for a 40-year service life. Owner shall reserve the right to attend factory witness testing of step-up transformers.

The transformer may be used to aid in harmonic cancellation. If the transformers are a liquid-filled type, PCBs shall not be used. Contractor shall provide a SPCC if transformers are liquid-filled type.

If the Project is a Special-built enclosure or building enclosed project, the EPC Contractor shall be responsible to account for the thermal loading design of the Medium Step-Up Transformers.

3.5 Power Plant Controller & BESS SCADA

The Owner and Contractor scope of supply shall generally include design, supply, and installation of, but not limited to, the following:

Table 3 — Power Plant Controller & SCADA Scope of Supply

SR. NO.	**SCOPE OF DESIGN, SUPPLY, AND INSTALLATION** Contractor shall install all equipment provided (unless otherwise noted).
1	Contractor to provide a redundant fiber-based network connecting all the inverters, battery management systems, energy management system, power plant controller, and safety systems.
2	Contractor to provide SCADA enclosures to integrate the inverters, battery management systems, energy management system, power plant controller and safety systems. Contractor to develop communication system single line and network block diagram.
3	Contractor to provide communication rack layout, including BOM and elevation drawings. Project to have redundant SCADA system with primary and secondary switches and connections.
4	Contractor to furnish appropriate SCADA, communications, wiring, fiber, and splice details.

SR. NO.	**SCOPE OF DESIGN, SUPPLY, AND INSTALLATION** Contractor shall install all equipment provided (unless otherwise noted).
5	Contractor to provide field installed SCADA communication panels at each inverter with layer 2,3 looped switch and fiber patch panel in a National Electrical Manufacturers Association (NEMA) 4X enclosure.
6	Owner controlled fiber to the site (i.e., ATT fiber which the Owner is the account owner of). Temporary cellular connection to support commissioning activities may be required by Contractor.
7	Owner to provide the fiber from the Owner network at the POI to the BESS SCADA shall be 96-strand, single mode, meeting Telecommunications Industry Association (TIA) 568.3-E. The fiber loop from the BESS SCADA to the BESS Assets shall be a minimum of 12 strand single mode, meeting Telecommunications Industry Association (TIA) 568.3-E
9	The Contractor provided SCADA System controller shall provide 20% spare hardware capacity input/output (I/O).
10	The Contractor shall provide all fiber optic cable shall contain at minimum 20% spare pairs for future use.
11	Contractor shall land the Owner controlled fiber (i.e., ATT) on an Owner supplied and installed firewall (Palo Alto or CheckPoint are acceptable firewalls) • Owner to supply and install a firewall managed Level II switch with 3 VLANs configured (Owner to supply subnet information) • The 3 VLANs consist of the following o Collector Substation o BESS Yard (Physical Site Security) o Power Plant Controller • Contractor to work with Entergy's Information Technology group in configuring the firewall using allow by exemption principle and opening only ports and protocols necessary for required functionality • Configure VLAN Access Control Lists to manage routing for only necessary functions
12	Contractor to provide redundant core switches (IE4010 switch or similar) and connect to upstream SM SFPs.
13	Contractor to provide fiber patch panels
14	Contractor to provide 42U server rack
15	Contractor to provide the UPS (uninterruptible power supply) system shall provide for 72 hr. back-up.
16	Contractor to provide miscellaneous fiber, ethernet jumpers, and cable management
17	Contractor shall configure the SCADA system for access credentials
18	Contractor supplies and configures a Power Plant Controller

SR. NO.	**SCOPE OF DESIGN, SUPPLY, AND INSTALLATION** Contractor shall install all equipment provided (unless otherwise noted).
	Power Plant Controller shall be configured to support the use cases in conformance to Appendix 2. A narrative of the control configuration shall be supplied.
19	Contractor shall supply and configure the plant's SCADA system. Details of the same are mentioned in subsequent clauses.
20	Contractor supplies IT rack for Owner's exclusive use: • 19" rack with 24"x36" footprint • Front and back lockable mesh doors and cable entry slots in roof • 36" front clearance and 24" rear clearance Dual 120 V_{ac} UPS backed power strip with UPS ethernet monitoring capability, with UPS capable of 72 hours of backup run-time
21	Contractor shall provide all cables and shall be labeled on both termination ends with "from" and "to" designations including port or terminal numbers. Cable labels shall be self-laminating vinyl wraps or zip tied. Flat labels wrapped around a cable are not acceptable.
22	If PV solar panels are included in scope of Project, Contractor shall supply a solar array irradiance meter for the Power Plant Controller to utilize to determine if and when a blue-sky day appears so that it can come out of hibernation, black start, form the grid, and bring up the grid following inverters at the existing PV site 5 minutes later (there is a 300 second built in delay in the inverters coming on line following a grid outage)
23	Contractor shall supply a fully functional Power Plant Controller and BESS SCADA System that meets all requirements herein.

The below criteria and requirements apply to transmission connected Project.

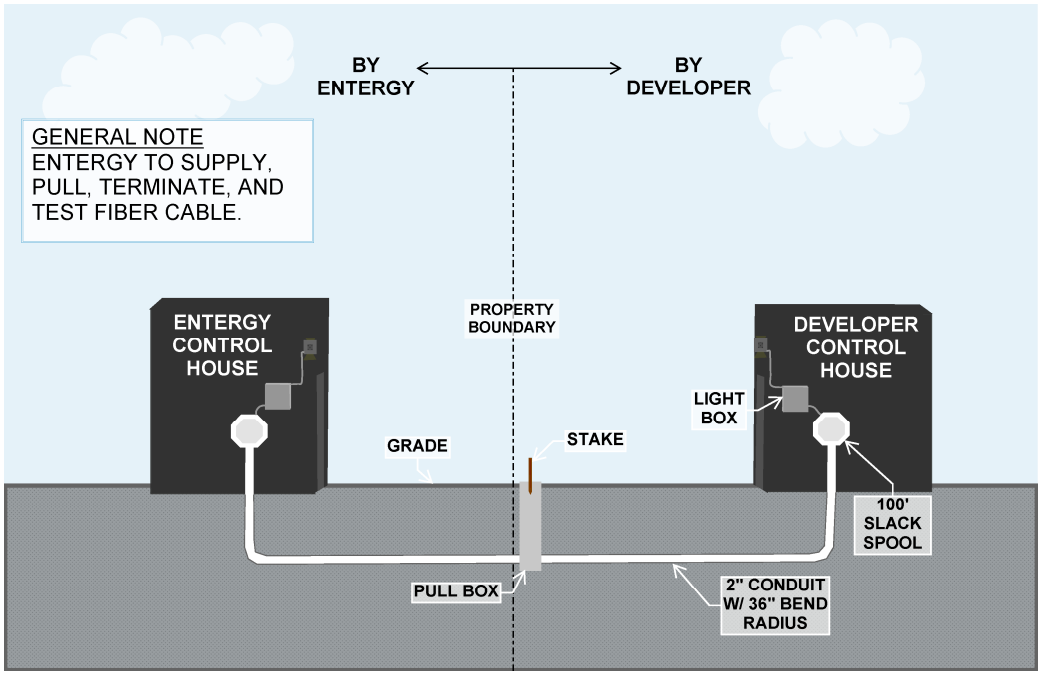
The below description is provided for information and reference only for Contractor to understand the overall design concept for the Power Plant Controller. Contractor scope of supply to incorporate these requirements as applicable to equipment furnished by Owner under these specifications

For the fiber between the Entergy network at POI to the BESS SCADA as called out in SR. No. 7 above:

- If the distance from the Entergy interconnecting substation to the Collector Substation <~1000' and Owner owns the property rights, then: (refer to Figure 3)
  - Underground the fiber
  - Owner supplied fiberoptic cable shall be underground rated
  - ADSS fiber to be pulled in microduct/conduit
  - Demarcation point between Owner/Contractor installed microduct/conduit from Control House and Owner's installed innerduct/conduit is a Contractor installed pull box or similar at a mutually agreed to point, typically at or the near the property boundary, between the interconnect substation and Control House (often initially marked as a stake in the ground) – refer to Figure 1 below

- Innerduct/Conduit shall be conduit or microduct (e.g., 2” PEX) with a minimum 2” diameter and 36” bend radius
- Contractor to install lightbox and 100 ft slack spool and associated innerduct/conduit in the Collector Substation
- Owner will supply and terminate fiber on both ends

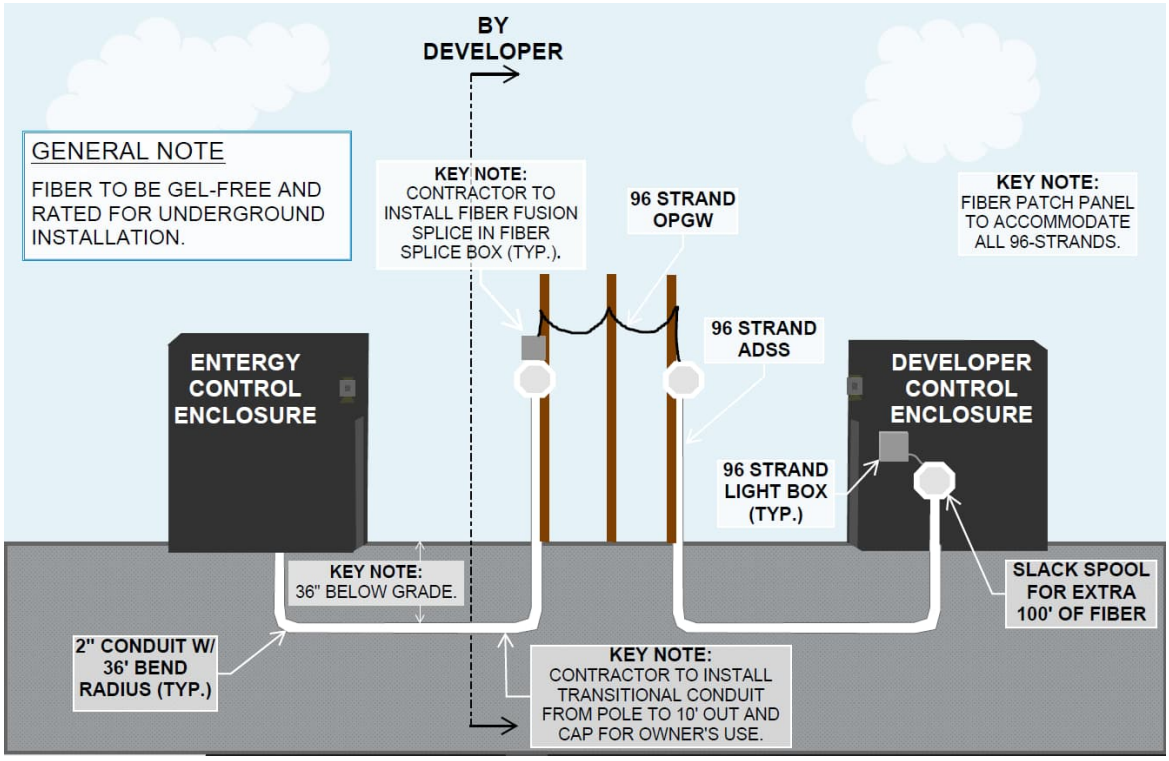
FIGURE 1 - SCADA CONNECTION LESS THAN 1,000 FT



- If the distance from the Owner interconnecting substation to the BESS SCADA >~1000’, OR if <~1000 and Entergy does not own property rights, then (refer to Figure 2):
  - Contractor to install 96-strand OPGW fiber and associated fiber splice box on pole to transition to underground to the Control House, including all fiber fusions in the splice box as required.
  - Contractor furnished fiberoptic cable shall be underground rated (from existing control house to dead end pole)
  - Contractor fiber shall OTDR reel test at 1550 nm and results provided to Owner in .SOR format
  - OPGW fiber shall be installed at a height >15’ on structures
  - At all splice locations, a 100’ plus height above ground level reel of fiber shall be installed on a Contractor supplied and installed coil bracket
  - Between the final structure and the Control House lightbox, Contractor to supply and install innerduct/conduit and associated ADSS fiber
  - Contractor to terminate ADSS fiber with Control House
  - Contractor to leave 100’ of fiber and slack spool on an Owner supplied and installed coil bracket within the Control House
  - Microduct/Schedule 40 PVC conduit with a minimum 2” diameter with 36” bend radius

- For purpose of developing a project, the Contractor can assume the following:
  - Demarcation point between Owner/Contractor installed Innerduct/conduit from the first structure and Buyer's installed innerduct/conduit is a Contractor installed splice box or similar at a mutually agreed to point, typically at or the near the property boundary, between the interconnect substation and first structure Control House (often initially marked as a stake in the ground)
  - Contractor to supply and install a splice box on the first structure.
  - Owner will supply and terminate fiber on both ends.
  - Owner to perform OTDR on all splices with no losses greater than 0.10 dB allowed.

Figure 2 - SCADA connection greater than 1,000 ft



4.0 DESIGN REQUIREMENTS

4.1 Civil/Structural Requirements

The Project civil and structural facilities provided by Contractor shall be designed in conformance with the requirements specified herein.

All structures on the Site shall be designed using environmental loads as specified in the American Society of Civil Engineers (ASCE) 7 code book *Minimum Design Loads for Buildings and Other Structures* and the applicable state building code if more stringent requirements. These include wind loads (Chapter 6), snow loads (Chapter 7), rain loads (Chapter 8), ice loads (Chapter 10), and earthquake loads (Chapter 11). Each structure on Site shall

be grouped in Occupancy Category III as defined in ASCE 7. The corresponding importance factor shall be used for each load calculation.

Contractor shall design all systems and site improvements in accordance with applicable codes and standards. Contractor shall design necessary road improvements to meet state and local transportation codes and meet or exceed requirements presented by construction equipment, delivery vehicles, and operation and maintenance traffic. All BESS equipment, building or enclosure foundations and structures shall be engineered by or under the direct supervision of a qualified professional engineer or architect registered in the state of the project as applicable. All final (Issued for Construction) drawings, specifications and calculations shall be wet stamped by Civil/Structural Engineer or Architect registered in the state of the project as applicable. All stormwater calculations and design documents shall be overseen, signed, and sealed by a Civil Engineer or Landscape Architect familiar with local codes and requirements, and registered in the state or jurisdiction of the project. All design shall be in accordance with seismic design requirements as specified elsewhere in this Technical Specification, and by the Contractor provided geotechnical study.

Contractor shall gain access to the site from existing public and private roads. Existing roads shall not be blocked or restricted without prior approval of Owner and local agencies. Contractor shall be responsible for damage to public roadways resulting from the work performed. Contractor shall also be responsible for the facilities access road's preparation/interconnection with the main road.

Contractor shall perform required Site preparation, to include earthworks, SWPPP, and erosion control. Contractor shall attempt to minimize earthwork and vegetation disruption for the installation of the Project to the extent it is compliant with the use permits; however, vegetation should be controlled to minimize fire danger and provide the ability to operate and maintain the Project. Any land contours that may affect BESS electrical generation should be included in the BESS system performance estimate. If required, Contractor shall import engineered fill to slope the Site and prevent accumulation of standing water. Any direct burial cabling shall be protected with adequate bedding materials to ensure long-term cable integrity. Dust control shall be maintained in accordance with state and local requirements until Final Acceptance is achieved. Contractor shall provide other Site maintenance as needed during construction. Any chemicals used for dust control during construction shall be approved by Owner.

Existing structures and utilities that are adjacent to or within the limits of the Project area shall be protected against damage. Contractor shall be fully responsible to Owner or other property owners for all repairs in the event of removal or damage of any existing structure, equipment or systems that are intended to remain in place.

4.1.1 Geotechnical Analysis and Hydrology Report

A geotechnical analysis shall be provided by Contractor and performed by a qualified geotechnical engineering firm. The required number of boreholes and location shall be determined by the engineer to meet design requirement an engineering firm shall prepare a hydrology report. The results of the analysis shall be used when designing the foundations for the structures on the Site.

In addition to the above minimum requirements, local jurisdictional regulations may require site specific hydrologic and infiltration testing. Contractor should determine specific requirements and coordinate with geotechnical engineering firm to obtain any required testing information, related to proposed stormwater management facility designs.

A detailed report shall be provided outlining the tasks performed and the results of the testing. Included in the report should be any recommendations for the foundation designs, structural support designs, corrosion protection for both underground steel and concrete, pile drive frequency, minimum pile size, and any geologic conditions that may prevent the development of the Project. Geotechnical report shall include recommendation of type of cement to be used based of the sulfate content to meet concrete durability and design life of foundations.

4.1.2 Excavation

Contractor shall perform all common and deep excavation necessary for installation of all foundations and utilities. All excavation shall be in accordance with OSHA regulations. Excavation spoils shall be the Contractor's responsibility and may be used for backfilling or embankment if suitable, per ASTM D 2487 for this application. Unsuitable or excess excavated material shall be properly disposed of.

Contractor shall verify that earth materials exposed in excavations are consistent with those assumed for Contractor's foundation designs. If earth materials are different than assumed for foundation design, Contractor shall modify the design and/or treat the earth material (over excavate, replace, etc.) as necessary to provide foundation meeting design requirements including frost depth.

