Appendix A
Scope of Work BESS

This **Exhibit** forms an integral part of the Agreement between Syrcuit Energy Solutions (the "Owner") and [Contractor Name] (the "Contractor").

1.0 General

1.1 Definitions

1. **“Battery System”** shall mean a set of battery racks, containing battery modules, within an enclosure integrated with onboard thermal management, Battery Management System (BMS), Fire Protection System (FPS), internal protection, monitoring and other systems as needed within the ESS enclosure(s), certified with applicable codes and standards in Exhibit [●] Scope of Work BESS Section 19.0 Codes and Standards, connected to a single Power Conversion System (PCS) or PCS/Medium-Voltage Transformer (MVT) skid solution.
2. **“Battery System Contractor”** shall mean the party responsible for the supply of the Battery System or Power Unit(s) if a different party than the Contractor.
3. "**BESS Facility**” shall mean all the equipment and services to produce a fully operational Battery Energy Storage System (BESS) from the medium voltage (MV) alternating current (AC) connection point at the Point of Interconnection (POI), through the PCS, and to the DC/BESS.
4. **“BESS Facility EMS”** shall mean the control system including but not limited to the Energy Management System (EMS) control hardware, software, communication, networking, cybersecurity and power plant controller (PPC) utilized to send power commands to, monitor and store data for the Project.
5. **“BESS Power Plant Controller”** or **“PPC”** shall mean the BESS Facility EMS controller that monitors the Unit Controller health and capability and distributes proportional P/Q commands.
6. **“Control Mode”** shall mean the programmed control setting of the EMS.
7. **"Guaranteed Availability”** shall mean the supplied BESS Facility availability guarantee defined in Exhibit [●] Performance Guarantees & Liquidated Damages.
8. **“Guaranteed Energy”** shall mean the Contractor provided useable energy at the POI (net of Station Power usage) at continuous power (CP) used as defined in Exhibit [●] Performance Guarantees & Liquidated Damages.
9. **“Guaranteed Power”** shall mean the Contractor provided Guaranteed Power as defined in Exhibit [●] Performance Guarantees & Liquidated Damages.
10. **“Guaranteed RTE” or “Guaranteed Round-Trip Efficiency”** shall mean the Contractor supplied Guaranteed RTE at the POI defined in Exhibit [●] Performance Guarantees & Liquidated Damages.
11. **“HMI” or “Human Machine Interface”** shall mean the EMS Web User Interface that shall be used by Supervisory Control and Data Acquisition (SCADA), Owner or Qualified Scheduling Entity (QSE) to interface with the BESS Facility EMS.
12. **“Maximum Charging Capability”** shall mean the maximum charging capability at full power.
13. **"Measured Availability”** shall mean the measured availability of the BESS Facility at the POI by the BESS Facility.

14. **“Measured Energy”** shall mean the measured energy output of the BESS Facility at CP at the POI meter by the BESS Facility EMS.

15. **“Measured Power”** shall mean the measured power output of the BESS Facility at the POI by the BESS Facility EMS.

16. **“Measured RTE”** shall mean the measured RTE of the BESS Facility at full power at the POI by the BESS Facility EMS.

17. **“POI” or “Point of Interconnection”** shall mean the meter located on the primary side of the Medium Voltage Transformer (MVT) as shown in the single-line diagram (SLD) in Exhibit [●] Single Line Diagram.

18. **“Power Unit” or “PU”** shall mean a single PCS (bi-directional grid-connected power electronic converter) connected to a Battery System and associated control system. A PU can charge and discharge independently.

19. **“Project”** shall mean the BESS Facility and all the equipment and services to produce a fully operational BESS up to the POI, capable of [Contractor Guaranteed Power] MW / [Contractor Guaranteed Energy] MWh at Beginning of Life (BOL).

20. **“Station Power”** shall mean energy used for operating the electric equipment on the site of the BESS facility for the lighting, thermal management system, fire protection system, onboard computers, and office equipment needs of equipment buildings on the site of such a generation facility that are used in the operation, maintenance, or repair of the facility.

21. **“Substantial Completion Test Procedures”** shall mean the performance test procedures in Exhibit [●] Substantial Completion Test Plan.

22. **“Test Extension”** shall mean any additional time required beyond the test period, to demonstrate BESS Facility operation and performance. The duration of the Test Extension shall be at the sole discretion of the Owner. A Test Extension may be required due to a Test Interruption or weather conditions. All analyses of the test data shall include the data collected during the additional time period due to a Test Extension.

23. **“Test Interruption”** shall mean a time period in which any part of the BESS Facility is partially operational or non-operational due to Owner or Contractor intervention or due to any events outside of Contractor’s control. Data collected during a Test Interruption will not be used to satisfy the requirements of that test and shall be excluded from the analysis of that test.

24. Abbreviations listed below.

1.2 Abbreviations

AC	Alternating Current
ACL	Access Control List
AGC	Automatic Governor Controls
AHJ	Authority Having Jurisdiction
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers

AVG	Automatic Voltage Control
BESS	Battery Energy Storage System
BMS	Battery Management System
BOL	Beginning of Life
BOS	Balance of System
CCTV	Closed-Circuit Television
CFD	Computational Fluid Dynamics
CIP	Critical Infrastructure
COD	Commercial Operation Date
CP	Continuous Power
CT	Current Transformer
CVE	Common Vulnerabilities and Exposures
DAQ	Data Acquisition
DAS	Data Acquisition System
DC	Direct Current
DETC	De-Energized Tap Changer
DDP	Delivery to Warehouse Duties Paid
DMZ	Demilitarized Zone
DOD	Depth of Discharge
DOE	Department of Energy
DSP	Distribution Service Provider
DSM	Dynamic System Monitoring Equipment
DVR	Digital Video Recorder
EMS	Energy Management System
EPC	Engineering, Procurement, and Construction
ERP	Emergency Response Plan
ESS	Energy Storage System
EURT	Equivalent Uniform Radial Thickness
FAT	Factory Acceptance Testing
FACP	Fire Alarm Control Panel
FACU	Fire Alarm Control Unit
FEOC	Foreign Entity of Concern
FMEA	Failure Mode Effects Analysis
FNE	Field Network Enclosure
FPS	Fire Protection System
FRT	Frequency Ride Through
GPS	Global Positioning System
HMA	Hazard Mitigation Analysis
HMI	Human Machine Interface
HSSE	Health, Safety, Security, and Environment
HVAC	Heating Ventilation and Air Conditioning