Contractor should be familiar with type of soil by review the geotechnical report and boring logs, it's the responsibility of Contractor to determine the most efficient method to excavate considering the project schedule.

Contractor shall be responsible for making all excavations in a safe manner and consistent with the requirements of the Occupational Safety and Health Administration.

Contractor shall provide adequate measures to retain excavation side slopes to ensure that structures, equipment, and persons working in or near the excavation are protected.

Contractor shall protect all above grade and below grade utilities. Protect below grade liquid systems from frost.

4.1.3 Construction Surveying

Contractor shall furnish all labor, equipment, material, and services to perform all surveying and staking essential for the completion of the Project in conformance with the plans and specifications. Surveying shall include but not limited to Arial, Topographic, and subsurface utility engineering (SUE level B and A). Contractor shall locate or have located all underground utilities within the area of work prior to excavating.

Contractor shall have necessary entities to locate all underground and overhead facilities at site. This will include sewer, irrigation, water, gas, electric, and communication that will be in direct conflict with the works. No compensation to be paid for locating of these utilities or any associated delays results from relocation works.

Contractor shall retain qualified survey crews knowledgeable in proper and up-to-date survey techniques and shall use these qualified survey crews when conducting the survey. Such crews shall be under the supervision of a Professional Land Surveyor registered in the state or jurisdiction of the project.

Surveying crew shall establish a permanent benchmark at the project to be used as basis to perform current and future surveying activities.

4.1.4 Fills

Earth fill material adjacent to and below structures shall conform to Contractor's design requirements for the structure. Contractor prepared specifications and drawings shall indicate the types of soil to use for fills, compaction, and compaction testing requirements. These same requirements apply to access roads to the Project site.

Samples of Fill material shall be tested and classified, if the fill material meets requirement, then the fill material shall be tested in accordance to determine "Max. Density – optimum moisture test" for compaction requirement.

Fill shall be placed as uniformly as possible on all sides of structural units. Fill placed against green concrete or retaining walls shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly.

4.1.5 Equipment Pads

All equipment pads shall be located such that adequate personnel access is provided to such equipment. A minimum of 4.0 feet (or 1.5 meters) horizontal clearance from obstructions that would otherwise limit access to the equipment on the pad shall be provided around all equipment pads. The pads shall be sized sufficiently to allow safety and adequate working space around the equipment. The inverter stations, switchgear, substation (if applicable), and other buildings shall be elevated 12 inches above the 100-year flood and the 24-hour design basis rainfall inundation level. The slope of the earthwork around the inverter stations and other equipment shall allow safe and ergonomic access to the equipment and provide for adequate drainage and maintenance. Above ground electrical equipment, including transformers, inverters, and BESS building or enclosures will be protected with bollards painted yellow.

Contractor shall provide reinforced concrete or pile-driven foundations for all BESS equipment, including but not limited to:

- BESS enclosures
- PCS
- MV Transformers
- MV switchgear
- Auxiliary Transformers
- LV distribution panels
- ERP – Emergency Response Panel

All equipment shall be on foundations twelve-inch (12”) freeboard above the 100-year, 24-hour rainfall event.

BESS site shall be lime or Geotech stabilized with minimum 4’ deep rock.

4.1.6 Foundations and Concrete Work

All foundations and supports must be designed in accordance with the applicable state building code using the calculated environmental loads discussed above and soil properties provided in the geotechnical report. All foundations and supports must be designed according to the civil/structural design criteria to meet all loads combinations and over-load factor of safety. In addition, all placed concrete shall at a minimum comply with ACI 301 and ACI 117 publications. Form materials and required steel reinforcement shall comply with local regulations and site specifications. At a minimum, reinforcing bars shall comply with ASTM A 615 or ASTM A 706 for Low-Alloy-Steel Reinforcing bars.

Concrete work shall, as a minimum, be designed, specified, and installed in accordance with applicable ACI requirements. Reinforced concrete structures and foundations shall be designed in accordance with the applicable provisions of ACI 318, "Building Code Requirements for Reinforced Concrete." Concrete work shall conform to the requirements of ACI 301, Specifications for Structural Concrete.

Concrete mix design shall be submitted for engineering review/approval prior to any concrete works per project specifications. All concrete works shall be tested before pouring concrete for temperature, slump, and air content. Samples shall be collected and tested for concrete strength test by qualified testing laboratories.

4.1.7 Electrical Duct Banks

Contractor shall provide raceways for all below grade cable in conduits or duct banks (use of direct buried cabling is prohibited).

4.1.8 Corrosion Protection

Corrosion protection shall be utilized on the structures of the Project. The type and amount shall depend on the selected materials of construction and conditions at the Site. A study of these conditions along with recommendations from the geotechnical report shall be used to design the corrosion protection.

The corrosion protection provided by the Contractor shall apply the following criteria and requirements.

- Estimate the corrosion rates of buried ferrous structures in the soil using a similitude analysis.
- Foundation design life is the same as the Plant design life.
- Use the corrosion database compiled by Melvin Romanoff in the National Institute of Standards and Technology (formerly National Bureau of Standards, NBS) Circular 579 entitled Underground Corrosion. This procedure requires some corrosion knowledge and experience and shall only be performed by a Corrosion Engineer.
- The procedure shall include performing onsite resistivity testing and conducting laboratory analyses on soil samples collected from the site. Seller shall ensure the number and type of soil samples is representative of the overall project site and accounts for the areas with most aggressive exposure. A minimum of 1 resistivity test shall be performed on site per 25 acres. Perform laboratory testing per the following standards: saturated electrical resistivity values per AWWA G187, pH per AWWA G51, and chloride and sulfate concentrations per ASTM D4327. Report the results.
- A soil in the corrosion database shall be selected that most closely matches the worst-case onsite parameters in the soil samples. It may be necessary to select two or more soil samples based on site heterogeneity. Select the sample(s) with special emphasis on the following parameters:
    - Lowest electrical resistivity
    - Lowest pH
    - Highest concentration of chloride ions
    - Highest concentration of sulfate ions
    - Geographic location
    - Site drainage conditions
- Use the corrosion database to estimate the uniform corrosion rates after selecting the soil sample(s). If multiple soil samples are selected report the highest corrosion rate amongst the soil samples.
- Report the steel corrosion rate in mils per year (mpy)
- For galvanized steel, estimate the corrosion rate of zinc and steel separately and report in mpy; and
- Utilize a safety factor of 1.5 on the calculated corrosion rate when reporting the corrosion rates.
- Calculate the anticipated section loss of the steel substrate based on the corrosion rate and desired service life. Include this value in the design as the corrosion allowance.
- On galvanized piles subtract the consumption life of the zinc layer from the structure design life and calculate the steel corrosion rate on the remaining years.
- Consider the structure geometry to determine if the corrosion progresses from one side or both sides. For example, for an H-beam section, multiply the corrosion rates by 2 to account for corrosion progression occurring form both sides of steel surfaces exposed to soil (referred to as “two-sided” corrosion rates). The corrosion rate for hermetically sealed pipe piling where only the outer steel surfaces is exposed to soil is “single-sided” and do not need to be multiplied by 2.
- The localized corrosion rates listed in the corrosion database can be disregarded unless pitting and localized corrosion penetration could either compromise the structure integrity during the service life of the structure or alter the estimated corrosion rate. For example, a through-wall pit in a pipe pile would cease to be hermetically sealed and a single-sided corrosion rate would not be appropriate.

- There are other corrosion mechanisms such as galvanic coupling between steel piles and copper grounding, and pH concentration cells between steel piles and concrete pile caps. Either include corrosion allowances for these mechanisms or ensure the design prevents these mechanisms from occurring.
- An alternative method for determining the corrosion rates is to perform Linear Polarization Resistance (LPR) laboratory testing per ASTM G59 or with suitable proprietary instrumentation that integrates the Stern-Geary equation. This method also requires representative soil samples from the project site.
- Ensure that the LPR testing is conducted by a qualified laboratory with a minimum of 5 years of experience performing such tests. Submit documented experience along with proof of up-to-date device calibrations along with the results.
- Report corrosion rates for both steel and zinc in mpy.
- Report initial and steady state corrosion rates.
- If utilizing proprietary instruments additionally report the imbalance, which is a measure of pitting tendency.
- Calculate the anticipated section loss as detailed above.

The Contractor shall provide calculations for galvanization thickness and corrosion allowance steel structures in contact with soil for the stated design life of the plant. The depletion rate for galvanization and steel loss after depletion of galvanization shall be considered constant over the life of the plant using the values developed by Romanoff in “Corrosion of Galvanized Steel in Soils.”

The corrosion protection study shall be performed by a qualified corrosion expert and documented with references and calculations showing that the foundations, supports, racking, fasteners, and conduit shall meet a Design Life in aboveground and belowground conditions, as specified in Appendix 2. If galvanized materials are used, field-applied zinc coatings shall meet American Society for Testing and Materials (ASTM) A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings. This standard contains minimum requirements for the material, surface preparation, and application process. For example, repairs to damage due to vibratory pile driving shall conform to ASTM A780.

It is required that all holes in structural members requiring galvanization shall have the holes drilled before the galvanization is applied. Should holes be drilled in the field, galvanizing shall be applied to the exposed steel as specified in ASTM A780. All field welds shall have a field-applied galvanization as specified in ASTM A780. For example, if torque tubes with a 3.0-mil (0.003-inch) hot-dip galvanization are to be welded in the field, a field-applied coating, such as hot stick repair, shall meet or exceed the original 3.0-mil coating thickness of the torque tube per ASTM A780 requirements.

Only steel bolts with pre-applied corrosion inhibitors or stainless-steel bolts and fasteners shall be allowed in the entire mounting structure.

4.1.9 Erosion Control & NPDES Coverage

Contractor shall submit a site-specific Erosion and Sedimentation Control Plan. If required by local regulations, this plan is to be reviewed and approved by the local jurisdiction prior to construction. The erosion and sedimentation control plan will be consistent with and incorporate applicable elements of the SWPPP in addition to local regulations. All areas of temporary soil disturbance are to be graded, if necessary, and re-vegetated in a timely manner to limit erosion as required by the local jurisdiction. In addition to the Erosion and Sedimentation Control Plans, depending on state regulation the site may need to apply for coverage under the National Pollutant Discharge Elimination System (NPDES). This coverage is normally issued by the state environmental agency and is normally required for any site disturbing 1 acre or more. Contractor to investigate and apply for any permit authorizations related to earth disturbing activities.

4.1.10 Grading and Drainage

The grading and drainage plan shall be designed and installed in accordance with local code and permit requirements. The grading and drainage plan will be consistent with and incorporate applicable elements of the SWPPP and the erosion control plan. All structures required for the drainage plan, if any, shall comply with state standard specifications for drainage facilities. Grading and drainage will be designed to efficiently convey water away from the site, prevent ponding and point source discharge, promote sheet flow of water, and limit long-term maintenance of the Project site. Stormwater Management facility designs if required shall meet all state and local design requirements for Water Quality, Volume and Rate reduction as deemed appropriate for the site.

4.1.11 Dust Control

Contractor shall apply dust control materials, at Contractor's expense, to minimize raising dust from construction operations and traffic, including but not limited to haul routes, using only dust control mixtures approved by the local jurisdictions.

4.1.12 Site Finish Grade

Contractor shall leave the Site in a clean condition upon completion of the work. Efforts shall be made to restore area to a clean condition as soon as practical. Contractor shall remove all trash, debris, and stockpiles. The Site access roads shall be returned to a condition that meets the original specification by repairing road damage such as ruts, gouges, and weather damage that may have occurred during construction.

The Site finish grade within the equipment footprint and in areas required for operation and maintenance of the Project shall be fully stabilized and gravel covered to prevent vegetation growth.

Provisions of the SWPPP for final storm water drainage shall be implemented.

Contractor shall seed and mulch all areas of the Project Site that have been disturbed beyond the permanent portion of the Site and access road, per the SWPPP.

4.1.13 Construction Signage

Contractor shall provide temporary signage for local traffic control in accordance with state department of transportation and/or local city requirements and in accordance with Owner's standards.

4.1.14 Personnel Access

Contractor shall make access to all equipment safe and reasonably ergonomic for maintenance staff. For example, if an inverter pad is elevated, the earthwork surrounding the concrete pad shall have a safe approach slope.

4.1.15 Construction Access

Contractor shall abide by all load limits established by the applicable state department of transportation.

Contractor shall be responsible for providing, operating, and maintaining equipment, services, and personnel with traffic control and protective devices, meeting the requirements of the local municipal traffic laws as required, allowing traffic flow on haul routes and onsite access roads in a safe manner. Contractor shall be responsible for any costs to comply.

Contractor is responsible for construction of temporary access around areas of excavation and other construction activity, if necessary and as required.

4.1.16 Site Access and On-site Roads

The Site access road shall be designed and installed by Contractor and shall include a loop road that parallels the perimeter fence. This design shall be based on sufficient soils and subsurface investigation by a qualified professional engineer licensed in the jurisdiction of the project to ensure that the constructed road will meet its intended purpose. The design life of the access road shall be 30 years (assuming annual maintenance). The Site access road shall be a gravel compacted road (unless local regulations specify otherwise) sufficient to satisfy the loading requirements of class 8 commercial vehicles and to provide all-weather access for operation and maintenance of the BESS. Site access roadway design shall comply with local permit requirements and be appropriately graded for drainage. At a minimum, the site access road shall consist of the following: soil stabilized, geotextile, and two lifts of 6-inch compacted fill for a total of 12 inches with a width 16 feet with 2 feet shoulders on both sides (total of 20 feet). Roads shall have a minimum 75-foot inside radius, unless otherwise instructed by state or local requirements. A smaller turning radius may be approved with written approval from Owner.

Temporary construction roads and staging areas not connected to permanent roads (if any) shall be restored by Contractor in accordance with permit requirements.

4.1.17 BESS or PCS Cooling System

If a water/glycol system is proposed, Contractor shall prepare a Spill Prevention Control and Countermeasures plan and provide secondary containment for accidental discharges of the mixture.

4.2 Electrical Requirements

The Project electrical systems and equipment provided by Contractor shall be designed in conformance with the requirements specified herein.

The electrical auxiliary power system shall be sized so that in no case it limits unit output power relative to the specified nominal capacities detailed in Appendix 2. Any revisions to the existing electrical power system installation (e.g., protective relaying) shall be designed for Owner coordination, safe operation, and maintenance.

A conceptual single-line diagram for the BESS facility is provided in **Error! Reference source not found.**.

Load flow, dynamic stability, harmonic interaction, short circuit, voltage droop, coordination, grounding system safety and other studies shall be performed to properly determine equipment capacity, performance, withstand requirements, transformer impedances, etc. Contractor shall submit design criteria, harmonic profile, short circuit characteristics, and calculations associated with these studies to Owner for review. Owner will provide data on existing Owner equipment and electric grid as necessary and will be available to facilitate Contractor's performance of these studies.

Electrical systems shall not inhibit the BESS from complying with Frequency Ride Through (FRT)/ Voltage Ride Through (VRT) requirements per Owner's requirements listed in the Technical Specification.

Areas of the BESS enclosures subject to explosive concentrations of gases due to faulty systems, failure of ventilation, etc., shall be classified as hazardous locations in accordance with the latest NFPA criteria. Accordingly, electrical equipment in those areas shall be provided with the appropriate enclosures for the installed locations.

Electrical system design shall be performed under the supervision of a professional engineer. Specifications and drawings shall be sealed if required for submittal to regulatory agencies.

Electrical systems shall be equipped with protective relaying to trip circuit breakers for de-energizing and isolation of equipment in the event of electrical faults. Contractor supplied relaying protection will include primary and back-

up relaying and overlapping zones of protection. Contractor protection relaying is to be coordinated with Owner's existing relaying. Areas of Contractor supplied relaying will include, but not be limited to, MPTs, MV system, and DC/UPS systems. Protection relaying shall comply with Owner's requirements.

4.2.1 MV Switchgear

Contractor shall provide and install Outdoor Switchgear necessary by Contractors detailed design to provide a means of disconnect between the PCS and the POI interface. Outdoor switchgear shall be in a National Electrical Manufacturers Association (NEMA) 4 lockable enclosure.

The switchgear shall be designed, manufactured, and tested in accordance with the latest IEC, ANSI, and NEMA standards. The MV and LV switchgear shall be of a design that has passed testing for arc-flash resistance according to Standard IEEE C.37.20.7 or shall be provided with arc-flash mitigation if required. Switchgear shall include an auxiliary compartment containing all instrument transformers associated with the protective relays and metering. The protective relay system shall be specified, designed, and installed in accordance with standards, codes, and Industry practice. Switchgear monitoring and communication hardware shall be included to meet the requirements of BESS SCADA system, and the metering requirements of Owner. Relay current transformers shall be C400 accuracy class at a minimum unless a higher class is required due to saturation current per IEEE C37.110.

The switchgear shall be adequately rated per Appendix 2 of the Scope Book.

Medium-voltage protective device selection and relaying should be based on the use of Schweitzer Electric Laboratories (SEL) relays or approved other.

4.2.2 Protection and Control Relaying

A complete protective relaying system shall be provided by the Contractor for the PCS and transformer(s) as stated below:

- Inverters equipped with internal relays with 27, 59, 81U/O and voltage-controlled overcurrent 51C functions shall be provided with one utility grade relay with 27, 59, 81 U/O and 51C functions as secondary protection. Otherwise, two utility grade relays and one Owner-designated interrupting device shall be installed to meet the protection requirements.
- Protective relays shall be hardwired to the device they are tripping.

Interconnection interrupting devices shall have DC trip coils and tripping energy shall be derived from Contractor supplied battery separate from the BESS main batteries.

Owner will review Contractor's relay settings and their calibration and test results of those relays to satisfy Transmission Provider's protection practices.

- Contractor shall provide phase and neutral overcurrent protection for the PCS transformer(s).
- Protective relays shall have backup power of 125 VDC system supplied by station batteries.
- Relay settings files are to be included following the completion of the IFC design package.

Contractor shall use microprocessor type protection equipment.

The protective relaying and metering shall be integrated with the BESS SCADA system. However, integration into the BESS SCADA system shall not circumvent normal protective relaying functions nor shall any protective relay or revenue metering values be used for control within the project control system.

Based on the finalized and approved relay settings and relay configuration for the project, the relay programming shall be performed. The Contractor shall inspect and test each protective relay in accordance with NETA-ATS section 7.9. Contractor shall program each device with the recommended relay settings provided by the engineer.

After energization, Contractor shall perform all relay phase in verifications on all relays. This includes calculating expected magnitude and phase angles to compare to actual values. Phase in documentation shall be submitted upon successful verification.

4.2.3 Auxiliary Power

Primary AC station service shall be provided from the low voltage side of the Project PCS transformer bus of a dedicated auxiliary transformer. If required by Contractor's design, back-up station service shall be provided. All facilities required to provide primary and back-up station service to the Project and building, including auxiliary power transformers, transfer switches, protection and distribution panels shall be Contractor's responsibility.

In the event of a loss of the Auxiliary Power connections to Project, primary and/or backup station service may or may not be available. Back-up UPS to power Project controls, and auxiliaries in the event of a total failure of the primary and back-up station service feeds shall be provided for orderly shutdown. The UPS shall be separate from the BESS main battery system and sized for an orderly shutdown of the Project for a loss of station service with the UPS at 80% rated capacity. The UPS shall be housed in a separate location from the BESS main battery to facilitate ease of maintenance.

All auxiliary DC station service requirements for the BESS shall be designed, engineered, furnished, and installed by Contractor. 125 V_{DC} shall be used for protective relay power.

As described in detail throughout this document, Contractor shall engineer, furnish, and install to the Site all material required for a complete auxiliary power system to complete the Project, including but not limited to, the following material:

- Electrical Medium Voltage switchgear
- Auxiliary/backup power including emergency generator, DC, UPS etc.
- Low voltage switchboard, auxiliary transformers
- Remotely accessible data acquisition system
- AC and DC Cables
- All electrical conduit, cable trays and junction boxes
- Grounding and Lightning protection system
- Protective devices for switchgears, transformers etc.
- Lighting system including emergency lighting
- Concrete equipment pads, or driven piles.
- Fencing, gates, security cameras, and security camera recording equipment
- Communications infrastructure, I&C systems
- All materials related to drainage and access roads required by the civil engineering plan

- Miscellaneous steel
- Components (nuts, bolts, clamps, etc.)

Each item of equipment to be supplied by Contractor shall be subject to inspection and testing during and upon completion of its fabrication and installation further described in Section 7.0.

Installed equipment and materials shall be new, and suitable grade for the intended purpose, and not a lower grade or quality than specified in the design and engineering plans or in manufacturers' recommendations. Utility-grade equipment shall be used. Commercial- or residential-grade equipment shall not be acceptable. No equipment shall utilize polychlorinated biphenyls (PCBs).

Contractor shall provide detail calculation and drawings for all the auxiliary power system.

4.2.4 Grounding

A suitable equipment grounding system shall be designed and installed for the Project. Contractor will be responsible for providing an effective grounding mechanism. Contractor shall provide detailed information (such as ground-grid drawings and calculations) for the project grounding. Contractor is responsible for designing and providing the Project system grounding and equipment grounding. The Project grounding system shall provide personnel protection for step and touch potential in accordance with Institute of Electrical and Electronics Engineers (IEEE) 80. Equipment and systems not covered by IEEE 80 shall comply with grounding requirements of National Electrical Code (NEC). The system also shall be adequate for the detection and clearing of ground faults. The Project grounding system shall be reviewed and approved by Owner.

All exposed non-current carrying metal parts shall be solidly grounded. Particular attention shall be given to prevention of corrosion at the connection of dissimilar material such as aluminum and steel.

All ground conductors shall be stranded copper or copper weld and may be bare if exposed. Ground conductors in conduits shall be green insulated. Ground lugs shall be mechanical and rated aluminum to copper. All below grade connections shall be exothermic welds. Mounting structures shall be grounded in a manner that is sized for maximum available short-circuit current and lightning current (if required). All the equipment shall be grounded as per OEM's instructions and recommendations.

Contractor shall submit to Owner grounding and lightning calculations for assurance of safe step and touch potentials on the Site, in accordance with Owner's standards. Contractor shall conduct a ground resistivity test to verify that the grounding system meets minimum requirements for the overall grounding scheme.

Fencing around the perimeter of the overall Project Site shall be grounded in accordance with IEEE 80, NEC, and local codes.

4.2.5 Lighting System

The Contractor shall provide and install lighting. Both interior and exterior lighting shall be provided, and at the entrances to all interior spaces and main entry gates.

All lighting in all spaces shall be per IESNA recommendations; and shall meet those recommendations.

Emergency egress lighting shall be supplied at all exits, inside and outside the control enclosure.

Lighting controls shall be provided around the PCS equipment area; however, these lights should be controlled and not full-time running lights.

4.2.6 Cables and Cabling System

Cables shall be designed in accordance with the proposed voltage levels of the Project. All cables shall be halogen-free, fire-retardant, and self-extinguishing, with XLPE isolation where required. All cable (regardless of voltage level and use) shall have a fire-retardant jacket and shall have successfully passed the appropriate (IEEE, ASTM, or UL) flame spread and smoke generated test for the class, voltage rating, and size of the specific cable.

AC cables shall be rated for the correct maximum voltage and sized according to the operating and short-circuit currents.

Contractor shall provide raceways for all below grade cable in conduits or duct banks (use of direct buried cabling is prohibited). All cabling, which may be exposed to mechanical damage shall be placed in conduits, wireways, overhead trays, or other enclosures suitable to Owner. Alternating Current (AC) and DC circuits shall be installed in separate conduits. Wires shall have identifying labels or markings on both ends. The labels shall identify the opposite end destination.

All cabling shall be new and continuous for each run; splices are not acceptable unless reviewed and approved by Owner on a case-by-case basis. All conductors shall be copper.

Control and instrumentation wiring shall be separated from power and high voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure according to the National Electric Code (NEC) or governing standard.

BESS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible (Class W or DLC stranding or equivalent) and shall include loops to prevent mechanical stress or fatigue on the wires.

The instrumentation and control cable shields, where applicable, shall be multi-point grounded.

Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

Raceway and cable systems shall not block access to equipment by personnel.

All conduit and raceway systems shall comply with NEC and NESC requirements. The conduit and raceway system design shall accommodate power and control cables, communication circuits, underground feeders, and optical fiber cables.

Low voltage cables used for protection and control, or station power shall be placed in conduit wherever they connect to oil immersed equipment to reduce the risk of burning oil flowing in raceways and causing severe damage to cables. All conduit systems including wiring size shall be detailed on drawings.

Contractor shall provide for all external cable and wiring of all BESS equipment, including but not limited to:

- DC cable and connections
- Auxiliary Power cable and connections
- FO communications cable and connections
- Fire protection devices (if required)
- Grounding connections

4.2.7 MV and Fiber Cable and Conduit for connecting to POI

The Contractor shall provide and install an allowance of 300 lineal feet of 6" conduit for 3-phase 24.5 kV power tie-in. The conduit will connect the MV switchgear to the POI. The Contractor shall also provide and install an allowance an allowance of 300 lineal feet of 2" PVC conduit to support 96 fiber optic cable to the POI. The conduit must be suitable for outdoor installation. The conduit installation shall include all necessary trenching, backfilling, and protective measures to ensure the integrity of the installation over the expected lifespan. The Contractor shall also provide all required fittings, connectors, and supports to secure the conduit. The Owner shall furnish and install fiber optic cabling from offsite to the POI.

4.2.8 Surge and Lightning Protection

Contractor shall provide a lightning risk assessment performed to Industry Standards by a certified lightning protection professional, as outlined in Section 4.2.12 External Lightning Protection System (LPS). The results of this assessment shall be the basis for determining the requirements and extent of the facility LPS and a surge protection system that provides protection of the batteries, DC power circuit, PCS, measurement control and communications systems, and other major electrical equipment including transformers.

4.2.9 Surge Protection

A staged, comprehensive surge protection system, inclusive of Types 1, 2, and 3 surge protective devices (SPDs), shall be incorporated as determined by the lightning risk assessment or as required by the PCS manufacturers in all relevant pieces of electrical equipment. Protection shall be provided within the inverter on both the DC and AC sides as required by inverter manufacturer. Additionally, surge protection shall be provided in combiner boxes, and measurement control and communication systems as determined by the lightning risk assessment study. Type 3 surge protection installed within that equipment shall be mounted on DIN rails and must have finger safe replaceable modules that can be exchanged without the use of tools. SPDs shall be applied on all power circuits (AC and DC) and all communications and control circuits in a coordinated, staged manner. The operating status of the power SPDs shall include visual indication and shall be able to be remotely monitored by a set of integral contacts.

In addition to the performance requirements indicated above, all SPDs shall be compliant to the respective domestic or international standards, including, but not limited to, the following standards and guidelines:

- UL Standard 1449 3rd edition.
- IEEE Guideline C62.41.1-2002
- IEEE Guideline C62.41.2-2002
- IEEE Standard C62.42-2005
- IEEE Standard C62.45-2002
- IEEE Standard 1100-2005

4.2.10 Surge Protection Devices Applied on AC Power Circuits

Surge Protection Devices (SPD's) applied on AC systems must meet all the requirements listed above in this general section and must be specifically designed for and compliant to UL 1449 3rd edition. SPDs must be selected for the system voltage where they are to be applied. SPDs are to have a short-circuit current rating (SCCR) higher than the short circuit availability where they are installed, therefore not requiring external fusing. SCCR of 200,000 A is ideal.

4.2.11 Surge Protection Devices on Measurement, Control, Instrumentation, and Communications Circuits

All critical non-power circuits are to be protected with appropriate DIN rail-mounted pluggable surge protection for the system they are applied. Surge protection bases are to permit signal continuity even if the SPD module is removed from the base.

4.2.12 External Lightning Protection System (LPS)

Based on the findings of the lightning risk assessment, an external LPS may be required to be installed. If so, Contractor shall provide an LPS to protect the overall Project from direct lightning strikes to any portion of it, including, but not limited to, inverters, outside cabinets, and buildings housing electrical equipment. The LPS shall consist of air terminals of proper height and spacing (using the rolling sphere method), properly rated and properly designed and placed down-conductors to assure safety of personnel during discharges, and a properly designed and installed ground system.

The systems shall be designed in accordance with the latest globally recognized standards for such designs, which are IEC 62305-1 and IEC 62305-3, or NFPA 780.

Grounding systems shall be in compliance with IEEE Standard 142-2007, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.

Designs are to be provided by a recognized expert LPS design firm, supplier, or professional engineer licensed in the state of the project and are to be submitted to Owner. All components of the LPS shall be in compliance with the selected system design standard chosen.

4.2.13 Control Enclosure

Control enclosure shall have suitable space and racking for all Owner equipment, Protection panels, Communications, SCADA, and reactive power controls. Spare space for future expansion shall be provided.

Control enclosure shall be a free-standing building, complete with framing, or self-framing panels, roofing, siding, doors, windows, hardware, fasteners, flashing, weather-stripping, HVAC, and other components as required.

Control enclosure shall have ample room for all equipment required including the control and protection panels and a workspace.

The control enclosure shall have exterior access stairs and railings installed to code.

All steel shall be galvanized and be bonded to the ground grid by two separate connectors.

The building will be bonded to the ground mat by at least two separate connections.

Control enclosure must meet all electrical clearances.

The control enclosure shall be designed using the applicable code as required by the Authority Having Jurisdiction (AHJ).

4.2.14 Control and Instrumentation Cabling

All cabling shall be new and continuous for each run; splices are not acceptable unless reviewed and approved by Owner on a case-by-case basis. All conductors shall be copper.

All cabling, which may be exposed to mechanical damage shall be placed in conduits, wireways, overhead trays, or other enclosures suitable to Owner. All below grade runs shall be in buried conduit unless proximity to a roadway requires concrete duct bank. Alternating Current (AC) and DC circuits shall be installed in separate conduits. Wires shall have identifying labels or markings on both ends. The labels shall identify the opposite end destination.

Control and instrumentation wiring shall be separated from power and high voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure according to the National Electric Code (NEC) or governing standard.

BESS control and instrumentation system wiring shall be bundled, laced, and otherwise laid in an orderly manner. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible (Class W or DLC stranding or equivalent) and shall include loops to prevent mechanical stress or fatigue on the wires.

The instrumentation and control cable shields, where applicable, shall be multi-point grounded.

Wiring to terminal blocks shall be arranged as marked on wiring diagrams. Terminal groupings shall be in accordance with external circuit requirements.

Raceway and cable systems shall not block access to equipment by personnel.

4.3 Mechanical Requirements

All mechanical design shall be in accordance with the International Mechanical Code and the International Fire Code, the additional documents incorporated by reference and the additional requirements herein. All mechanical design shall be performed by or done under the direction of a Professional Engineer registered in the state. All Life Safety requirements shall meet all national, state, and local codes, as well as agree with the local Authority Having Jurisdiction.

In accordance with State and Local Laws, all final (Issued for Construction) drawings, specifications, and calculations shall be wet stamped by a Registered Mechanical Engineer in the state where the project is located.

Contractor shall provide heating, ventilation and/or space conditioning for the project equipment, as required, to meet the equipment manufacturers' recommendations over the range of site conditions and over the full operating range.

Ventilation and space conditioning equipment controls shall be interlocked with the fire protection and if provided suppression systems to operate appropriately in the event of fire.

Ventilation system fans shall be provided with non-return, motor operated dampers. Forced ventilation air streams shall not impinge directly on electrical equipment. Inlet and outlet enclosure dampers shall be of a design that prevents wind driven water and dust intrusion. If required, ventilation systems shall be provided with an interlocked and automatic temperature control system, including appropriate alarming, for each Project building or enclosure.

Space site ambient temperature conditioning as required for the Project enclosure equipment provided shall be provided as complete systems with all accessory items required for proper operation. Consideration shall be given primarily to requirements for efficient conditioning of the installed BESS equipment except in normally occupied areas such as the control room. Normally occupied areas or areas requiring access for local operation shall consider operator comfort in addition to requirements for equipment conditioning. Space air conditioning equipment shall be designed for the loss of one unit without derating of the Project. Where heating or cooling is

provided, the equipment shall have a minimum EER, IEER, SEER rating in accordance with the Energy Codes. Space air conditioning shall be provided with an automatic temperature control system, including appropriate alarming, for each Project operational enclosure.

All electrical equipment, enclosures, disconnects, and overcurrent devices shall be clearly marked and identified according the international/local standards and regulations. Markings shall reference the same designations called out in the final design drawings.

4.4 BESS Special Built Enclosure or Building Enclosed Projects

If the Project is a Special-built enclosure or building enclosed project, the EPC Contractor shall provide the following.

Special Built Enclosure projects no more than 10 MWh in size

- Access to the battery's modules shall be from external swing doors.
- Hydrogen, Li-ion Tamer, or similar UL listed early off gas detection shall be included
- Fire detection per NFPA-72
- Deflagration vents to exterior sized for structure integrity
- HVAC shall go into purge mode on receipt of early off gas detection
- Container environmental sample tube routed to exterior of container for FD air sampling.
- Provide a manual closed head sprinkler typical of NFPA 13 riser(s) internal the container, supplied by a dry FDC connection exterior the container. No releasing or alarm hardware required.

Building Enclosed projects

- The building is expected to be Tilt-Up style on a pre-stressed slab floor
- Two-hour fire walls shall separate the energy storage system into no more than the lesser of fifty-percent total capacity or 20.0 MWh capacity will be lost due to an event.
- Deflagration vents to exterior sized for structure integrity
- Compartment environmental sample tube routed to exterior of container for FD air sampling.
- Hydrogen, Li-ion Tamer, or similar UL listed early off gas detection shall be included
- Fire Detection per NFPA-72 HVAC shall go into purge mode on receipt of early off gas detection
- NFPA 13 or NFPA 15 automatic suppression shall be provided in each fire zone. An acceptable water supply shall be provided.