IA	Interconnection Agreement
ICMP	Internet Control Message Protocol
IFC	Issued for Construction
I/O	Input and Output
ISO	Independent System Operator
ISP	Internet Service Provider
KVM	Keyboard, Video, Mouse
LEL	Lower Explosive Limit
LFL	Lower Flammable Limit
LNTP	Limited Notice to Proceed
LOTO	Lock Out / Tag Out
LSFT	Large-Scale Fire Testing
LSZH	Low Smoke Zero Halogen
LTC	Load Tap Changers
LVRT	Low Voltage Ride-Through Requirement
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
LTC	Load Tap Changers
LTSA	Long-Term Service Agreement
LVRT	Low-Voltage Ride Through
MFA	Multi-Factor Authentication
MPT	Main Power Transformer
MV	Medium Voltage
MVSG	Medium-Voltage Switchgear
MVT	Medium-Voltage Transformer
MW	Megawatt
MWH	Megawatt hour
NEMA	National Electrical Manufacturers Association
NERC	National Energy Regulatory Commission
NIST	National Institute of Standards and Technology
NTC	Negative Temperature Coefficient
NTP	Network Time Protocol / Notice to Proceed
O&M	Operations and Maintenance
OE	Owner’s Engineering
OEM	Original Equipment Manufacturer
OVRT	Over Voltage Ride-Through Requirements
PCS	Power Conversion System
PF	Power Factor
PFE	Prohibited Foreign Entity
PFG	Performance Guarantees
POI	Point of Interconnection

POD	Plan of the Day
POI	Point of Interconnection
PPC	Power Plant Controller
PT	Power Transformer
PVC	Polyvinyl Chloride
PWA	Prevailing Wage and Apprenticeship
QA/QC	Quality Assurance/Quality Control
QSE	Qualified Scheduling Entity
RBAC	Role-Based Access Control
RMU	Ring Main Unit
RTAC	Real Time Automation Controller –SEL 3530 device or equivalent
RTE	Round-trip Efficiency
RTO	Regional Transmission Operator
RTU	Remote Terminal Unit
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ration
SLA	Service Level Agreement
SLC	Single Line Circuit
SLD	Single Line Diagram
SOC	State of Charge
SOE	State of Energy
SOH	State of Health
SOP	State of Power
SPCC	Spill Prevention, Control and Countermeasures
SVC	Static Var Compensators
THD	Total Harmonic Distortion
TMS	Thermal Management System
TSP	Transmission Service Provider
UPS	Uninterrupted Power Supply
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VRS	Voltage Regulation System
VTP	VLAN Trunk Protocol
WAN	Wide Area Network
WebUI	Web User Interface

1.3 Referenced Documents

#	Document Name	Version
1	Exhibit [●] Division of Responsibility	1
3	Exhibit [●] Performance Guarantees & Liquidated Damages	1
4	Exhibit [●] Hot Commissioning Test Plan (Provided by Vendor)	1
5	Exhibit [●] Hot Commissioning Verification Test Plan (Provided by Vendor)	1
5	Exhibit [●] Substantial Completion Test Plan	1

2.0 Project Requirements

2.1 Scope of Work

1. Unless otherwise specified, the Contractor shall provide/supply the following equipment:
    A. Battery Systems: The Contractor shall supply battery systems to include battery racks, containing battery modules, within an enclosure integrated with onboard thermal management, BMS, FPS, internal protection, monitoring, and other systems as needed within the enclosure(s), certified with applicable codes and standards.
    B. Bidirectional PCS: The Contractor shall supply PCS (internal string, modular, or central) to include reactive power loading requirements.
    C. MVT: The Contractor shall supply the MVT (can be PCS/MVT skid solution).
    D. Additional Balance of Plant (BOP) Equipment: The Contractor shall supply any additional BOP equipment, supplies, machinery, and tools required to deliver a fully operational site, to include at minimum: Medium-Voltage Switchgear (MVSG), LV auxiliary transformers, field network enclosures (FNEs), switchboards, DC conduit, and wiring between BESS Facility equipment to the POI:
2. The Contractor shall provide all services and equipment to complete device-, unit-, site- and Project-level integration to include:
    A. EMS/PPC: The Contractor shall provide an EMS and device integration with controllers, HMI, SCADA, networking, communications, and cybersecurity.
3. The Contractor shall perform all commissioning and testing procedures to include:
    A. Factory Acceptance Testing (FAT) certifications
    B. Original Equipment Manufacturer (OEM) cold and hot commissioning of the provided equipment
    C. EMS/PPC unit- and site-level commissioning
    D. Substantial Completion Testing.[1]
4. The Contractor shall provide pricing and details for BESS Facility performance, availability,

[1] Bidder to review Appendix H – Substantial Completion Test Plans.

monitoring, spare parts, preventative and corrective maintenance to include:

   A. Warranty and Performance Guarantees (PFG): The Bidder shall supply pricing and details for a standard warranty and Performance Guarantees covering the equipment and services provided, with options for annual extensions.
   B. Long-term Service Agreement (LTSA): The Bidder shall supply an LTSA template with annual pricing for preventative maintenance and corrective maintenance, warranty, and performance guarantees.

5. Engineering, Procurement and Construction (EPC): Bidder shall provide engineering design, equipment procurement and construction services required to deliver a fully operational BESS to the POI, including but not limited to permitting, receiving/handling/transport, installation, site safety, and coordination, to include, but not limited to the following:
   A. Coordinate with the Owner to optimize the design, layout, and integration of the BESS within the overall Project, and to minimize any conflicts, gaps, or inefficiencies in the scope of work.
   B. Obtain all necessary permits, approvals, and certifications required for the design, fabrication, transportation, installation, and operation of the BESS Facility, except for those explicitly identified as the Owner's responsibility in Exhibit [●] Permit Matrix.
   C. Provide all necessary documentation, drawings, calculations, and test reports to demonstrate compliance with the Contract requirements and applicable codes and standards as detailed in Exhibit [●] Contractor Deliverables.
   D. Participate in regular Project meetings, status reports, and design reviews with the Owner, and shall promptly address any issues, questions, or changes that arise during the Project execution.
   E. Provide a dedicated project manager, engineering lead, and quality assurance/quality control (QA/QC) lead for the duration of the Project, with the necessary qualifications, experience, and authority to ensure successful delivery of the BESS.
   F. Comply with all applicable safety, environmental, and security requirements, as further defined in the Project Agreement(s) and applicable Health, Safety, Security, and Environment (HSSE) Plan(s).
   G. Provide training and knowledge transfer to the Owner's personnel, including operation and maintenance manuals, on-site demonstrations, and classroom sessions, to ensure safe and effective use of the BESS throughout its lifecycle.
6. The Contractor shall also be responsible for the supply of all incidentals, including, but not limited to:
   A. Temporary power to meet construction needs, including service to construction trailer offices, to include all start-up loads until back feed is available
   B. Site lighting sufficient to illuminate all work areas, day or night
   C. Trailer offices sufficient for all onsite personnel contracted by Contractor.
   D. General maintenance and dust control for all aggregate roads used during construction
   E. Site security and on-site Safety Manager through the Commercial Operation Date (COD)