4.4.1.1 Building Design

For building Enclosed projects, the following specifications shall apply to the Contractors scope of supply:

Structural Framing:

- Design primary and secondary structural members and exterior covering materials for applicable loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practice Manual" Structural Steel: For design of structural steel members, comply with the requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

- Light Gauge Steel: For design of light gauge steel members, comply with requirements of the American Iron and Steel Institute's (AISI) "Specifications for the Design of Cold Formed Steel Structural Members" and "Design of Light Gauge Steel Diaphragms" for design requirements and allowable stresses.
- Welded Connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for Welding procedures.

Basic Design Loads:

- All loads shall be based on the site-specific conditions and latest IBC, ASCE 7, state, and local codes.
- All structures on the Site need to be designed using environmental loads as specified in the American Society of Civil Engineers (ASCE) 7 code book Minimum Design Loads for Buildings and Other Structures and the applicable state building code if more stringent requirements. These include wind loads, snow loads, rain loads, ice loads, and earthquake loads. Each structure on Site shall be grouped in Risk Category III as defined in ASCE 7. The corresponding importance factor shall be used for each load determination.
- Live Load shall be based be in accordance with IBC and the state local code.

Auxiliary Loads:

- Include dynamic live loads such as those generated by suspended ceilings, sprinkler systems, electrical or mechanical systems or any suspended HVAC units, and exterior frames and doors.

Design:

- Each member shall be designed to withstand stresses resulting from the combination of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual".

Table 4 — Site Dimensions

A	Fence line to Battery	100 ft	Minimum distance or must maintain distance so that <1psi shall be felt at fence on explosion
B	Distance between BESS units or other equipment	20 ft	Minimum Distance required between BESS units unless an NFPA 80a exposure protection Thermal Flux Calculation demonstrates acceptable separation with no fire service intervention.

Note: Table 3 applies to Container or Special Built Enclosures only, and not Buildings, as Buildings have a two-hour fire wall requirement.

The Site Dimensions for the Project shall incorporate space requirements for battery augmentation for the Project Design Life specified in Appendix 2.

4.4.1.2 Control of HVAC Systems

If the Project is a building enclosed or special-built enclosure project, the EPC Contractor shall be responsible to provide the HVAC/Thermal Management system based on information and requirements specified by the BESS Equipment OEM.

If the Project is a building enclosed or special-built enclosure project, HVAC system shall communicate with Owner's SCADA via a standard protocol as listed in specifications. The minimum remote monitoring requirements shall be as follows:

- System State
- Battery cell and module temperature
- Humidity Levels
- Area Temperatures (air-cooled systems)
- Fresh air operation status (air-cooled systems)
- Coolant temperature (liquid-cooled systems)
- Ambient temperature (liquid-cooled systems)
- Coolant Flow Rate (liquid-cooled systems)
- Pump Pressure (liquid-cooled systems)
- Manual Control
- Alarms/Warnings

4.5 Fire Protection and Project Security

4.5.1 Fire Protection and Suppression (for Enclosures)

Fire detection and suppression system, for equipment and system outside of BESS enclosure, shall be in the scope of the Contractor. It shall be provided by applicable code or as described in this document for property preservation. Detailed of the fire detection/suppression system to be provided to the owner prior to construction.

Contractor shall be aware of all local requirements of the authority having jurisdiction (AHJ). All requirements of the AHJ shall be satisfied by the Contractor and shall be incorporated into the design and construction of the Project. Contractor shall ensure that project has access for emergency response vehicles as determined by the local AHJ.

The BESS / SCADA shall have a system including current/history of data and alarms. System shall be described in the Contractor's proposal and shall include:

System and alarm status, unit voltages, temperatures, and other necessary system details

- Trouble notification when preventive maintenance is needed.
- System level alerts shall be provided by the manufacturer over customer interface.
- Remote Shutdown capability that shall include:
    - Strobe lights and audible alarm – at least one for each of the following:
    - Fire Alarm
    - High Gas Alarm
- The Contractor shall provide and install one Remote Shutdown Panel (RSP) measuring 4' wide x 5' x 1' deep (minimum) outside of the fence line at the gate entry that is accessible to emergency

responders. The RSP shall be installed on a 3’ x 6’ x 8” thick reinforced concrete pad with one 4” conduit dedicated for fiber communications cables and one 4” conduit dedicated for power cables.

- Contractor shall provide and install one area light fixture at Remote Shutdown Panel.
- Fire alarm control panel
- Electrical remote shutdown for associated equipment on site to be safely shutdown during emergency situations.

Contractor shall develop posted instructions for tasks that site staff and local fire department may need to perform, such as system shutdown during an emergency.

4.5.2 Fire Protection and Suppression (for Special Built or Building Enclosures)

For Special Built Enclosures or Building Enclosures Projects, the EPC Contractor shall be responsible to provide the fire protection and suppression installation and based upon requirements specified by the BESS Equipment OEM and the following requirements.

Special Built Enclosures and Building Enclosures provided by the Contractor shall adhere to the concepts outlined in FM Property Loss Prevention Data Sheets 5-33, “Lithium-Ion Battery Energy Storage Systems.”

If the BESS Equipment OEM requires fire protection standpipes to either their BESS enclosure, or the Project requires it to the Remote Shutdown Panel, or if in general, the Project requires a fire protection water-based system, then the EPC Contractor shall provide and install.

Fire detection and suppression system shall be provided by applicable code or as described in this document for property preservation. Detailed of the fire detection/suppression system to be provided to the owner prior to construction.

The BESS / SCADA shall have a system including current/history of data and alarms. System shall be described in Section 3.5 and shall include:

- System and alarm status, unit voltages, temperatures, and other necessary system details
    - Trouble notification when preventive maintenance is needed.
    - System level alerts shall be provided by the manufacturer over customer interface.
    - Remote Shutdown capability that shall include:
        - Strobe lights and audible alarm – at least one for each of the following:
            - Fire Alarm
            - High Gas Alarm
        - Physical panel that is located outside of the fence line at the gate entry that is accessible to emergency responders. Panel shall include contact information for remote operations facility.
        - Fire alarm control panel
        - Electrical remote shutdown for associated equipment on site to be safely shutdown during emergency situations.
    - The EPC Contractor shall be responsible for designing, with OEM cooperation, procuring, and installing the Remote Shutdown Panel (RSP), with all conduits, cabling, and interfacing required to provide an integrated system.

The fire panel shall communicate with Owner's SCADA via a standard protocol as listed in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- System State
- Fire/Smoke Detector Status
- Fire System Trouble
- Countdown to discharge
- Discharge Completed
- Manual Release Request
- Abort
- Alarms/Warnings

4.5.3 Project Security (including Fencing)

Contractor shall provide a security system for the Project. The security system around the perimeter shall include a 7-foot-high chain link fence with 1-foot top guard (total 8-foot high) of three strands of nine-gage barbed wire and designed to meet NESC and IEEE standards.

The Contractor shall ensure there are no gaps greater than two inches between the ground and bottom of fence fabric and the fence is secure.

Barbed wire shall be on arms oriented at 45 degrees facing up and outward. Fence posts shall be spaced no more than 8 ft apart, set in concrete finished no more than 2 inches above finished grade, and shall be grounded to meet NESC and IEEE standards. If any portions of the fence are located under transmission lines, they shall be isolated and grounded according to Utility requirements and NESC standards

The perimeter fence shall include at least two locked gate pairs to restrict access: one with a width of 24 feet with a keypad or access card operated electrically driven slide gate for vehicles and one pedestrian entrance with a width of four feet.

Perimeter signage shall be provided by Owner and installed by Contractor in accordance with Owner standards. Signage shall be installed with a maximum distance between signs of 100 feet along the perimeter fence and on all gates. Signage indicating electrical hazard and NO TRESSPASS shall be installed five feet above ground level and comply with ANSI Z535 for size and font. Sign lettering shall be no less than 0.2" stroke width.

Contractor shall be responsible for security during construction.

This equipment shall include:

- LED Spot or LED flood lights.
- Security cameras must be low-light capable located such that they are capable of adequate identification of intruders or animals covering the perimeter of the Site. Cameras shall be placed at a height that permits line-of-sight access to the property.
- Cameras with a control and detection system that assists in the detection and identification of intruders or animals.
- Network - Digital Video Recorders used to record video that could be used for evidence in the event of theft or vandalism.
- Contractor shall negotiate with third party vendor to identify the scope of work that will be performed by Contractor, to ensure that a complete and operational security system as described by third party

vendor is provided. Third party vendor shall provide to Contractor the security system design, which will indicate the location of cameras, DVRs, security lighting and any security communications equipment, based on third party vendor's overall System design. The work that may be provided by third party may include the furnishing and installation of wiring, cabling, labor, tools, equipment, and ancillary materials required for a complete and operational security system. At minimum, it is expected the Security Sub-Contractor will provide the following equipment: cameras, network DVRs, and any specialized security communications equipment.

- Contractor shall be responsible for the furnishing and installation of all necessary conduits, 120-V_{ac} power extensions for all Security related equipment.
- Contractor shall provide a free-standing weather-proof enclosure with adequate space required for Security Control Equipment as specified by the third party.
- Installation of telephone lines, and/or cellular modem(s), and/or local area network for the interconnectivity of all related Security System Equipment.
- Contractor shall provide fiber optic cable for Security System Communications. Fiber optic cable shall consist of a minimum of six fiber strands between each required camera location.
- The system shall be complete, tested, and fully operational. Prior to construction, Contractor shall provide the following:
    - Descriptive statement and single-line block diagram to show how all related equipment will interface and operate as a complete system.
    - Product data: manufacturer's technical data sheets on each product to be used.
    - Drawings, including plans, elevations, equipment mounting heights, and dimensions required to show devices' locations and demonstrate accessibility compliance in accordance with referenced documents.
    - Detailed schematic wiring diagrams for all system devices; wiring information shall include cable type, conductor routings, quantities, and connection details at devices.
    - Manufacturer's user's manuals for operations, administration, installation, and maintenance.

4.6 Other Facility Requirements

4.6.1 Hydrogen Mitigation

For Special Built Enclosures or Building Enclosures, the Contractor shall be responsible for providing and installing Hydrogen Detection systems as outlined in Appendix 3, and to install ventilation systems to mitigate Hydrogen generation provided in Appendix 3. The BESS OEM shall provide the Hydrogen Detection system required for the EPC Contractor to install and also define the required volume of off-gassing that the Contractor shall design the Special Built Enclosures or Building Enclosures ventilation system to accommodate.

If applicable for the battery chemistry proposed, the BESS OEM shall calculate the maximum hydrogen emission rates for the battery (normal and runaway) and design accordingly a fully redundant forced-air ventilation/fan system and conflagration vents to satisfy all codes and standards. These calculations shall be included in the proposal and shall include the safety margins used.

The BESS OEM shall provide and install UL approved hydrogen detectors and configure their control logic such that the hydrogen detection system alarms at one percent hydrogen concentration. Additional alarms and logic shall be provided electrically isolate the battery if the hydrogen concentration exceeds a safe level.

Any enclosures into which a flammable gas may propagate during normal or abnormal operations shall be protected against accumulation of a flammable or explosive mixture or protect against ignition by an external spark of any such mixture that may nevertheless occur.

If flooded electrolyte cells are used, the BESS OEM shall install flash arresters on the cells.

4.6.2 Toxic Materials

If a significant amount of a toxic substance can be emitted from the equipment during a failure, fire or emergency/protective operation, an alarm system to alert personnel shall be included in the equipment. The toxic nature of the substances as well as treatment for exposure to it shall be included in the Operation and Maintenance (O&M) manual and emergency response plan.

4.6.3 Signage and Labeling

Permanent naming placards should be placed on all equipment, including BESS, inverters, transformers Switchgears etc. Naming on placards and/or tags shall match drawing naming convention following current Industry and local standards. Instruction plates, nameplates and labels shall be provided for all items of the Plant giving particulars about rating, duty, size, model number, serial number and full information for identification and operation. Labels shall be of sufficient size to carry a full description of the Plant item and its complete identifier. The Contractor shall provide all required Labels to all BESS equipment, including ARC flash labels.

For all outdoor equipment labels, Contractor shall provide 1/16" UV stabilized Acrylic Polypropylene labels printed in UV resistant ink with UV resistant laminate affixed with hot melt adhesive or epoxy suitable for the atmospheric conditions.

Fence signage shall be placed per section 4.5.3. Onsite roadway signage shall be posted at intersections where necessary to indicate exit routes and dead-end corridors. All gates and access points shall have a uniquely identifiable location name and 911 address with emergency contact information posted.

All cables shall be labelled to meet applicable codes and standards. All cables shall have a label affixed to the outer jacket with a Brady or equivalent cable marker at each termination of a type accepted by Owner before installation. Labelling will match the point-to-point drawings. Contractor is required to place arc flash labels on all inverters, combiner boxes, and other equipment requiring such. A method for ensuring labeling is complete must be included in Contractor's QC Inspection Point Program.

4.6.4 Audible Noise

The maximum sound level generated from the BESS and any associated equipment supplied by Contractor under any output level within the Project operating range, shall be limited to the level specified in Appendix 2 in any direction from the facility fence or building exterior. Contractor shall comply with all ordinances and regulations that may apply to the BESS installation as determined by the local building codes. Results of noise studies shall be provided for major equipment such as HVAC and PCS units.

Noise produced by the Project and any associated subsystems shall be designed and furnished such that the ambient noise level in the BESS control room, or any typically occupied area with applicable standards in a building shall not exceed the level specified in Appendix 2.

4.6.5 Broadband Interference

Seller shall take necessary precautionary measures to ensure that there will be no interruption, damage, or danger to any equipment or system due to broadband, radiofrequency, or comparable interference. Seller shall ensure

that there are no discharge sources from the Project that could cause interference with radio and television reception, wireless communication, telecommunication, or microwave communication systems. The Work shall include any mitigation necessary to ensure that such communication systems are not adversely affected.

No aspect of the operation of the Project shall produce electromagnetic interference (EMI) that will cause faulty operation of instrumentation, communication, or similar electronic equipment within the Project or elsewhere on the Transmission System. The Project shall be designed to suppress EMI effects and must meet the specifications of the latest revision of IEEE 519 and its referenced standards, as applicable.

Interference to any radio service that requires a license, FCC licensees, military radio frequencies or medical devices is prohibited.

Seller should provide testing is required to validate broadband interference.

4.6.6 Radio Interference

Seller shall ensure that the Project does not degrade radio reception.

Seller should provide testing is required to validate radio interference.

4.6.7 Television Interference

Seller shall ensure that the Project and related equipment does not generate any discharge sources that could degrade television reception. Seller shall take all necessary action to ensure that television reception is not adversely affected.

Seller should provide testing is required to validate television interference.

4.6.8 Wireless Communication Interference

Seller shall ensure that there are no discharge sources from the Project and related equipment that could cause interference with wireless communication systems. Seller shall take all necessary action to ensure that cellular and PCS communication is not adversely affected.

Seller should provide testing is required to validate Wireless Communication Interference.

4.6.9 Microwave Interference

Seller shall furnish information concerning any potential interference sources and levels that might emanate from the Project and related equipment that could adversely affect microwave communication. Seller shall take all necessary action to ensure that any microwave system is not adversely affected.

Seller should provide testing is required to validate Microwave Interference.

4.6.10 Painting / Logos

Seller shall paint the entire exterior of the building or enclosure with a finish coat in a color approved by Owner. The paint shall be suitable for application to the exterior material of the building or enclosure and the environmental conditions applicable to the site. Owner may supply image(s) of company logo for display on buildings or enclosures, after painting. Upon completion of painting, remove surplus material, rubbish, and debris resulting from this work and leave the building and enclosures and Site in a neat, clean and acceptable condition.

All builders' hardware shall be suitable for the required functions. Hardware shall be of a durable grade consistent with the life expectancy of the facility and appropriate Federal specifications. Exit and fire door hardware shall conform to UL specifications. Installation of exits shall conform to NFPA No. 80.

5.0 FACILITY REQUIREMENTS

5.1 Electrical Systems

Contractor's scope of supply will end at the POI as defined in the Interconnection Agreement and as defined in the Points List. The Project electrical systems and equipment shall be designed in conformance with the Project requirement.

The electrical auxiliary power system shall be sized so that in no case it limits BESS unit output power relative to the specified nominal capacities detailed in Appendix 2. Any revisions to the existing electrical power system installation (e.g., protective relaying) shall be designed for Owner coordination, safe operation, and maintenance.

Load flow, dynamic stability, harmonic interaction, short circuit, voltage droop, coordination, grounding system safety and other studies shall be performed to properly determine equipment capacity, performance, withstand requirements, transformer impedances, etc. Contractor shall submit design criteria, harmonic profile, short circuit characteristics, and calculations associated with these studies to Owner for review. Owner will provide data on BESS equipment, existing Owner equipment and electric grid as necessary and will be available to facilitate Contractor's performance of these studies.

Electrical systems shall not inhibit the BESS from complying with Frequency Ride Through (FRT)/ Voltage Ride Through (VRT) requirements per Owner's requirements listed in the Technical Specification.