F. Weather protection, rodent/animal/foreign object protection, and temporary support fixtures/steel/lumber for all parts and equipment stored onsite during construction
G. Component shipping, offloading, receiving, inspection, laydown, inventory management, and safe distribution of materials throughout the construction site
H. All tooling and equipment needed for project construction and commissioning, including all cranes, forklifts, manlifts, trucks, generators, welding machines, power tools, hand tools, etc.
I. Construction surveying to locate equipment and structures according to the design
J. As-built drawing markups in the field and drafting to provide a complete as-built drawing set
K. Strength testing of concrete and other materials as needed
L. Supply of all personal protective equipment, including but not limited to hard hats, eye protection, gloves, hearing protection, clothing, and proper footwear and training
M. Safe, guaranteed shipment of all required parts and equipment
N. Supply of shipping fixtures as needed
O. Dumpster(s) for use by onsite personnel
P. Offsite disposal of waste and construction debris
Q. Scaffolding, if required
R. Supply of potable and non-potable water as needed
S. Supply of portable toilet facilities

3.0 Project Design Criteria

3.1 General

1. At a minimum, projects shall be designed to withstand a 100-year, 24-hour storm event.
2. Where not otherwise specified, design shall utilize the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Monthly Maximum 0.4%.
3. The Contractor shall design the Project in accordance with the design specifications in Table 1 - Project Design Criteria Buena Vista BESS and Burnt Mill BESS, Table 2 - Project Design Criteria El Moro BESS and Ft Laramie BESS, and Table 3 - Project Design Criteria LaGrange BESS and Swallows BESS.

Table 1 - Project Design Criteria Buena Vista BESS and Burnt Mill BESS

Specifications	Buena Vista BESS	Burnt Mill BESS
Location	Buena Vista, CO 38.853858, -106.139249	Pueblo, CO 38.12176405, -104.68145097
Guaranteed COD	September 30, 2027	December 30, 2027
Configuration	Standalone BESS	Standalone BESS
Useable Power - AC Power at the POI	4.5 MW	5.0 MW
Initial Usable Energy (usable at the POI, net of Station Power usage) at CP	18.0 MWh 4.5 MW over 4 continuous hours	20.0 MWh 5.0 MW over 4 continuous hours

POI	Revenue meter located on the primary side of the 12.47 kV MVT	Revenue meter located on the primary side of the 12.47 kV MVVT
AC RTE (POI to POI) *Including* auxiliary power losses	86% minimum	86% minimum
POI Power Fractor[2]	+0.95 / -0.95 leading and lagging at the POI	+0.95 / -0.95 leading and lagging at the POI
POI Voltage	12.47 kV	12.47 kV
Total Harmonic Distortion (THD)	3% Individual 5% THD	3% Individual 5% THD
Maximum Annual Cycles	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day
Degradation Management	Maintain power and energy capacity for 20 years at the POI	Maintain power and energy capacity for 20 years at the POI
System Design Life	20 Years	20 Years
System Frequency	60 Hz	60 Hz
Altitude	2,426 meters above sea level	1,430 meters above sea level
Seismic Zone	Zone: Low Seismic Category: C	Zone: Low Seismic Category: B-C
Corrosion Class	Class: C2	Class: C2
Voltage Regulation[3]	≤ 2.5 % average across the site ≤ 3.0 % peak	≤ 2.5 % average across the site ≤ 3.0 % peak
Voltage Flicker[4]	≤1.0 / ≤0.8 at the POI	≤1.0 / ≤0.8 at the POI
Response Time	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.
Applications:	Defined in <u>Section 5.1 EMS Controls / Applications</u>	Defined in <u>Section 5.1 EMS Controls / Applications</u>
Independent System Operator (ISO):	WECC	WECC

[2] Per IEEE Std 1547-2018
[3] Per ANSI C84.1-2020, IEEE Std 1547-2018 / 2020 and NFPA 70
[4] Per IEEE 1453-2022 and IEEE 1547, subject to the DSP final approval.

Distribution Service Provider (DSP):	Sangre de Cristo Electric Association, Inc.	San Isabel Electric Association, Inc.
Fire Safety Authority Having Jurisdiction (AHJ):	TBD	TBD
Tax Credit Qualification	• Start of Construction: 2026 • Non-Prohibited Foreign Entity (PFE): 55% • Prevailing Wage and Apprenticeship (PWA) Requirements[5]	• Start of Construction: 2026 • Non-PFE: 55% • PWA Requirements

Table 2 - Project Design Criteria El Moro BESS and Ft Laramie BESS

Specifications	**El Moro BESS**	**Fort Laramie BESS**
Location	El Moro, CO 37.22404465, -104.47937851	Fort Laramie, WY 42.138865, -104.557604
Guaranteed COD	December 30, 2027	October 31, 2027
Configuration	Standalone BESS	Standalone BESS
Useable Power - AC Power at the POI	5.0 MW	5.0 MW
Initial Usable Energy (usable at the POI, net of Station Power usage) at CP	20.0 MWh 5.0 MW over 4 continuous hours	20.0 MWh 5.0 MW over 4 continuous hours
POI	Revenue meter located on the primary side of the 24.7 kV MVT	Revenue meter located on the primary side of the 34.5 kV MVT
AC RTE (POI to POI) *Including* auxiliary power losses	86% minimum	86% minimum
POI Power Fractor[6]	+0.95 / -0.95 leading and lagging at the POI	+0.95 / -0.95 leading and lagging at the POI
POI Voltage	25 kV	34.5 kV
THD	3% Individual 5% THD	3% Individual 5% THD
Maximum Annual Cycles	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day
Degradation Management	Maintain power and energy capacity for 20 years at the POI	Maintain power and energy capacity for 20 years at the POI

[5] Contractor shall meet PWA requirements for the Clean Electricity Investment Credit - https://www.irs.gov/credits-deductions/prevailing-wage-and-apprenticeship-requirements
[6] Per IEEE Std 1547-2018

System Design Life	20 Years	20 Years
System Frequency	60 Hz	60 Hz
Altitude	1,249 meters above sea level	1,280 meters above sea level
Seismic Zone	Zone: Low Seismic Category: B	Zone: Low Seismic Category: B
Corrosion Class	Class: C2	Class: C2
Voltage Regulation[7]	≤ 2.5 % average across the site ≤ 3.0 % peak	≤ 2.5 % average across the site ≤ 3.0 % peak
Voltage Flicker[8]	≤1.0 / ≤0.8 at the POI	≤1.0 / ≤0.8 at the POI
Response Time	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.
Applications:	Defined in Section 5.1 EMS Controls / Applications	Defined in Section 5.1 EMS Controls / Applications
ISO:	WECC	WECC
DSP:	San Isabel Electric Association.	The Wyrulec Company
Fire Safety AHJ:	TBD	TBD
Tax Credit Qualification	• Start of Construction: 2026 • Non-PFE: 55% • PWA Requirements	• Start of Construction: 2026 • Non-PFE: 55% • PWA Requirements

Table 3 - Project Design Criteria LaGrange BESS and Swallows BESS

Specifications	**La Grange BESS**	**Swallows BESS**
Location	La Grange, WY 41.639497, -104.16958	Pueblo, CO 38.31657221, -104.83829874
Guaranteed COD	October 31, 2027	December 30, 2027
Configuration	Standalone BESS	Standalone BESS
Useable Power - AC Power at the POI	5.0 MW	10.0 MW
Initial Usable Energy (usable at the POI, net of Station Power usage) at CP	20.0 MWh 5.0 MW over 4 continuous hours	40.0 MWh 10.0 MW over 4 continuous hours

[7] Per ANSI C84.1-2020, IEEE Std 1547-2018 / 2020 and NFPA 70
[8] Per IEEE 1453-2022 and IEEE 1547, subject to the DSP final approval.

POI	Revenue meter located on the primary side of the 34.5 kV MVT	Revenue meter located on the primary side of the 24.7 kV MVT
AC Rountrip Efficiency (POI to POI) *Including* auxiliary power losses	86% minimum	86% minimum
POI Power Fractor[9]	+0.95 / -0.95 leading and lagging at the POI	+0.95 / -0.95 leading and lagging at the POI
POI Voltage	34.5 kV	25 kV
THD	3% Individual 5% THD	3% Individual 5% THD
Maximum Annual Cycles	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day	365 cycles (0% to 100% SOC full or aggregate); up to two cycles per day
Degradation Management	Maintain power and energy capacity for 20 years at the POI	Maintain power and energy capacity for 20 years at the POI
System Design Life	20 Years	20 Years
System Frequency	60 Hz	60 Hz
Altitude	1,392 meters above sea level	1,529 meters above sea level
Seismic Zone	Zone: 1 Seismic Category: 2	Zone: 1 Seismic Category: 2
Corrosion Class	Class: C2	Class: C2
Voltage Regulation	≤ 2.5 % average across the site ≤ 3.0 % peak	≤ 2.5 % average across the site ≤ 3.0 % peak
Voltage Flicker	≤1.0 / ≤0.8 at the POI	≤1.0 / ≤0.8 at the POI
Response Time	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.	≤250 milliseconds Defined as the time from the site controller acknowledging a command to the high-speed check meter, with syncrophasor protocol enabled, adjacent to the revenue meter at the POI.
Applications:	Defined in Section 5.1 EMS Controls / Applications	Defined in Section 5.1 EMS Controls / Applications
ISO:	WECC	WECC
DSP	The Wyrulec Company	San Isabel Electric Association

[9] Per IEEE Std 1547-2018

Fire Safety AHJ:	TBD	TBD
Tax Credit Qualification	• Start of Construction: 2026 • Non-PFE: 55% • PWA Requirements	• Start of Construction: 2026 • Non-PFE: 55% • PWA Requirements

3.2 Loss Assumptions

Project Name	From	To	Distance	Impedance value in pu covering "from-to"	Total one-way losses in %
Buena Vista BESS	Primary terminals of MVT	POI (12.47 kV)	~200 ft	[Contractor Calculated]	[Contractor Calculated]
Burnt Mills BESS	Primary terminals of MVT	POI (12.47 kV)	~200 ft	[Contractor Calculated]	[Contractor Calculated]
El Moro BESS	Primary terminals of MVT	POI (25 kV)	~200 ft	[Contractor Calculated]	[Contractor Calculated]
Ft Laramie BESS	Primary terminals of MVT	POI (34.5 kV)	~200 ft	[Contractor Calculated]	[Contractor Calculated]
LaGrange	Primary terminals of MVT	POI (34.5 kV)	~200 ft	[Contractor Calculated]	[Contractor Calculated]
Swallows BESS	Primary terminals of MVT	POI (25 kV)	~1,800 ft	[Contractor Calculated]	[Contractor Calculated]

3.3 Site Ambient Design Criteria

1. The Project shall be capable of continuous operation for the full range of "Ambient Operational Temperature Range" conditions at the respective Project location and as shown in Table 4 - Project Ambient Temperature .
2. All equipment and materials shall be rated to withstand the full range of "Ambient Temperature Rating Range" conditions shown in Table 4 - Project Ambient Temperature Reference Criteria, and conform to the weather criteria in Table 7 - Project Site Loading Design Criteria.
3. The Contractor shall maintain equipment in accordance with the Original Equipment Manufacturer (OEM)'s recommended operating, standby, and storage conditions.