Areas of the BESS enclosures subject to explosive concentrations of gases due to faulty systems, failure of ventilation, etc., shall be classified as hazardous locations in accordance with the latest NFPA criteria. Accordingly, electrical equipment in those areas shall be provided with the appropriate enclosures for the installed locations.

Electrical system design shall be performed under the supervision of a professional engineer. Specifications and drawings shall be sealed if required for submittal to regulatory agencies.

Electrical systems shall be equipped with protective relaying to trip circuit breakers for de-energizing and isolation of equipment in the event of electrical faults. Contractor supplied relaying protection will include primary and back-up relaying and overlapping zones of protection. Contractor protection relaying is to be coordinated with Owner's existing relaying. Areas of Contractor supplied relaying will include, but not be limited to, MPTs, MV system, and DC/UPS systems. Protection relaying shall comply with Owner's requirements.

BESS auxiliary electrical power shall communicate with Owner's SCADA via a standard protocol as listed elsewhere in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- Availability of normal and backup power sources.

5.2 Interconnection of Utilities

Contractor shall provide all utility interconnections needed for construction, commissioning, and testing of the Project or performance of the Work in each case or any portion thereof (e.g., potable, and non-potable water, wastewater, sanitation (including sewage), temporary power, telecommunications, broadband internet, and fuel). This interconnection of utilities is separate and distinct from the site's electrical interconnect with Owner.

5.3 Physical Security Installations

The physical security of the site shall comply with Owner and regulatory requirements. Contractor is responsible to implement as described in the table below and the following sections.

LOCATION	DESCRIPTION	FACILITIES AND EQUIPMENT BY CONTRACTOR	EQUIPMENT BY OWNER
Collector Substation (if applicable)	Minimum two cameras located at opposite corners of substation area	Two 1" PVC conduits with pull cables for power and communication wiring, between BESS SCADA and camera masts, and required hardware supports and 15 ft camera masts capable of supporting pan, tilt, zoom cameras.	Cameras
	Electrically operated slide gate with keycard reader	Keypad, slide gate, gate operator, wiring (power and communications), grounding loop, and hardware for mounting keycard reader. In addition, two 1" PVC conduits with pull cables for power and communication wiring between BESS SCADA and keycard reader.	Keycard reader
Control House (if applicable)	Keycard reader for lock on control house personnel door	Keypad, wiring (power and communications), and required hardware supports for mounting keycard reader.	Keycard reader
Site Main Gate	Electrically operated slide gate with keycard reader	Keypad, slide gate, gate operator, wiring (power and communications), grounding loop, and hardware for mounting keycard reader. In addition, two 1" PVC conduits with pull cables for power and communication wiring between BESS SCADA and keycard reader.	Keycard reader

5.4 Control System and Communication Requirements

5.4.1 Cyber Security[2]

Seller shall design, build, and deliver a cyber security system and plan for the Project that conforms to the requirements specified in Appendix 7.

5.4.2 Network Devices

5.4.2.1 Network Servers

The BESS SCADA System shall include a networked GPS synchronized clock capable of providing time synchronization signal to other devices in the BESS SCADA System using IRIG-B via coaxial cable.

All hardware and software shall support and implement standard, open protocols and datasets such as MODBUS and DNP3. No proprietary protocols shall be utilized. The BESS SCADA System shall retrieve data from all capable devices within the BESS and interconnect substation. The BESS SCADA System shall be capable of interfacing with Owner's external historian database protocol systems.

All servers and functionality shall be implemented with redundant hardware and software in a hot standby architecture. Virtualized systems may be utilized to provide redundancy.

All hardware shall support redundant hot-swappable power supplies, hot-swappable solid-state drives, and RAID. All software shall be installed on a commercially available operating system with regularly provided security and reliability updates.

5.4.2.2 Routers, Switches, and Modems

Seller shall supply network hardware as necessary to connect all servers, relays, meters, and other equipment capable of communicating with the BESS SCADA System and Owner's corporate SCADA via external networks. All hardware shall be implemented using ruggedized industrial models unless housed in climate-controlled cabinets.

Seller shall supply redundant network switches as necessary to the BESS SCADA System network. Switches shall meet or exceed IEEE 1613 (Class 2). Switches shall support modern security functionality, including VLAN, SNMPv3, RSTP, MAC-based port security, traffic prioritization, port mirroring, PTP time synchronization and pass through, user-based accounts, and dual power supplies.

Seller shall supply redundant network routers as necessary to connect the BESS SCADA System network to Owner's existing SCADA system via external networks. Router shall meet or exceed IEEE 1613 (Class 2). Router shall support stateful firewall with NAT, IPSec Virtual Private Networking, AES256, RADIUS centralized password management, multi-level passwords, SSH/SSL encryption, MAC-based port security, VLAN and SNMPv3, external user access logging for auditing purposes.

Seller shall supply modems as necessary to support the requirements of Owner and/or telecom utility to connect Owner's external network. Seller shall work with Owner to determine the number of internet connections needed

[2] The Cyber Security Plan set forth in this Appendix 7 was designed for a solar facility, is preliminary, indicative only, and subject to updating and modification (including expansion).

and minimum bandwidth requirements. Seller shall work with Owner to determine a list of acceptable internet providers.

5.4.2.3 Operator Workstations

Seller shall supply one operator workstation. The workstation shall consist of one monitor, keyboard, mouse, and PC for display of the operator interface. All components of the workstation shall be utility grade off the shelf components and capable of operating in the BESS environment. Each workstation shall include all software necessary to access the BESS SCADA System and all functionality of the installed equipment with licensing for a minimum of five years.

Remote operation workstation shall be included for the remote operations of the BESS site. This can be achieved via remote access VPN tunneling or SSL.

5.4.3 Control and Monitoring Network

5.4.3.1 Supervisory Control

Seller shall supply BESS controllers compliant with the communication methods, protocols and datasets provided in the MODBUS and DNP3 standards. Any operational function of the BESS shall be capable of being controlled through the BESS SCADA System HMI via either local or remote operator workstations. Function parameters of any operating function shall be capable of being modified remotely or locally.

The control system shall be configurable and capable of hardware, firmware or software upgrades to provide additional operating functions in the future, if needed. Seller shall provide 10 percent additional or spare hardware capacity to add to or reconfigure the modes of operation via software applications, replacement firmware, expansion of the operating system memory or additional input/output and/or logic.

The control system shall have the necessary hardware and software such that it is compliant with the latest Owner standards and NERC CIP reliability standards for control system security requirements.

5.4.3.2 SCADA Panels

Seller shall supply one or more SCADA panels within the BESS to install the PLCs, RTUs and other devices necessary to provide the required functionality of the BESS SCADA System. Each SCADA panel shall match the design of other panels as specified in this document, including power source, fuses, terminal blocks and other equipment necessary to the function of the BESS SCADA System. In the event that there is loss of Auxiliary power, UPS shall be included in the design and installation inside the panels containing essential control and network hardware.

The SCADA panel shall allow operators to connect to the facility network via standard Ethernet port for control or diagnostic purposes.

5.4.3.3 Interoperability

The BESS System shall communicate with Owner’s corporate SCADA system via the communication methods, protocols and datasets provided in the MODBUS and DNP3 standard. Parameters to be communicated to Owner will include, but not be limited to: SOC, actual and contractual Up Reserve and Down Reserve capability when the BESS is responding under its frequency response, status of frequency response, power output in MW, energy output in MWh, available energy capacity in MWH, circuit breaker status, physical availability in percentage, voltage at Revenue Metering Point, and other telemetered information that Owner may require for system operations.

In the event of loss of communication between Owner and the BESS SCADA System, a provision must be made for the BESS systems to institute Owner's desired behavior in such circumstance, including but not limited to maintaining the previously communicated operating behavior, accepting a curtailment command from a local terminal, or a safe and linear shutdown.

5.4.4 HMI Color Coding

- Colors shall be used consistently throughout all software (HMI screens, etc.). Red shall indicate energized, closed, and live.
- Green shall indicate de-energized, open, tripped.
- Yellow shall indicate loss of communication with a device.

5.4.5 Local Control

The BESS local controls and indication requirements shall be designed in close coordination and with an approval from Owner. The BESS shall include a local control panel or console within the BESS control room. The local control panel may consist of manual control switches, with redundant control actions initiated by digital signals through a local control console. Emergency trip push buttons shall be manually operated and not require action from the digital control, as described elsewhere in these Technical Specifications. As a minimum, the following operator controls shall be located on the local control panel:

- Trip/reset for the MV circuit breakers connected to the main step-up transformer.
- Trip/reset for the PCS circuit breaker.
- Trip/reset for the DC circuit breaker/contactor.
- PCS on/off.
- BMS on/off
- Reset toggle or push-button. When reset is initiated, the control system shall resume control and proceed to the appropriate operating mode.
- Reset cut-out selector switch to disable remote or local reset signals.
- A selector switch to manually set the operating state (i.e., shutdown, disconnect and operate) and to have the control systems set the operating state automatically.
- A selector switch to manually set the operating mode (i.e., VAR control, discharge and charge) and to have the control system set the operating mode automatically.
- An emergency trip pushbutton shall be located near the control panel and be suitably protected to prevent accidental operation.

5.4.5.1 Remote Control

All functionality available through the Local Control Units shall be available via the BESS SCADA System for remote operation via Owner's SCADA connection and remote operations center.

5.4.5.2 Application-Specific Control Panels

Where appropriate, additional control panels shall be provided to control specific functionality and applications of BESS equipment. All functionality available at these panels shall be available remotely via the BESS SCADA System.

5.4.6 Integrated Automation Controls

The BESS SCADA System shall consist of established manufacturers' components such as balance of plant instruments, equipment and integral controls, process input/output equipment and companion PID "loop" controllers, equipment specific controllers, communication processors and various other necessary devices. The integrated BESS SCADA System electronic components taken together shall form the interconnecting means and functions required to; control, monitor, alarm protect, interlock, diagnose, maintain, and safely operate BESS facilities installed under an assigned project scope of work.

The installed BESS SCADA System equipment shall perform the requirements of supervisory and discrete control, equipment protection and process interlocking, component diagnostic, upset analysis, maintenance guidance, and alarm/data logging or archiving functions. Seller selected BESS SCADA System hardware and software provided shall meet all desired modes and conditions of operation, assuring a safe, environmentally compliant, and economic operation of distributed energy storage capabilities described in the scope of work.

BESS related systems startup, manual operation, shutdown, response to upsets, and other operating conditions shall be performed by: 1) intervention by an operator in any specific BESS local control point: or 2) remotely from a central or dispatch center via HMI operator positions with necessary software for that BESS facility. Once desired and stable functional BESS mode has been achieved, autonomous and selected supervisory modes shall automatically maintain, within tolerance, that selected mode until override, or manual intervention by the central or dispatch operators is enabled.

Supervisory, monitoring and mode management required BESS functions shall be gained by means of both local and/or remote operator HMI interface workstations. Functions and logic of control, protection, and interlock of BESS components and support systems shall be distributed to independent microprocessor based controllers or unit programmable controllers as feasible to minimize a single point of failure.

Likewise, interface and networking equipment between the BESS SCADA System and the separate process control and instrumentation packages of individual equipment shall be redundant for both communication functions and control power source. The intent of the Project is that the BESS SCADA System as a Supervisory and Control System HMI be designed and implemented for intuitive and understandable human interactions, high reliability, including critical system redundant BESS control and sensing elements for specific BESS systems, to enable the desired degree of safe and automated operation.

HMI interaction and autonomous control of some independent auxiliary BESS systems may be as self-contained as practical. These independent systems may be controlled through integrated distributed controllers with local control panels incorporating a self-contained HMI. Alerts, alarms and process data along with auxiliary system diagnostic information shall be sent to the BESS System. Independent auxiliary BESS system controls shall be developed upon a common architecture, with data communications protocol compatible with the BESS SCADA System. Simplicity of operator interaction and ease of maintenance should be the design criteria.

The fundamental BESS SCADA System control logic and related functions shall be segregated to the extent that failure of one or more modes of operation does not result in the failure of other functions. The BESS SCADA System controller shall be designed with regard for redundancy in critical "control loop" functions so that no single component fault will cause the failure of process-controlled equipment in any one system or cause the BESS diagnostics and protection systems to malfunction.

BESS SCADA System indication, control and alarm element redundancy shall be provided for all events or upsets in critical "control loop" functions that may directly cause a self-protection system to activate. Redundancy in the BESS SCADA System controller architecture shall be configured such that selected standby process equipment shall alarm and start automatically upon failure of the primary system. Specific standby components shall have

self-initiated automatic start capability field wired to function in parallel with fundamental BESS SCADA System control logic.

5.4.6.1 Control of Fire-Suppression Systems (if applicable)

Fire panel shall communicate with Owner's SCADA via a standard protocol as listed in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- System State
- Fire/Smoke Detector Status
- Fire System Trouble
- Countdown to discharge
- Discharge Completed
- Manual Release Request
- Abort
- Alarms/Warnings

5.4.6.2 Control of HVAC Systems

HVAC system shall communicate with Owner's SCADA via a standard protocol as listed in specifications. The minimum remote monitoring requirements shall be as follows:

- System State
- Battery cell and module temperature
- Humidity Levels
- Area Temperatures (air-cooled systems)
- Fresh air operation status (air-cooled systems)
- Coolant temperature (liquid-cooled systems)
- Ambient temperature (liquid-cooled systems)
- Coolant Flow Rate (liquid-cooled systems)
- Pump Pressure (liquid-cooled systems)
- Manual Control
- Alarms/Warnings

5.4.6.3 Control of Electrical Systems

BESS auxiliary electrical power shall communicate with Owner's SCADA via a standard protocol as listed elsewhere in this Technical Specification. The minimum remote monitoring requirements shall be as follows:

- Availability of normal and backup power sources.

5.5 Locks

The site will be a mix of Owners access control system for control houses and battery storage. All equipment shall be lockable per NERC/CIP requirements. Contractor responsible for project until COD. Owner will supply its own locks at COD.

All egress and ingress doors on buildings, and access control system shall utilize approved locking hardware and release features that shall not delay egress per NFPA 101.

All minimum NEMA 3R rated equipment enclosures shall utilize a high security padlock or a clasp lock for the following use equipment types:

- IT
- Telecom
- Inverter

Contractor shall coordinate with Owner's Security to intake and begin management of CyberLock equipment using the CyberLock system managed by Owner.

5.6 High Security Chain

Contractor shall provide high security chains on appropriate gates or other site access points. The chain will be 0.375-inch minimum, heavy-duty construction rated either "high security" or grade 100 or higher with a through-tempered alloy and square-sided construction to minimize cutting ability.

5.7 Lock Forms

The acceptable types of locks Contractor shall provide at the Project Site are:

- High Security Padlock – A padlock that meets certain levels, a minimum grade of F5/S6/K5/C4 per ASTM F883-13
- High Security Puck Lock – A padlock in the form of a hockey puck with the shackle hidden in a recess on the back side. This type of lock provides its high security by protecting the shackle itself from access, uses the same high security key as the padlock, and includes a special hasp that has a surround shield protecting the hasp tab and hole from cutting where the shackle enters the padlock

Clasp Lock or Cam lock that fits the minimum NEMA 3R rated cabinets as required.

5.8 Instrumentation Requirements

All metering, sensors, transducers and test points in the BESS shall be easily and safely accessible for calibration, maintenance and troubleshooting by Owner. Seller shall provide and install current and voltage test switches for each protective relay and for each set of metering within a CT circuit.

Seller shall provide a complete metering system for the BESS, including any required current and voltage transformers, to measure all required parameters at the Revenue Metering Point. The metering system shall be utility grade, revenue class accuracy in all components. The metering system shall be capable of measuring all required quantities, including but not limited to, BESS MVA in/out, BESS MW in/out, MWh in/out, MVAR in/out, MVARh in/out, voltage, frequency and harmonic content. Bi-directional quantities shall be measured and recorded independently. Metering of net quantities is not acceptable.

Seller shall furnish and install a complete metering system, including any required current and voltage transformers, for the AC station service. The metering system shall be utility grade, revenue class accuracy in all components. The metering system shall measure all BESS AC auxiliary station service loads, whether served from the primary or back-up AC station service system.

As a minimum, the BESS shall include instrumentation to measure and report locally and to Owner's SCADA, as applicable to the system proposed, the following:

- Battery voltage and current at sufficient points to monitor the SOH of the battery.
- Cell temperature at sufficient points recommended by the seller to represent the battery temperature.
- Charging system trouble alarms.
- Battery ground faults, including fault location.
- Temperatures in PCS, battery rooms or other critical cabinetry.
- Hydrogen detectors.
- Smoke detection.
- Fire suppression equipment status (if provided).
- Ventilation system status (if provided)
- Battery leakage current-to-ground.

Other sensors and equipment, as needed to provide for monitoring and alarms as determined by Seller. As a minimum, the following meters shall be installed on the BESS local control panel and/or be displayed on the local control console. Meters shall be digital displays and shall be no less than 1.0-inch high. These metering signals shall also be supplied to Owner's SCADA system.