Table 4 - Project Ambient Temperature Reference Criteria Buena Vista and Burnt Hill BESS

Reference Criteria	Design Conditions

	Buena Vista BESS	Burnt Mill BESS
AHRAE Weather Station Reference No.	720532 (Harriet Alexander Field / Salida area – closest primary station serving Chaffee County)	724640 (Pueblo Memorial Airport)
Minimum Site Ambient Temperature Range (°C)[1]	−25.6°C annual −35.6°C 50-year event	−20.6 annual −33.9 50-year event
Maximum Site Ambient Temperature Range (°C)[1]	32.2°C annual 35.6°C 50-year event	37.2 annual 42.2 50-year event
Minimum Ambient Operating Temperature Range (°C)[2]	−26.1	−17.2
Maximum Ambient Operating Temperature Range (°C)[2]	29.4	36.7
Minimum Ambient Rating Range (°C)[3]	−23.3	−15.0
Maximum Ambient Rating Range (°C)[3]	28.3	35.6

Table 5 - Project Ambient Temperature Reference Criteria El Moro and Ft Laramie BESS

Reference Criteria	Design Conditions	
	El Moro BESS	Fort Laramie BESS
AHRAE Weather Station Reference No.	724640 (Pueblo Memorial Airport)	WBAN:94053 (Torrington Municipal Airport – primary local station for all of Goshen County
Minimum Site Ambient Temperature Range (°C)[1]	−20.6 annual −33.9 50-year event	−18.9°C annual −32.26°C 50-year event
Maximum Site Ambient Temperature Range (°C)[1]	37.2 annual 42.2 50-year event	36.1°C annual 40.0°C 50-year event
Minimum Ambient Operating Temperature Range (°C)[2]	−17.2	−21.1
Maximum Ambient Operating Temperature Range (°C)[2]	36.7	34.4
Minimum Ambient Rating Range (°C)[3]	−15.0	−18.3
Maximum Ambient Rating Range (°C)[3]	35.6	33.3

Table 6 - Project Ambient Temperature Reference Criteria LaGrange and Swallows BESS

Reference Criteria	Design Conditions	
	La Grange BESS	Swallows BESS
AHRAE Weather Station Reference No.	WBAN:94053 (Torrington Municipal Airport – primary local station for Goshen County	724640 (Pueblo Memorial Airport)
Minimum Site Ambient Temperature Range (°C)[1]	−18.9°C annual −32.26°C 50-year event	−20.6 annual −33.9 50-year event
Maximum Site Ambient Temperature Range (°C)[1]	36.1°C annual 40.0°C 50-year event	37.2 annual 42.2 50-year event
Minimum Ambient Operating Temperature Range (°C)[2]	−21.1	−17.2
Maximum Ambient Operating Temperature Range (°C)[2]	34.4	36.7
Minimum Ambient Rating Range (°C)[3]	−18.3	−15.0
Maximum Ambient Rating Range (°C)[3]	33.3	35.6

[1] Site Ambient Temperature Range: Based on ASHRAE climatic data – Extreme Annual Mean Database and 50-Year Extreme Database Temperatures.
[2] Equipment, components, and materials can withstand this range while operating at rated capacity without accelerating degradation of equipment beyond design rate or suffering damage or degradation to performance, so repair or replacement is required to restore performance.
[3] Equipment, components, and materials can withstand this range when not in operation, or at reduced operational performance, without suffering damage or degradation to performance, so repair or replacement is required to restore performance.

3.4 Site Loading Design Criteria

Table 7 - Project Site Loading Design Criteria Buena Vista and Burnt Mill BESS

Reference Criteria	Design Conditions	
	Buena Vista BESS	Burnt Mill BESS
Wind 3 Sec Gust	115 mph (ASCE 7-22, Risk Category II)	115 mph (ASCE 7-22, Risk Category II)
Wind Exposure Category	Category: C	Category: C
Seismic Soil Class[1]	Category: D	Category: D
Seismic Special Accelerations (SS/S1)[1]	SS = 0.20 / S1= 0.08	SS = 0.15 / 0.06
Seismic Importance Factor[1]	1.0	1.0
Ground Snow Load (lbs/sqft)	GSL= 35	GSL= 30
Snow Importance Factor	1.0	1.0
Ice Equivalent Uniform Radial Thickness (EURT) inch	0.25	0.25
Ice Importance Factor	1.0	1.0
Frost / Adfreeze[2] (inch)	24	30

Table 8 - Project Site Loading Design Criteria El Moro and Ft Laramie BESS

Reference Criteria	Design Conditions	
	El Moro BESS	Fort Laramie BESS
Wind 3 Sec Gust	115 mph (ASCE 7-22, Risk Category II)	115 mph (ASCE 7-22, Risk Category II)
Wind Exposure Category	Category: C	Category: C
Seismic Soil Class[1]	Category: D	Category: D
Seismic Special Accelerations (SS/S1)[1]	SS = 0.12 / 0.05	0.12 / 0.05
Seismic Importance Factor[1]	1.0	1.0
Ground Snow Load (lbs/sqft)	GSL= 25	30
Snow Importance Factor	1.0	1.0
Ice Equivalent Uniform Radial Thickness (EURT) inch	0.25	0.25
Ice Importance Factor	1.0	1.0
Frost / Adfreeze[2] (inch)	36	36

Table 9 - Project Site Loading Design Criteria LaGrange and Swallows BESS

Reference Criteria	Design Conditions	
	La Grange BESS	Swallows BESS
Wind 3 Sec Gust	115 mph (ASCE 7-22, Risk Category II)	115 mph (ASCE 7-22, Risk Category II)
Wind Exposure Category	Category: C	Category: C
Seismic Soil Class[1]	Category: D	Category: D
Seismic Special Accelerations (SS/S1)[1]	SS = 0.12 / 0.05	SS = 0.12 / 0.06

Seismic Importance Factor[1]	1.0	1.0
Ground Snow Load (lbs/sqft)	GSL= 25	GSL= 25
Snow Importance Factor	1.0	1.0
Ice Equivalent Uniform Radial Thickness (EURT) inch	0.25	0.25
Ice Importance Factor	1.0	1.0
Frost / Adfreeze[2] (inch)	36	30

[1] Seismic design criteria are currently based on ASCE. The Contractor shall adjust values based on their geotechnical study and report.
[2] Contractor shall determine frost and adfreeze depths based on the geotechnical study.

4.0 BESS Equipment Specifications

All BESS equipment and components shall be sourced from proven Tier 1 Contractors with an extensive, verifiable track record of successful supply to U.S. utilities of similar or greater-sized projects with two years of operation. Preference may be given to domestically supplied equipment.

4.1 Battery System

General

1. The Battery System shall be prefabricated, capacity tested at the factory with a dedicated FPS.
2. All equipment and subcomponents shall have proper signage, labels, markings, and placards for energy storage systems, hazards, emergency response, and service disconnects per NFPA 70, NFPA 855, ANSI Z535-2002, NFPA 704, and CFC 608, and IFC 2024 requirements using proper materials, placement, locations, and heights.
3. The Contractor shall provide datasheets, drawings, and manuals for major third-party equipment integrated into the battery enclosure, to include the thermal management, packaged chillers, AHJ-approved fire alarm components, combustible gas detectors, BMS, and Uninterrupted Power Supply (UPS), as applicable.
4. Factory Acceptance Tests (FATs) shall be performed for all Battery Systems as required in Section 16.1 Factory Acceptance Testing. FAT records shall be submitted for Owner approval.
5. There shall be no cellular modems or external communication devices installed in battery enclosures.
6. The Battery System must meet requirements in Section 19.0 Codes and Standards.

Cells

1. All Battery Cells shall be traceable to the point of origin for the purpose of addressing safety, manufacturing, quality, and forced labor issues. Documentation verifying this includes labels, symbols, and markings on batteries and battery-containing products.
2. Battery Cells have completed independently verified cycle testing before qualifications, with guaranteed cycle- and calendar-based degradation comparable (within 10%) to its peer Tier-1 battery Contractors.

3. Battery cells must meet requirements in Section 19.0 Codes and Standards.

Packs (Modules)

1. Battery Packs must be field replaceable as discrete modules without requiring modification to the surrounding rack or system enclosure.
2. Labeling of the packs shall include the OEM name, cell type, nameplate rating, date of manufacture, and unique serial number for each serviceable unit, in fully legible characters.
3. Replacement modules of the same design or of a directly compatible design shall be readily available from the OEM for a minimum of 5 years following the Substantial Completion date, such that rack modifications are not required.
4. Battery Packs shall be pre-populated in Battery Racks/Clusters inside the Battery Enclosure.
5. Battery Packs used in conjunction with a liquid-cooled TMS shall have a minimum IP65 ingress rating to prevent exposure to coolant leakage.
6. Battery Packs must meet requirements in Section 19.0 Codes and Standards.

Racks (Strings)/Clusters

1. Battery Racks must meet requirements in Section 19.0 Codes and Standards.
2. Battery Racks shall be mechanically separated battery cabinets to reduce the likelihood of thermal runaway, using fuses, DC disconnects, and fault instigation for safety and serviceability.

BMS

General
1. The BMS shall consist of multiple hierarchical levels, e.g., pack, rack, and system level.
2. The BMS must meet the application requirements of 1500Vdc ESS.
3. SOC/State of Health (SOH) estimation accuracy must be at a minimum of +/-3 % throughout the full range of operation, regardless of how the system is operated. Recalibration cycles may be run at a monthly rate.
4. The BMS shall have power limiting functionality through continuous real-time monitoring and control algorithms to calculate allowable power levels based on current battery conditions and enforce them by opening contacts if necessary to protect the system while maximizing available capacity.
5. The Contractor shall manage all software/firmware versions of the installed devices during system and Facility integration and provide associated point maps for the delivered system revision to the project integrators or EMS provider, if different parties.
6. No software/firmware updates are allowed without informing the EMS provider (if a different party than the Contractor) and the Owner.
7. The BMS must meet requirements in Section 19.0 Codes and Standards.

System BMS
1. The System BMS shall monitor and display:

    A. Pack-level parameters (voltage, temperature, and current)
    B. Rack-level parameters (voltage, current, SOC/SOH, and isolation data)
    C. System SOC/SOH
    D. Contactor and breaker status
2. The System BMS shall provide the following protection (warning/alarm/fault):
    A. Overvoltage and undervoltage protection of battery cells
    B. Overvoltage, undervoltage, and overcurrent protection of battery racks
    C. Over-temperature, under-temperature, temperature-difference, and voltage-difference protection of battery cells
    D. Online insulation detection, fault detection, thermal management control, and other protective functions
3. The System BMS shall provide the following alarms:
    A. Overvoltage, undervoltage, overcurrent, and isolation alarm of the battery rack
    B. Over-temperature and under-temperature alarm of battery cells
    C. Temperature-difference, temperature rise, and voltage-difference alarm
    D. Low SOC alarm of the rack
    E. Communication loss

<u>Rack BMS</u>

The Rack BMS shall provide and support:
1. Real-time data processing and management of modules and racks.
2. Real-time terminal voltage detection
3. Real-time terminal current detection for real-time isolation of current data acquisition (DAQ) and processing
4. Battery system insulation detection and fault detection function per config files
5. SOC/SOH/State of Energy (SOE)/State of Power (SOP) estimation
6. Active thermal management measurement and derating currents at high or low cell temperatures
7. Enhanced safety features, e.g., multiple active/passive node outputs, relay control management, and effective isolation of faults.
8. Battery status data processing, summarize real-time data of pack BMS, and manage and control redundant busbar contactors of the battery pack and rack after data processing
9. Terminal voltage detection via the battery terminal voltage isolation collection processing.
10. Fault detection function according to voltage, current, temperature, SOC, SOH, and other threshold alarm functions.

<u>Pack BMS</u>

The Pack BMS shall provide and support:
1. Real-time measurement of cell-level voltage and temperature
2. Negative Temperature Coefficient (NTC) (10K) temperature monitoring points
3. Digital signal Input/Output (I/O) detection
4. Passive balance control
5. Fan speed control, fan state feedback, and speed detection

6. Alarms related to power supply, cell voltage (overvoltage, undervoltage), temperature (overtemperature), communication failure, and other faults
7. Balancing fault detection
8. Wire harness (voltage, temperature) drop detection

<u>Data</u>
1. The Owner shall have the ability to access all data provided by the BMS through the EMS.
2. The BMS shall monitor the data points listed in the following table at an interval of at least once per second.