- Battery voltage overall and in each string
- Battery current overall and in each string
- PCS DC power overall and from each PCS
- PCS AC power (real, MW) overall and from each PCS
- BESS net AC power (real, MW)
- BESS net AC power (apparent, MVA)
- BESS net AC power (reactive, megaVARs)
- PCS Transformer High Side Voltage (each phase)
- BESS net AC Amperes (each phase)

As a minimum, the following indicator lights or similar displays shall be installed on the local control panel or console.

- PCS breakers status
- Status of all contactors and motor-operated disconnect switches (if applicable)

At a minimum, the following alarm functions shall have indicator lights or similar displays on the local control panel or console, as applicable:

- PCS breaker trouble alarms (to be determined)
- Grid voltage present
- Battery, PCS or other equipment over temperature
- Battery ground fault (DC ground current exceeds trip level)
- Smoke/Fire detection
- Fire Suppression Activation
- Excess hydrogen level detected
- Synchronization Error Shutdown
- Control logic trouble
- Blown fuse

- Building door(s) and/or gate open
- Battery under voltage
- Module under voltage
- String under voltage

At a minimum, alarms from the battery monitoring/alarm system, if automatic, shall be displayed locally at the control panel or console and Owner's SCADA system.

The BESS control and instrumentation systems shall include provisions for determining and storing in non-volatile memory, the sequence of abnormal events, trips and/or alarms that cause the BESS to go to a disconnect or shut down state. In addition, the BESS shall include a dynamic system monitor or fault recorder to record the BESS output and waveform, and other Seller and specified parameters, for all events where the BESS is required to operate as described elsewhere in these Technical Specifications. Waveform recording shall be triggered automatically by Seller and Owner specified means and shall record a sufficient amount of pre-event data to analyze the event.

The BESS shall transmit all the above meter quantities and alarm/status indicators to Owner's SCADA system as described elsewhere in these Technical Specifications. Seller shall provide all transducers, interposing relays, or other equipment required to interface to Owner's SCADA system. Seller shall engineer and install wiring from the BESS equipment to the interface enclosure located in the control room. Such wiring shall be placed in conduits or wireway and shall be designed for ease of installation of future wiring by Owner.

5.9 Nameplates and Tagging

Nameplates shall be furnished and installed on the exterior of all equipment provided by Contractor.

Equipment designation nameplates shall be furnished and installed on the front and back interior of all cabinets and panels.

This provides for equipment designation with doors removed.

Internal nameplates shall also be furnished and installed for all cabinet and panel internal components including, but not limited to, internal devices, modules, and terminal blocks (identification scheme to be finalized during detailed design).

All nameplates shall have white background with black engraved letters and shall be firmly and positively fastened to panels or walls by means of screws.

Unless utilization of screws would affect the NEMA and/or UL rating, in which case nameplate attachment via two-part epoxy shall be permitted.

Holes for attaching nameplates with screws shall be provided regardless of the attachment method (screws or two-part epoxy).

Nameplates shall be legible from ground level.

Contractor shall provide nameplate lettering charts, which shall show engraving information for all nameplates.

6.0 ENGINEERING SERVICES AND STUDIES

6.1 Design Package

6.1.1 Engineering Design Package

Based on the review of the Project Site and infrastructure, Contractor shall design (or have designed by consulting engineers) a Project (including all layout, civil, electrical, and structural components) that will meet the required performance and that is capable of being operated in a safe, normal, reliable, and continuous manner as required by the Contract at all operating conditions and modes specified above. The system design shall comply with all applicable laws and regulations and applicable permits. Studies prepared by Contractor's third-party consultants shall be provided to Owner for review.

The Engineering Design Package shall include all items:

- Studies related to the Project, such as the geotechnical engineering report and the lightning protection study.
- Schematic and preliminary designs.
- Design calculations.
- All drawings including mechanical, fire protection, HVAC, electrical, structural, civil, and construction drawings Site plans, schematic single lines, index, and detail drawings.
- Project schedule.
- Product and manufacturer description information.
- Bill of Materials.
- Equipment details, descriptions, and specifications.
- Instrumentation and electrical lists, including preliminary circuit schedules.
- Layout and arrangement of equipment.

The Engineering Design Package shall be provided prior to commencement of construction.

Owner shall be provided an opportunity to review, comment, and approve or reject all equipment and engineering provided by the Contractor and the Subcontractor. The requirements are as follows:

Electronic copies approval drawings depicting the physical and operational characteristics of the equipment and installation must be delivered to Owner. These drawings must clearly indicate arrangement, size, function, pertinent dimensions, interface with other equipment or material type(s) or components(s), operational limitations, and job name.

Contractor shall provide for a minimum of ten (10) working days for Owner review of any drawings submitted for approval. The 10-day period will commence upon electronic receipt of drawings and end upon transmittal to the Contractor.

Contractor shall identify revisions by alpha characters, date, and subject in a revision block on the face of the submittal for each drawing during permitting and design phase.

Following return of approved drawings, Contractor, shall make corrections or revisions as required and re-submit all drawings in final form. Contractor shall not proceed with purchase or fabrication until Contractor has made all revisions to technical submittals that are required by the Owner. Each revision shall be identified by number, date, and subject in a revision block on the face of the submittal.

Owner review and approval does not constitute an approved deviation or exemption from any Project specifications, standards, or codes. Any requests for deviations or exemptions must be formally requested and approved by Owner. Any contradicting specifications in the Project documents should be formally submitted to Owner for clarification and resolution. Owner's review of technical submittals shall not be construed as a complete check but only as a check that the general method of construction and detailing is satisfactory. Review by Owner shall not relieve Contractor of his responsibility to perform the scope of Work correctly. It shall be the Contractor's responsibility to make and verify all measurements required for the fabrication and installation of equipment for the Project.

6.1.2 Maintainability

Maintenance features shall be incorporated into Contractor's design to optimize maintenance work. This shall include adequate space inside Project enclosures, adequate space around and inside DC racks removable panels in electromechanical enclosures and positioning of equipment access to allow removal of equipment, and other features that facilitate material handling. Required maintenance activities during normal operations and how it impacts system SOC and performance must be appropriately considered.

6.1.3 Operability and Safety

The Project shall be designed for primary operation via its own autonomous control. The secondary operation shall be via remote dispatch centers and the Project shall also have the capability to operate via local panels for normal startup, operation, shutdown, and emergency shutdown capability for all BESS related equipment. BESS, balance of plant equipment, power conversion, instrumentation, controls, and monitoring devices shall be designed for ease of operation and maintenance. Attention shall be given to adequate lighting, access, and ventilation of operational spaces.

The BESS and supporting equipment shall be operable from remote dispatch centers under all normal conditions including automatic startup and shutdowns as a load following mode of operation.

Where redundant equipment is supplied, the idle device shall be capable of immediately backing up the operating device. The switchover shall be accomplished automatically through a system local panel, or the BESS SCADA system.

"Single point of failure contingency" shall be incorporated into the Project design such that the loss of any single IT switch, server, or control system shall not interrupt BESS availability to the grid.

The major equipment items shall include a battery, four-quadrant bi-directional PCS, MV step-up transformer, and local, remote control/monitoring equipment, container cooling system, and integrated explosion protection systems. Additional equipment shall include battery monitoring system (BMS), rack management system (RMS, if applicable), Energy Management System (EMS) harmonic filters, HVAC system, fire suppression system, auxiliary cooling systems, wiring, connectors, protective devices, grounding, junction boxes, enclosures, instrumentation, and all other items needed for a fully functional, utility-interactive BESS, installed to meet the requirements set forth in this Technical Specification.

The standby power of the BESS should be compliance with NFPA 855.

The BESS shall be designed to produce low-cost power capacity, with low-cost energy storage as a significant secondary factor. Costs include initial cost as well as overall BESS efficiency, cell life, disposal and replacement cost, maintenance costs and other contributors to life-cycle energy cost. The BESS shall also be designed to have high reliability, Design Life as listed in Appendix 2 and designed for unattended operation with 24-hour remote monitoring and control by Operator in addition to Owner's SCADA system.

The BESS shall be “Utility Grade.” This means that all equipment shall be expected to last through the Design Life with only typical routine maintenance and planned consumable goods.

6.1.4 Project Objectives

The overall objective of this Project is to meet the use cases called out in Appendix 2 and optimize the priority of the system operation for revenue and grid requirements as specified in Appendix 2.

The BESS shall be “Utility Grade.” This means that all equipment shall be expected to last through the Design Life with only typical routine maintenance and planned consumable goods.

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6.2 Electrical System Studies

Contractor shall prepare electrical system studies as required to configure the Project and to determine control response and settings. The short circuit and arc flash models and reports shall be made in SKM and be made available for Owner’s use. Contractor shall provide the PSSE/PSCAD models related to the electrical studies. These studies, at a minimum, shall address and solve the following concerns:

- Harmonic analysis of the proposed system
- Minimum system requirements and configuration for proper operation of the BESS (i.e., requirements to stabilize a self-commutated power conversion system (PCS))
- Minimum spacing requirements between equipment to maintain safe energization and maintenance conditions
- Battery degradation and expected power output at end of life of the BESS
- Charge and discharge curves of the project for potential tie into other renewable systems
- Requirements for Volt-Ampere Reactive (VAR) support, peak shaving, battery charging and other support services as described in this Technical Specification.
- Safety requirements for operation compliance with applicable codes and standards

6.2.1 Grounding System Study

Contractor shall perform studies to determine the parameters for the Project’s grounding system in WinIGS, CDEGS or equivalent.

6.2.2 Required Dynamic Models

6.2.2.1 Frequency Models

- Contractor shall prepare individual models of the fundamental positive sequence behavior of the BESS.
- Owner shall be provided PSSE models in the version required by the interconnection authority that accurately represent the control characteristics and dynamic behavior of the BESS in response to balanced voltage and frequency disturbances. This model shall be provided with all available information once the 60% design is complete and refined to reflect the final design configuration at IFC.

- Fully detailed equivalent models are required; generic models from the WECC approved model library are preferred if they can accurately model the BESS behavior in response to voltage disturbances and system frequency disturbances.
- The PSSE models shall be validated for accurate representation of disturbances that are within the model's appropriate range of application, using a validated electromagnetic transient model or full-scale testing.
- The PSSE models shall be fully documented.
- The PSSE models must be non-proprietary and shall be accessible to other utilities, system operators, asset owners, and other entities associated with the interconnection.
- The PSSE models shall be updated by Contractor prior to any change to the inverter controls or control parameters that affect the dynamic performance.
- Contractor shall ensure compatibility of the provided PSSE models with the version of PSSE that Owner utilizes at the start of commercial operation. Upgrades and modification of the models to maintain compatibility with ongoing PSSE versions shall be the responsibility of Contractor over the lifetime of system performance.

6.2.2.2 Model Inputs

The PSSE model should reflect the current design of the power plant and a general network equivalent or detailed network, depending upon interconnection study requirements.

For design purposes, the power system characteristics, at the Project location, and for which the BESS will be required to provide rated output, shall be considered are as follows:

- Maintain frequency and voltage within the utility set limits
- Supply required real and reactive power at a power factor range of -1 to +1.

6.2.3 Lightning Protection Study

Contractor shall provide a lightning risk assessment performed to Industry Standards by a certified lightning protection professional, as outlined in Section 3.18.2 External Lightning Protection System (LPS). The results of this assessment shall be the basis for determining the requirements and extent of the facility LPS and a surge protection system that provides protection of the batteries, DC power circuit, PCS, measurement control and communications systems, and other major electrical equipment including transformers.

6.2.4 Interference and Harmonic Suppression

Contractor shall perform studies and analysis to determine required AC harmonic filter types and ratings if filters are required to meet the harmonic specifications. In addition, these studies shall be used to demonstrate that the AC filters do not cause any resonance with Owner's power system and that the harmonic distortion limits can be met by the filters designed by Contractor. Contractor shall design the Project to be completely compatible with and their associated controls. Owner will not be required to change or modify the existing system to accommodate the Project. However, actual compliance will be based on field measurements after commissioning.

6.3 Hazard Mitigation Analysis

A Hazard Mitigation Analysis (HMA) shall be conducted by a qualified engineer or consultant, appointed by Contractor, in accordance with NFPA 855 (2023) and IFC (2021) requirements and provided to Owner for review

and approval. The HMA shall be provided for the initial design and, as a minimum, shall be updated for the 60% design and final design. This analysis is an evaluation of potential BESS failure modes and the safety-related consequences attributed to the failures. At a minimum, the analysis shall evaluate the consequences of the

- Thermal runaway conditions
- Failure of the BMS
- Failure of the required ventilation/cooling system or exhaust system
- Failure of the required systems (fire, gas, smoke, exhaust or ventilation, and deflagration)

The HMA shall also include a design basis that describes all the mitigations to these events (including all active and passive systems described in this specification) as well as any associated assumptions and/or calculations.

6.4 Emergency Response Plan (ERP)

Contractor shall provide an Emergency Response Plan (ERP). The ERP shall establish procedures in place to prepare for and respond to an emergency at the BESS Project. The Plan delineates emergency response responsibilities of personnel and identifies mutual aid resources available by off-site responders. The plan identifies training provided to site personnel in responding to emergencies and identifies drill procedures and incident investigation procedures. Coordination and approval of an emergency response plan consistent with the guidance of NFPA-855 for the local fire protection agency is required prior to acceptance by Owner.

6.5 Decommissioning Plan

Contractor shall provide a Decommissioning Plan to provide a description and strategy for to the de-commissioning of the Project at End-of-Life EOL). Contractor shall include descriptions for configuration to begin disassembly, making the energy storage components safe at all times, disconnection and disassembly sequence, and packaging/handling/ shipping requirements of the BESS. A recycling plan for the battery packs shall be included. This is not required for the electrical equipment common to commercial/industrial/utility power systems unless directly related to handling of the energy storage components.

7.0 TESTING, COMMISSIONING AND START-UP

7.1 General

Contractor shall furnish a commissioning plan and process outlining the tasks, processes, procedures, and deliverables necessary to commission the Project, conduct the Project Performance Tests, and prove the function and performance of the Project, including its components.

The plan will specify the tests and processes required to be completed and performed before Mechanical and Substantial Completion, including all quality assurance and quality control (QA/QC) tests and all Project Performance Tests. Contractor shall perform a random pile/pull testing campaign in accordance with ISO-2859-1.

Contractor shall provide the Commissioning Plan to Owner reasonably prior to the commencement of Contractor's commissioning activities. If Owner provides comments, Contractor shall revise the Commissioning Plan to address Owner's comments and resubmit the revised Commissioning Plan to Owner for review and approval. This procedure shall be repeated until the Commissioning Plan, as modified, is approved by Owner. Owner shall promptly notify Contractor in writing when it has approved the Commissioning Plan. Owner shall be given reasonable advance notice of and a reasonable opportunity to review, monitor, and witness all commissioning

and testing activities performed as part of the Work. Contractor shall provide Owner a schedule of all factory and Project Site tests, inspections, and performance tests.

Owner and its Representatives shall be permitted access to the Project Site at all times and shall be permitted to visit factories during the manufacturing of equipment, materials, and components for the Project and to witness factory tests and inspections. Owner may contract with one or more third parties to conduct individual inspections and tests at any time to confirm test results and to verify that the Project has been installed and constructed in accordance with the requirements of the Agreement, and this Scope Book.

Contractor shall furnish all supervision, technical personnel, labor, normal and special test instruments, tools, equipment, spare parts and consumables and materials required to perform the electrical, instrumentation and mechanical checkout and testing of components and equipment to verify the initial operation of the systems and equipment in Contractor's scope.

Contractor shall perform and successfully complete Site acceptance testing following Commissioning Tests on systems and equipment to demonstrate the safety, operability and reliability of the systems and equipment within specified design limits according to the contract, engineering drawings, documents, and specifications. All normal and necessary tests shall be conducted using written test procedures signed and verified by Contractor.

For each test scope, the Contractor shall provide a manual describing the test to perform and criteria for success or failure. Test manual(s) shall require Owner review and approval. The Contractor shall be required to provide a certificate for successful completion of each test scope.

Overall administration of the commissioning and testing activities for OEM equipment shall be carried out by the Contractor with the support provided by each original equipment manufacturer (OEM).

Contractor shall coordinate with Owner for all tests where the BESS is to be connected to Owner's power system. No such tests shall be performed unless permission by Owner has been granted. The tests must be performed in a fashion to minimize unanticipated disturbances on the power system. These tests may have to be performed during the night or low load periods for certain types of tests.

7.2 Commissioning Tests

Contractor shall perform Commissioning Tests per ESIC Section 4.0 ESS Commissioning.