Table 10 - Minimum BMS Monitored Parameters

Each Battery Rack or String	Rack Voltage
	Rack Current
	Rack SOC
	Rack SOH
	Rack Fault Status
	Rack Alarm Status
	Maximum Cell Voltage Value
	Maximum Cell Voltage Position
	Minimum Cell Voltage Value
	Minimum Cell Voltage Position
	Maximum Cell Temperature Value
	Maximum Cell Temperature Position
	Minimum Cell Temperature Value
	Minimum Cell Temperature Position
	Rack DC Switch Status
Battery System	All electronic or monitoring points for system voltages, currents, temperatures, alarms, switch / breaker / contactor status, cooling system operation, fire system operation, deflagration, etc.

3. Data points shall also be transmitted to the Site Controller / EMS Historian for long-term data storage and retrieval.
4. The Contractor shall provide the OEM BMS points list to the EMS Provider, if a separate entity, to facilitate integration to include, at a minimum:
   A. Point name
   B. Address
   C. Data Type

D. Data Range
E. Unit
F. Address Type
G. Definition

FPS

Battery System

The Battery System FPS must include:

1. An automatic fire alarm system that includes smoke detectors, fire detection, and gas detection. The FPS shall be designed and provided to satisfy NFPA 855 v2026, UL 9540 certification, and UL 9540A performance test approvals (see Section 19.0 Codes and Standards).
2. An explosion control system in accordance with NFPA 69 is mandatory, as well as a deflagration study per NFPA 68 in accordance with NFPA 855 v2026. Calculations demonstrating that the Lower Explosive Limit (LEL) is maintained below 25% shall be provided per NFPA 69.
3. A sounder beacon for audible and visual alerts during an alarm event, visible from the nearest site access road.
4. A gas detection system designed to activate the mechanical ventilation system (fans) when the level of flammable gas in the enclosure exceeds 25% of the Lower Flammable Limit (LFL) of the enclosure volume. The mechanical ventilation system shall remain on until the flammable gas detected is less than 25 percent of the LFL. Failure of the gas detection system shall annunciate a trouble signal at an approved central station, proprietary or remote station service in accordance with NFPA 72, or shall initiate an audible and visible trouble signal at an approved constantly attended on-site location. The mechanical exhaust ventilation system shall be provided with a minimum of 2 hours of standby power.
5. Active Venting shall be provided and integrated into controls. Venting shall be manually activated and shall include a provision for natural ventilation when power is unavailable.
6. Transmission of alarm signals from the onboard Fire Alarm Control Panel (FACP) systems to a central station, site-level FACP, in accordance with NFPA 72.
7. Compliance with codes and standards listed in Section 19.0 Codes and Standards.

Contractor

The Contractor must:

1. Provide documentation showing certifications with UL 1973 (cell and rack) and UL 9540 (system), per Section 19.0 Codes and Standards. The certificates must be provided to the fire code official and the Owner for review and approval.
2. Documentation showing successful test results for UL 9540A (cell, pack, and unit) testing. The test results must be provided to the fire code official and the Owner for review and approval.
3. Documentation for the completion of large-scale fire testing (LSFT). The testing must have been conducted or witnessed and reported by an approved testing laboratory and must show

that a fire involving one battery system will not propagate to an adjacent battery system. The test report must be provided to the fire code official and the Owner for review and approval.

4. Provide a pre-construction plan to include:
    A. Details on the hourly fire-resistance ratings of assemblies enclosing the battery system
    B. The quantities and types of battery systems to be installed
    C. OEM specifications, ratings, and listings of each battery system
    D. Description of energy (battery) management systems and their operation.
    E. Location and content of required signage
    F. Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust, and deflagration venting systems, if provided
    G. Support arrangement associated with the installation, including any required seismic restraint
    H. A commissioning plan
    I. A decommissioning plan
    J. Fire safety and evacuation plan in accordance with IFC 2024 Section 404
5. Provide a hazard mitigation analysis (HMA) from the Battery System OEM that evaluates the consequences of the following failure modes:
    A. A thermal runaway condition in a single electrochemical battery unit
    B. A mechanical failure of a non-electrochemical battery unit
    C. Failure of any BMS or FPS within the storage equipment that is not covered by the product listing failure mode effects analysis (FMEA).
    D. Failure of any required protection system external to the battery system, including but not limited to ventilation, exhaust ventilation, smoke detection, fire detection, gas detection, or fire suppression system.
6. Provide an Emergency Response Plan (ERP) template from the Battery System Contractor at Limited Notice to Proceed (LNTP), to be later updated by the Contractor at Substantial Completion. The ERP must cover the following topics:
    A. Emergency contact details
    B. Battery OEM escalation protocol
    C. Battery system information
    D. Fire, explosion, toxic gas release, and smoke incident flow
    E. Disassembly flow chart
    F. Disposal of fire-damaged modules flow chart
    G. Emergency response lithium-ion
    H. Lithium-ion battery transportation emergency response
    I. BESS handling methodology
    J. First-aid measures
    K. Site-specific exhibits
7. Provide documentation for the completion of LSFT conducted on a representative battery system in accordance with UL 9540A. The testing must have been conducted or witnessed and reported by an approved testing laboratory and show that a fire involving one battery system will not propagate to an adjacent battery system. The test report must be provided to the fire code official for review and approval.
8. Provide a commissioning plan that includes the following documentation:

    A. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
    B. A listing of the specific battery system and associated components, controls, and safety-related devices to be tested, a description of the tests to be performed, and the functions to be tested.
    C. Conditions under which all testing will be performed are representative of the conditions during normal operation of the system.
    D. Documentation of the Owner project requirements and the basis of design necessary to understand the installation and operation of the battery system.
    E. Verification that required equipment and systems are installed in accordance with the approved plans and specifications.
    F. Integrated testing for all fire and safety systems.
    G. Testing for any required thermal management, ventilation, or exhaust systems associated with the battery system installation.
    H. Preparation and delivery of operation and maintenance documentation.
    I. Training of facility operating and maintenance staff.
    J. Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.
    K. Identification and documentation of personnel who are qualified to service, maintain, and decommission the battery system, and respond to incidents involving the battery system, including documentation that such service has been contracted for.
9. Provide a commissioning report, describing the results of the system commissioning, to the fire code official before final inspection and approval, and it must be maintained at an approved on-site location.
10. Provide an operation and maintenance manual to the Owner, or their authorized agent, and the Battery System operator before the Battery System is put into operation and must include the following information. The battery system must be operated and maintained in accordance with the manual, and a copy of the manual must be retained at an approved on-site location.
    A. OEM's operation manuals and maintenance manuals for the entire battery system, or for each component of the system requiring maintenance, that clearly identify the necessary routine maintenance actions.
    B. Name, address, and phone number of a service agency that has been contracted to service the battery system and its associated safety systems.
    C. Maintenance and calibration information, including wiring diagrams, control drawings, schematics, system programming instructions, and control sequence descriptions, for all energy storage control systems.
    D. Desired or field-determined control set points that are permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
    E. A schedule for inspecting and recalibrating all battery system controls.
    F. A service record log form that lists the schedule for all required servicing and maintenance actions and space for logging such actions that are completed over time and retained on-site.