The tests shall include, but are not limited to:

- Grounding System Testing
- Megger Tests
- High Pot Tests (or VLF)
- Functional Tests of all Controls, Protection Relays, and Interlocks
- Functional tests of all Safety Devices and Alarms
- AC/DC Motor Tests
- Battery and UPS Test (with TA Support)
- PCS Test (with TA Support)
- Switchgear Test
- Control Circuit Checkout
- Instrument and Loop Calibration
- Fire protection test

- Functional test of the Remote Shutdown Panel
- SCADA system
- All manufacturer recommended equipment tests
- Safety plan during startup and commissioning.
- Review of all QA/QC testing on the DC and AC sides of inverters.
- Detailed procedure for Project startup, including switching sequencing.
- Confirm testing and energizing inverters in conformance with manufacturer's recommended procedures; note operating voltages; and confirm inverter is performing as expected. (with TA Support)
- Testing the communication system for offsite monitoring (with Buyer and TA Support).
- Testing the Project metering and protective relaying to verify they meet utility requirements.
- Insulation check of auxiliary cables.
- Verification of operation of station auxiliary power distribution.
- DC distribution system, battery, and battery charger.
- Verification and tuning of cooling system (if required).
- Check of operation and indications of circuit breakers disconnect and earthing switches.
- Capacitance check of capacitor banks (if required).
- Verify proper operation of all pump fans and motors.
- Verify proper operation of heating, ventilation, and lighting systems.
- Check of current and voltage transformers.
- Overall check of trip operations from protections to breaker.
- Check of circuits through the local control interface and the remote interface.
- Detailed procedure for interface and initialization with the grid and completion of all Transmission Provider forms to be provided prior to construction.
- Documentation of successful startup and commissioning procedure.
- Written notification submitted by Contractor to Owner that the completion of Acceptance Testing and Commissioning has occurred.

Additional required procedures include, but are not limited to:

- Start-up Program Organizational Procedure
- Safety Tagging Procedure
- Confined Space Entry Procedure

7.3 ESS Qualification, Evaluation and Safety Testing

Seller shall provide ESS Qualification, Evaluation and Safety Tests per ESIC Section 5.0 ESS Qualification, Evaluation and Safety Testing.

Where a specific testing protocol is outlined in the ESIC Manual, then it shall be used. If a specific testing protocol is not outlined in the ESIC Manual, then the Supplier shall create a project-specific test protocol for Buyer's review and approval.

7.4 Systems Specification Verification

Seller shall provide ESIC Section 6.0 Systems Specification Verification.

Where a specific testing protocol is outlined in the ESIC Manual, then it shall be used. If a specific testing protocol is not outlined in the ESIC Manual, then the Supplier shall create a project-specific test protocol for Buyer's review and approval.

6.1.1 Available Energy Capacity

6.1.2 Charge Duration

6.1.3 Rated Continuous Power

6.1.4 Auxiliary Load Determination and Monitoring

6.1.5 Round Trip Efficiency

6.2.1 Self-Discharge Rate

6.2.2 Startup and Shutdown Time

6.2.3 Response, Rise, and Settling Time

6.2.4 Synchronization

6.2.5 Harmonic Distortion

6.3 Operational Performance Test

7.5 Duty Cycle Performance Testing Procedures

Seller shall provide ESIC Section 7.0 Duty Cycle Performance Testing Procedures.

Where a specific testing protocol is outlined in the ESIC Manual, then it shall be used. If a specific testing protocol is not outlined in the ESIC Manual, then the Supplier shall create a project-specific test protocol for Buyer's review and approval.

7.6 Functional Capability Evaluation

Seller shall provide ESIC Section 8.0 Functional Capability Evaluation.

Where a specific testing protocol is outlined in the ESIC Manual, then it shall be used. If a specific testing protocol is not outlined in the ESIC Manual, then the Supplier shall create a project-specific test protocol for Buyer's review and approval.

7.7 Performance Verification

The total system performance verification plan shall be submitted to Owner for review and approval sixty (60) days prior to initiation of BESS performance tests.

These tests shall demonstrate that the BESS capabilities, efficiencies, response, and features conform to Exhibit 4 – Functional and Performance Requirements.

Owner will not accept the BESS until all acceptance tests have been successfully completed and all provisions of the contract have been met.

7.8 Other Compliance Tests

Contractor is responsible for obtaining before and after BESS installation measurements to ensure the Project complies with this Technical Specification in the following areas. Owner reserves the right to perform (or request others to perform), at Owner's expense, identical compliance test measurements for the following:

- Broadband frequency signal strength and noise voltage
- Harmonic voltages and currents
- Audible noise measurements

7.9 Commissioning and Startup

Contractor shall provide a commissioning and startup plan for the Project. Contractor shall coordinate with Owner and the OEMs to develop an acceptable commissioning plan that includes a checkout and startup procedure. This work will assure that systems are activated in a manner that is safe for personnel as well as for the equipment, that Contractor work is complete and according to the contract documents, and that the systems perform as required by the contract documents and are ready to be turned over to Owner. As the construction and installation of the systems nears completion, Contractor and Owner shall prepare punch lists and conduct system walk-downs, sub-system and system checkouts, startups, testing, and turnovers. The final approved Acceptance Test and Commissioning Procedures shall, at minimum, include the following:

- Safety plan during startup and commissioning.
- Review of all QA/QC testing on the DC and AC sides of inverters.
- Detailed procedure for Project startup, including switching sequencing.
- Confirm testing and energizing inverters in conformance with manufacturer's recommended procedures; note operating voltages; and confirm inverter is performing as expected.
- Testing the system control and monitoring system to verify that it is performing correctly.
- Testing the communication system for offsite monitoring.
- Testing the Project metering and protective relaying to verify they meet utility requirements.
- Detailed procedure for interface and initialization with the grid and completion of all Transmission Provider forms to be provided prior to construction.
- Documentation of successful startup and commissioning procedure.
- Written notification submitted by Contractor to Owner that the completion of Acceptance Testing and Commissioning has occurred.

Contractor shall coordinate the interconnection and back feed power from the transmission system.

All proper protection systems shall be installed, including fusing, relaying and lightning protection, as applicable, to ensure the safe and reliable operation of the collection system. Collection system grounding shall meet all applicable codes, standards, and guidelines (including NEC) and shall ensure the safe and reliable operation of the collection system

7.10 Synchronization Procedures and Requirements

All testing shall be done in accordance with the LGIA and all the requirements to achieve electrical and mechanical completion of the Project.

7.11 Mechanical Completion

Contractor shall achieve Back feed and assure that the Project has been synchronized with the Owner Interconnection Facility before conducting the Capability Verification, Guarantee Design Conditions, and Guaranteed Performance Tests.

Mechanical Completion means:

- The scope of work is mechanically, and electrically complete and pre-operational testing has been successfully completed
- The components and systems included in the scope of work have been assembled, constructed, and installed and the project is ready to commence commissioning, testing, and operation
- All required system interfaces for the scope of work are complete and all process and safety systems for the scope of work are ready for operational testing
- Contractor has completed the scope of work other than the completion of any punch list items shown on the punch list agreed to between Contractor and Owner, including the value of those items to be completed or corrected prior to substantial completion
- The scope of work is in compliance with all Laws and applicable Permits

8.0 MAINTENANCE

8.1 General

Operations and Maintenance requirements shall be in compliance with the O&M contract and Contractor must meet the technical specifications and requirements of the equipment manufacturers. All equipment and construction documentation to be compiled into O&M manuals. Contractor to provide O&M procedures to properly guide the Owner for safe operations of the site.

The Project shall be designed so that regular planned maintenance may be carried out by either Contractor (under a separate contract) or by the Owner or by Others. Full Operations and Maintenance manuals for all equipment, the fully integrated facility and site tasks are required by the Contractor.

8.2 Maintenance Prior to Acceptance

Prior to Final Completion of the Project, the Contractor shall be responsible for maintenance of all components of the Project.

8.3 Maintenance Procedures

O&M procedure periods shall be identified to be consistent with manufacturer specified intervals. The BESS is intended to be unstaffed on a day-to-day basis. Expected O&M intervals for all equipment shall be provided.

All equipment planned maintenance for the period of the O&M Contract shall be identified prior to Commercial Operations date and presented in an O&M Plan, in accordance with Vendor’s maintenance requirements.

8.4 Spare Parts

Contractor shall submit a complete spare parts list needed for initial operation ('start up spares') and operation with prices.

The Contractor shall provide the recommended priced spare parts list for the BESS Equipment a minimum of six (6) months prior to the Guaranteed Delivery Date of the BESS Equipment. The recommended spare parts list shall consist of a complete listing of the name of the part, part numbers, recommended quantities, and unit price. The basis for the recommended spare parts and quantities shall be made for five (5) years of operation.

Contractor shall provide a recommended spare parts list, including prices and availability, as part of this proposal. Contractor shall also identify spare parts that Contractor recommends should be stocked locally to ensure prompt repair due to any failure that can be reasonably expected, considering the length of time required to obtain replacement parts. Owner will determine the need for and purchase separately all spare parts.

All spare parts for equipment covered by this Technical Specification shall comply in all aspects with the requirements of this Technical Specification. This includes documentation identical in kind and format to that required for the original equipment or material. Each of the spare parts shall be fully identified by reference to the spares list, part number, cost, and manufacturer drawing number.

If Contractor, their suppliers, or sub suppliers cease manufacture of any of the spare parts, or if for any reason any spare part will become unavailable at any time during the Design Life of the facility, as specified in Table 1, Contractor shall notify Owner in writing at least 180 days prior to the unavailability of such spare parts. Contractor shall provide Owner the opportunity to purchase sufficient stock of spare parts to support the system for its expected life.

The initial complement of equipment shall include a supply of chemicals as may be needed to neutralize small electrolyte spills.

Contractor shall provide, receive, store locally, distribute and restock spare parts, materials, test equipment, instruments, tools, and consumables required for start-up and operation of the systems and equipment within its scope until Substantial Completion.

9.0 TRAINING AND TOOLS

9.1 General

Contractor shall provide training for the Project as specified below. Contractor shall determine the content and duration for each training session. The suggested class durations in this Technical Specification are meant to illustrate the level of training expected. Performance evaluation testing of all trainees (i.e., a written test) is required for all classes. Contractor's minimum requirements for Training are:

- Submit training plan
- Plan shall be reviewed and approved by Owner
- Lesson Plan for each topic shall be provided
    - Learning Objectives
    - Instructor Qualifications

    - Classroom training objectives w/safety
    - Field training objectives w/ safety
    - Evaluation: Either test learning or demonstration
- Record keeping
    - Program
    - Each participant
- Certification of Training Completion

Training schedule shall be agreed upon prior Commercial Operational Date.

9.2 Operator Training

Contractor shall provide the necessary training in proper operation of the Project and related equipment. This training shall be conducted after completion of the Project performance verification testing, but before system commissioning. It is anticipated that this session will last one to two days and the Contractor will provide an outline and syllabus prior to the session. This session will be limited to a maximum of 20 people. Emphasis shall be placed on safety and hands-on operating experience interspersed with the critical background as necessary, including switching procedures and emergency response training.

9.3 Maintenance Training

Contractor shall provide necessary training in maintenance of the Project and related equipment if maintenance by Owner option is chosen. The maintenance training shall be scheduled after successful completion of the availability guarantee period. It is anticipated that this session will last one to two days and the Contractor will provide an outline and syllabus prior to the session. This session will be limited to a maximum of 20 people. The maintenance training shall include, but not be limited to:

- Safety and grounding procedures
- Periodicity of inspections and maintenance
- Normal maintenance methods
- Repairs and replacement
- Diagnostic procedures
- Equipment calibration
- Re-energization
- Special tests
- Spare parts
- Special tools

9.4 Training Schedule

Training schedule shall be agreed upon prior Commercial Operational Date

9.5 Spare Parts

Seller shall submit a complete spare parts list needed for initial operation (‘start up spares’) and operation with prices.

The Supplier shall provide the recommended priced spare parts list for the BESS Equipment a minimum of six (6) months prior to the Guaranteed Delivery Date of the BESS Equipment. The recommended spare parts list shall consist of a complete listing of the name of the part, part numbers, recommended quantities, and unit price. The basis for the recommended spare parts and quantities shall be made for five (5) years of operation.

9.6 Tools and Equipment

Contractor shall provide all “special tools and equipment” for maintenance and operation which are not normally or readily available. Contractor shall submit a complete list of tools and equipment needed for erection/installation and maintenance and a list of special tools and equipment that will be provided, including prices. Special tools and equipment shall become the property of Owner at the completion of the BESS installation. Owner reserves the right to purchase additional quantities of tools if desired.

9.7 O&M Documentation

For any equipment provided by Contractor, Contractor shall supply Owner with all manuals and/or handbooks (in printable electronic format) that provide, either in a single manual or handbook or collectively, complete operating and maintenance instructions (including inventories of spare parts and tools and parts lists with ordering instructions) for each major piece of equipment and system of the Project. O&M suggested schedule shall be coordinated among major equipment.

9.8 Turnover Documents Including O&M Manuals

For any equipment provided by Contractor, Contractor shall provide Owner with three paper copies and one editable electronic copy of all manuals.

The electronic copy of the manuals shall be organized in folders consistent with tabs in the paper manuals. Electronic copies of installation, operation and maintenance manuals shall be organized from the most general information in the top directory to the most specific information in the lowest level folder. The top-level folders shall include a document containing a directory of the subfolders describing the contents of every subfolder. Electronic copies of Installation, Operation and Maintenance manuals shall be organized by project, system, subsystem, equipment, and components. Manufacturers or vendors’ electronic manuals shall be delivered as individual files. Contractor shall not merge or combine manufacturer and vendor provided files containing manuals.

The manuals to be provided shall include:

9.8.1 Design Manuals

Design manuals shall contain the following items:

- Drawing List, Drawing and Specification Identification System, Units of Measurement and Formats
- System List and Equipment Numbering System
- List of applicable drawings
- System design requirements
- System and equipment descriptions
- Equipment lists itemizing type, performance, and technical requirements.
- Overall performance data

9.8.2 Start Up, Operation and Shutdown Manual

Contractor shall provide a startup, operation, and shutdown manual for the BESS, including comprehensive and complete procedures for checkout, startup and testing of the Project and will include as a minimum the following items:

- BESS start-up and shutdown procedures
- Startup schedule
- Startup organization chart
- Administrative procedures
- Data sheets
- Test procedures for all tests required for Mechanical and Electrical Completion and Final Acceptance.
- Turnover sequences and procedures
- Safety clearance procedure
- Work responsibility matrix

9.8.3 Installation, Operation, and Maintenance Manuals

Contractor shall provide installation, operation, and maintenance manuals for the Equipment, including information typically supplied for equipment and/or systems such as the following items:

- System or equipment startup and shutdown procedures
- Description / design criteria of each item of equipment
- Nameplate information and shop order numbers for each item of equipment and components thereof
- Operating procedures and instructions for commissioning, startup, normal operation, shut down, standby and emergency conditions and special safety precautions for individual items of equipment or systems
- List of any start-up prerequisites
- Normal range of system variables
- Operating limits and hazards for all equipment and systems including alarm and trip set points for all devices
- Testing and checking requirements
- Effect of loss of normal power
- Tolerance of electrical supply frequency variation
- Final performance and design data sheets, specifications and performance curves for all equipment including test data and test curves
- Preventive maintenance schedule and maintenance instructions for equipment including standard and special safety precautions and special conditions that trigger non-scheduled maintenance
- Dismantling and assembly procedures for equipment with associated tests and checks prior to returning equipment to service
- Detailed assembly drawings to complement assembly procedures mentioned above including parts lists and numbers for replacement ordering
- Cleaning procedures, including frequency, equipment, resources needed, water source, etc.
- Specifications for any gases, chemicals, solvents, or lubricants

- Drawing showing space provided for equipment maintenance for equipment and any fixed facilities for maintenance
- Methods for troubleshooting
- List of maintenance tools furnished with equipment
- Installation instructions, drawings, and details
- Vendor drawings as appropriate
- Installation, storage, and handling requirements.

The above requirements are a minimum; however, requirements which are clearly not applicable to specific items or components may be deleted, however, any additional information which is necessary for proper operation and care of the equipment shall be included.

9.9 Supplemental Appendix Information

For Appendix 3 and in accordance with the other terms of this Agreement, Seller shall update all applicable cells left blank as of the effective date in the Appendix with accurate data and content. Seller shall provide to Buyer periodic updates to each Appendix at the intervals specified in the Agreement for Seller's updates to the schedules. However, no cells may be updated within 90 days of closing without the prior written agreement of Buyer and Seller.

10.0 DOCUMENT SUBMITTALS

10.1 Document Submittals by Contractor During Project Design

Contractor shall prepare and submit to Owner the following documents during the design and engineering phase of the Project. Refer to Table 5 for requirements during design.

Table 5 — Document Submittals by Contractor During Project Design

Item	Description	Notes
10.1.1	Monthly progress reports	Monthly
10.1.1.1	Weekly meetings beginning at FNTP that show weekly progress of project and the following week project schedule and production plans.	Weekly
10.1.2	Overall Project Schedule showing an approximate start date, major milestones, and durations for Contractor's work. This shall include design and engineering work, procurement, and delivery of major within the scope equipment, FAT of major within the scope equipment, site surveys and studies, site preparation, construction activities, SAT and commissioning activities, and performance tests	30 days after FNTP, then with each monthly report
10.1.3	Drawings and documents provided with permit applications and copies of all correspondence exchanged prior to and after the closing date between or on behalf of Contractor and any governmental authority with respect to the Project	tbd
10.1.4	The initial, baseline Environmental Assessment (subject to the main body of the Agreement)	tbd
10.1.5	Project Plot Plan with landscaping notes	tbd
10.1.6	General arrangement drawings	tbd
10.1.7	Plans, sections, and details for each system	tbd

Item	Description	Notes
10.1.8	Underground arrangement drawings (mechanical, electrical, and civil)	tbd
10.1.9	Terminal point list	tbd
10.1.10	One-line diagrams	tbd
10.1.11	Three-line diagrams	tbd
10.1.12	Cable layouts	tbd
10.1.13	Electrical load flow studies	tbd
10.1.14	Electrical grounding calculations	tbd
10.1.15	Protective relaying settings and coordination study	tbd
10.1.16	Electrical short circuit analysis	tbd
10.1.17	Grading and drainage drawings, including hydrology report	tbd
10.1.18	Geotechnical Investigation Report	tbd
10.1.19	Foundation and structural steel drawings sealed by a PE licensed in the state where the project is located	tbd
10.1.20	Structural calculations for BESS foundations, including: • *Load derivations* • *Corrosion calculations* • *Detailed structural steel code checks* • *Pile load test data* • *Connection calculations*	tbd
10.1.21	Structural calculations for PCS foundations	tbd
10.1.22	Structural calculations for substation structure and foundation calculations	tbd
10.1.23	Specifications and datasheets for Battery racks, modules, cells, PCS, combiner box, cables, wire management, and other equipment datasheets	tbd
10.1.24	(If applicable) Construction pile installation QA/QC procedure, including: • *Pile installation tolerances* • *Out of tolerance remediation plan* • *Pile rejection criteria for damage to pile, extreme out of tolerance* • *Pile testing campaign for sampling population and acceptance criteria, pile load test procedure*	30 days prior to commencement of pile installation
10.1.25	System description of the main systems for the Project	tbd
10.1.26	Start-up and shutdown diagrams	tbd
10.1.27	Preliminary Commissioning Program with procedures for respective tests and activities	tbd
10.1.28	Draft project performance test procedures	tbd
10.1.29	Preliminary O&M philosophy	tbd
10.1.30	Property Protection Design Basis Document as described in Appendix 2	tbd
10.1.31	Project Site Security Plan	120 days prior to construction commencement date
10.1.32	Initial Point list for SCADA system	tbd

Item	Description	Notes
10.1.33	Project design basis (including design criteria)	At 30% design
10.1.34	Equipment receiving, handling, storage, and installation instructions and manuals	120 days prior to construction commencement date
10.1.35	Corrosion engineering report	At 30% design
10.1.36	Field touch-up procedures of painted equipment	120 days prior to construction commencement date
10.1.37	Site finish grade	At 30% design
10.1.38	I&C drawings (instrument list, network diagram, control panel layout, architecture, alarm list))	tbd
10.1.39	MSDS documentation	120 days prior to construction commencement date
10.1.40	Visual weld inspection procedures	120 days prior to construction commencement date
10.1.41	HVAC equipment	tbd
10.1.42	Electrical package including cable schedule	tbd
10.1.43	Transformer recommended assembly and filling procedure	tbd

Contractor is responsible for completing all engineering for the Plant. The Contractor shall prepare and submit to the Owner for approval, general arrangement and detailed design drawings of the Plant and parts thereof; drawings shall be dimensioned and generally drawn to scale in accordance with good industry practice. A professional engineer of record in the state where the project shall be constructed shall seal all design drawings, specifications, and calculations. Drawings submitted shall comply with this Technical Specification, all applicable laws, regulations, and applicable permits.

Submission of all documents shall be in electronic format through a mutually agreed-upon document manager. Documents shall be submitted for 30% design, 60% design, 90% design, issued for construction, and as built. A preliminary list of documents and drawings to be submitted to the Owner for review and approval is given below in the Submittals tab. The provided document list may not be inclusive of all documents that need to be submitted. The Contractor shall be responsible for providing all documentation necessary to fully characterize the design, construction, and operation of the Plant.

10.2 Document Submittals by Contractor During Project Construction

Contractor shall prepare and submit to Owner the following documents from and after the construction commencement date through substantial completion. Refer to Table 6.

Table 6 - Document Submittals by Contractor During Project Construction

Item	Description	Due
10.2.1	Monthly progress reports in accordance with Appendix 11	Monthly
10.2.2	Weekly construction status report in accordance with Appendix 11	No later than 5 PM Every Tuesday
10.2.3	Copy of all Project Work permits and Project operational permits when obtained	As obtained

10.2.4	Final Commissioning Program	30 days prior to Mechanical Completion
10.2.5	Final performance test procedure	Substantial Completion
10.2.6	Final O&M philosophy	Substantial Completion
10.2.7	Construction Test Reports, including compaction test results and related documents for roads, substation pads, and at non-pile supported foundations and structures; in situ pile test results and related documents	Substantial Completion
10.2.8	System graphics	Substantial Completion
10.2.9	Certificate of achievement of mechanical completion	Substantial Completion
10.2.10	Final post-mechanical completion punch list	Substantial Completion
10.2.11	OEM FAT and shop test reports for equipment listed in Scope Book Section **Error! Reference source not found.**	Prior to initial energization
10.2.12	Environmental Assessment	No earlier than 180 days prior to closing
10.2.13	Environmental test reports, inspections, and records	Closing
10.2.14	Training manuals	Substantial Completion
10.2.15	Coating specifications	Substantial Completion
10.2.16	Paint color samples	Prior to Mechanical Completion

10.3 Document Submittals by Contractor at Substantial Completion

Contractor shall prepare and submit to Owner the following documents as shown in Table 7 prior to Substantial Completion.

Table 7 – Document Submittals by Contractor at Substantial Completion

Item	Description	Due
10.3.1	Punchlist in accordance with the Agreement, including the agreed punch list holdback amount	Substantial Completion
10.3.2	Draft as-builts for all drawings and documents submitted during the engineering and design phase and during project construction	Substantial Completion
10.3.3	Power production estimates	Substantial Completion
10.3.4	OEM performance field test reports	Substantial Completion
10.3.5	Software licenses and Project intellectual property rights	Substantial Completion
10.3.6	Instrument calibration list and certificates	Substantial Completion
10.3.7	Protective relay settings list	Substantial Completion
10.3.8	Equipment list	Substantial Completion
10.3.9	Equipment O&M manuals	Substantial Completion
10.3.10	Construction turnover documentation	Substantial Completion
10.3.11	Commissioning turnover documentation	Substantial Completion
10.3.12	Input and output list	Substantial Completion
10.3.13	SCADA FAT results	Substantial Completion

10.3.14	Commissioning test results, bills of material, and drawings to demonstrate compliance with NERC standards (reference Appendix 10)	Substantial Completion
10.3.15	Project Site specific operating procedures	Substantial Completion
10.3.16	Arc flash study	Substantial Completion
10.3.17	NERC test reports and calibration records (reference Appendix 10)	Substantial Completion
10.3.18	All Project Performance Test analysis, reports, and results	Substantial Completion
10.3.19	All Project Functional Test analysis, reports, and results	Substantial Completion
10.3.20	All permits	Substantial Completion
10.3.21	All signed and approved design change requests	Substantial Completion
10.3.22	Invoices	Substantial Completion
10.3.23	Spare parts and consumables list	16 weeks prior to Substantial Completion

Contractor shall provide to Owner 'Red-Lined' drawings with all 'as built' changes made by the Contractor prior to Commissioning Team leaving site. A station copy shall remain in the Contractor's trailer during the project phase and shall be stored in the control enclosure house once the Project is turned over to Owner as an accurate set for operations personnel.

10.4 Document Submittals by Contractor at Final Completion

Contractor shall prepare and submit to Owner the following documents as shown in Table 8 at Final Completion.

Table 8 – Document Submittals by Contractor at Final Completion

Item	Description	Due
10.4.1	Final as-builts for all drawings and documents submitted during the engineering and design phase and during project construction	Final Completion
10.4.2	Red line drawings	Final Completion
10.4.3	Operator and maintenance personnel training records	Final Completion
10.4.4	Final equipment O&M manuals	Final Completion
10.4.5	Final system descriptions of as-built systems	Final Completion

10.5 OEM Documents Provided by Contractor During Project Design

Contractor shall prepare and submit to Owner the following documents during the design and engineering phase of the Project. Refer to Table 8 for requirements during design.

Table 8 — Document Requirements During Project Design and Engineering Phase of the Project

Item	Category	Description	Documentation Owner	Notes	Submittal Date
1.	Battery	NFPA 68 and/or NFPA 69 evaluation reports	Battery Supplier		

Item	Category	Description	Documentation Owner	Notes	Submittal Date
2.	Battery	UL9540A test results (cell, module, unit levels)	Battery Supplier		
3.	Battery	UL1973 certification	Battery Supplier		
4.	Battery	UL 9540 certification	Battery Supplier		
5.	Battery	Fire protection philosophy overview, component bill of material & datasheets	Battery Supplier	To evidence compliance with NFPA 855 and IFC	
6.	Electrical Studies	Arc flash hazard study	Battery Supplier PCS Supplier MVT Supplier	Battery container, PCS, and MVT to be evaluated for arc flash including recommendations for PPE. Units to be installed with proper arc flash signage	
7.	Electrical Studies	Short circuit contribution	Battery Supplier PCS Supplier MVT Supplier	Components able to contribute a short circuit to the balance-of-plant shall provide such values to the Engineer of Record	
8.	General/All	Detailed delivery schedule and shipping plan	Battery Supplier PCS Supplier MVT Supplier	To include any warehousing requirements, staging of deliveries, and shipment tracking information	
9.	General/All	Decommissioning Plan	Battery Supplier PCS Supplier MVT Supplier	Guidance for decommissioning of system at end of life	
10.	General/All	Points list and key set points	Battery Supplier	For BMS and EMS (Including details of alarm and control functions of BMS and response to fault events.)	
11.	General/All	Remote monitoring agreement (if applicable/offered by OEM)	Battery Supplier		
12.	General/All	LTSA agreement (if applicable/offered by OEM)	Battery Supplier PCS Supplier MVT Supplier	To discuss remote monitoring requirements for maintaining equipment warranty (standard expectations) and remote monitoring supplemental options (for preventative maintenance LTSA, etc.)	

Item	Category	Description	Documentation Owner	Notes	Submittal Date
13.	General/All	Non-site specific Hazard Mitigation Analysis inputs	Battery Supplier PCS Supplier MVT Supplier	Supplier to provide the Failure Modes and Effects Analysis of the product and other inputs for conducting the site-specific Hazard Mitigation Analysis (by Others)	
14.	General/All	Emergency response / first responder training material	Battery Supplier PCS Supplier MVT Supplier		
15.	General/All	Seismic Qualification	Battery Supplier PCS Supplier MVT Supplier	Per IEEE 693	
16.	General/All	Factory Acceptance Test results	Battery Supplier PCS Supplier MVT Supplier	Battery unit, PCS unit, and MVT, as well as any tests pertinent to the skidded assemblies	
17.	General/All	Product drawings	Battery Supplier PCS Supplier MVT Supplier		
18.	General/All	Technical specifications (including nameplate information, datasheet, etc.)	Battery Supplier PCS Supplier MVT Supplier		
19.	General/All	Warranty information and recommended spare parts	Battery Supplier PCS Supplier MVT Supplier		
20.	General/All	Operations & Maintenance Manual	Battery Supplier PCS Supplier MVT Supplier	Recommended preventative maintenance, LOTO procedure, etc.	
21.	General/All	Installation & Commissioning Manual	Battery Supplier PCS Supplier MVT Supplier	Handling and storage guidance, lifting and rigging guidance, grounding and wiring guidance, etc.	
22.	General/All	Site-Specific Commissioning Plan	Battery Supplier PCS Supplier MVT Supplier	To detail expectations before commissioning can commence, expected labor hours per task, isolation and energization needs/procedures, etc.	

Item	Category	Description	Documentation Owner	Notes	Submittal Date
23.	General/All	Independent Engineer Due Diligence - Technology Items	Battery Supplier PCS Supplier MVT Supplier	"* Bankability Reports	
24.	General/All	Equipment sourcing / country of origin information	Battery Supplier PCS Supplier MVT Supplier	* Deployment history of the battery and PCS technology, including discussion of fleet operational availability and resolution of any recurring issues	
25.	General/All	IP Escrow Agreement	Battery Supplier PCS Supplier MVT Supplier	* Manufacturing Facility 3rd party audits	
26.	General/All	Operator Training Material	Battery Supplier PCS Supplier MVT Supplier	* Equipment sourcing / manufacturing location	
27.	PCS	NERC/FERC Compliance (reference Appendix 10)	Battery Supplier PCS Supplier MVT Supplier	* Independent Laboratory evaluation or testing (e.g., laboratory degradation assessment)	
28.	PCS	Certificates and code/standard compliance	Battery Supplier PCS Supplier MVT Supplier	* Battery thermal management design overview, evidence of adequate heating/cooling capacity"	
29.	PCS	PSSE/PSCAD Models	Battery Supplier PCS Supplier MVT Supplier		
30.	Use Case & Sizing	Degradation and round-trip efficiency lifetime performance schedule (indicative or guaranteed)	Battery Supplier	To provide Owner with necessary information to operate equipment in event of failure of Supplier company	
31.	Use Case & Sizing	Aux Load Consumption details	Battery Supplier		
32.	Use Case & Sizing	Augmentation method/procedure guidance	Battery Supplier	Documentation evidencing NERC/FERC compliance (reference Appendix 10)	
33.	Use Case & Sizing	AC and DC System losses [assumed based on typical values for the cable	Battery Supplier PCS Supplier	"* IEEE 1547 or 2800, as applicable	

Item	Category	Description	Documentation Owner	Notes	Submittal Date
		losses, PCS losses (inverter / MV transformer), battery losses (internal), MPT losses, gen-tie/transmission losses] and corresponding determination of quantity of units to meet POI nameplate	MVT Supplier		

****END OF EPC SCOPE BOOK MAIN BODY****

APPENDIX 1. RESERVED

Reserved for future issuance.

APPENDIX 2. OWNER-PROVIDED INFORMATION

See spreadsheet file.

APPENDIX 3. DEVELOPER-PROVIDED INFORMATION

See spreadsheet file.

APPENDIX 4. PROJECT PERFORMANCE TEST AND LIQUIDATED DAMAGES

See document.

APPENDIX 5. MAJOR EQUIPMENT WARRANTIES[3]

Building or Special Built Enclosure Battery (to include batter modules, battery management system, thermal management system if integrated, safety elements if integrated, and power conversion system if integrated) – 3 Years from Mechanical Completion with Original Equipment Manufacturer (OEM) responsible for all In and Out cost.

Building or Special Built Enclosure Power Conversion System – 5 Years from Mechanical Completion with Original Equipment Manufacturer (OEM) responsible for all In and Out cost.

Containerized Battery (to include batter modules, racking and container, thermal management system, safety elements, battery management system, and power conversion system) – 3 Years from Mechanical Completion with Original Equipment Manufacturer (OEM) responsible for all In and Out cost.

Medium Voltage Transformer – 3 Years from Mechanical Completion with OEM responsible for all In and Out cost.

[3] The warranties set forth in this Appendix 5 are preliminary, indicative only, and subject to updating and modification (including expansion).

APPENDIX 6. DIVISION OF RESPONSIBILITY (DOR)

See document.

APPENDIX 7. CYBER SECURITY PLAN[4]

See document.

[4] The Cyber Security Plan set forth in this Appendix 7 was designed for a solar facility, is preliminary, indicative only, and subject to updating and modification (including expansion).

APPENDIX 8. PROJECT SITE MAP

Include general site arrangement for Battery Energy Storage System, Collector Substation if applicable, and High Voltage Transmission Line if applicable.

APPENDIX 9. COLLECTOR SUBSTATION

See ‘Appendix 1 to Solar BOT Scope Book’ document.

APPENDIX 10. NERC REQUIREMENTS

See ‘Appendix 10 to Solar BOT Scope Book’ document.

APPENDIX 11. PROJECT CONTROLS REQUIREMENTS

See ‘Appendix 11 to Solar BOT Scope Book’ document.

APPENDIX 12. HIGH VOLTAGE TRANSMISSION LINE

See ‘Appendix 2 to Solar BOT Scope Book’ document.

APPENDIX 13. APPROVED SUPPLIER LIST

This section contains a list of approved materials and equipment suppliers. If Contractor is considering the selection of a material or equipment supplier that is not listed herein, Contractor shall inform the Owner prior to executing any contract for the procurement of such material or with such equipment supplier. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement. Contractor should specify the lead time for each equipment and evaluate in a risk matrix the potential risk of delays.

Battery Energy Storage Systems

- EKS Energy
- Fluence Energy
- LG Energy Solution Vertech, Inc.
- Powin Energy
- Sungrow
- Tesla
- Wartsila North America
- Prevalon

SCADA Platforms

- Ignition

Network Equipment – Firewalls, Ethernet Switches

- CheckPoint
- Palo Alto
- Cisco
- SEL