11. Provide a decommissioning plan for removing the Battery System from service and from the facility in which it is located. The plan must include details on providing a safe, orderly shutdown of energy storage and safety systems, with notification to the fire code officials prior to the actual decommissioning of the system. The decommissioning plan must include contingencies for removing an intact operational battery system from service, and for removing a battery system from service that has been damaged by a fire or other event.
12. Provide evidence of a vegetation management plan showing that areas within 10 feet of the Battery Systems will be free of combustible vegetation.
13. Install Battery Systems at least 10 feet from any means of egress, unless a reduced separation distance is approved by the fire code official. The fire code official may approve a reduced separation distance if large-scale fire testing demonstrates that a battery system fire will not adversely affect occupant egress.

TMS

<u>General</u>

The Thermal Management System (TMS) shall be:

1. Designed to ensure OEM warranty conditions are always met under the full range of ambient temperature, humidity, and weather conditions expected at the BESS Facility site.
2. Provide the expected level of thermal homogeneity and adequately control the cell temperatures in cold and hot conditions while reducing energy consumption and maintenance time.
3. Be of heavy-duty, industrial-grade design with construction and installation designed to provide a minimum 20-year life expectancy.
4. Capable of warming cells when the ambient temperature is cold, allowing the cells to perform well even in freezing conditions.
5. Validated via OEM Computational Fluid Dynamics (CFD) analysis to show that, for a two-hour duration Facility, cell temperature is maintained below 50°C during two consecutive charge-discharge cycles, with one hour resting between the cycles, whereby the outside ambient temperature is 50°C.
6. Validated via OEM CFD analysis to show that, for a four-hour or longer duration Facility, cell temperature is maintained below 50°C during one charge-discharge cycles, whereby the outside ambient temperature is 50°C.
7. Designed using calculations to include cooling load calculations, heating load calculations, ventilation calculations, psychometric calculations, and pressure drop calculations.
8. Designed and arranged to provide maximum efficiency of operation and to provide easy access for performing routine maintenance.
9. Designed with redundancy such that failure of a single unit does not result in loss of more than 50% cooling capacity.
10. Integrated with the EMS unit and site controller to enable power limiting as necessary during loss of cooling capacity.
11. Integrated with the FPS per NFPA 68 and 69.

12. The thermal management control system shall monitor any equipment failures resulting in loss of cooling capacity. Diminished cooling capacity shall be interlocked with the Site Controller to limit battery charging/discharging rate as necessary to avoid cooling system overload.
13. Shall interface with the FPS per NFPA 68 and 69.
14. Supported by the Facility auxiliary power system and/or backup power (e.g., UPS).

Enclosure

The battery enclosure shall:

1. Be pre-assembled and capacity-tested at the factory and arrive on-site with battery racks populated and sub-systems installed.
2. Be shipped fully assembled to the extent practical to maintain compliance with UL 9540 certification.
3. Have enclosure doors on one side of the enclosure, allowing back-to-back field layout configurations.
4. Be weatherproof and tamper-resistant with a minimum ingress rating of IP65 that is suitable for the environmental conditions specified for the Facility in Section 3.0 Project Design Criteria.
5. Not have any history of water ingress due to a manufacturing defect or deficiency.
6. Be designed and assembled with full access to components for inspection, maintenance, and replacement.
7. Be suitable for mounting outdoors on a concrete pad, piling, piers, or other structure as specified by OEM, with pre-installed lifting lugs.
8. Have an installation manual with drawings, images, and measurements that adequately describe layout constraints, on-site installation procedures, raceways, and cable entries.
9. Be designed to safely collect and discharge condensed or leaked water without compromising the electrical barriers.
10. Include all internal DC and AC systems necessary for the operation of the battery system to address thermal management, control power, fire detection, fire suppression, and deflagration as applicable to system design.
11. Battery enclosures must meet requirements in Section 19.0 Codes and Standards.

Protection and Isolation

1. The design of the protection and isolation systems shall accord with the applicable codes, standards, and regulations in Section 19.0 Codes and Standards.
2. A local Emergency Stop Button shall be installed that immediately trips the Battery System and opens the main breaker.
3. Each party providing equipment for the BESS Facility is responsible for the design and implementation of the necessary protection coordination schemes and systems for their respective equipment.
4. Each DC bus shall have a lockable, load-break, two-pole, disconnect switch for the main DC power. The means of disconnection shall be visible and shall be capable of being locked in the open position (lockout).

5. Each Battery Rack section (or pair of sections if applicable) shall include a load-rated disconnecting means, to allow isolation of the Battery Rack's modules from the DC bus by the BMS.
6. All live conductors shall be insulated and/or covered such that no part of any live conductor shall be possible to touch by any person.
7. All exposed conductive elements shall be grounded in accordance with applicable codes, standards, and regulations.
8. The polarities of all connections (Battery Cell, Battery Pack, etc.) shall be marked and clearly visible.
9. Arc flash hazard arising from modules and racks partially and fully assembled shall be calculated, and the incident energy exposure for those assembling or maintaining the BESS Facility shall be minimized.
10. Any door providing access to an enclosure containing battery modules and ancillary equipment shall be lockable, with locks and keys supplied. Doors, locks, and keys shall be permanently labelled with a coherent, logical identification system to prevent unauthorized access.
11. The Battery System shall have self-protective and self-diagnostic features to protect itself from damage due to failure of another component in the BESS Facility or excursion of operating parameters outside of permitted ranges.
12. The Battery System shall have self-protective capability that, in the event of loss of mains and auxiliary loads, the Battery System shall shut down and protect itself from excessive energy capacity drain from the cells and state of charge falling below safe design limits. Upon return of the mains connection, the Battery System shall automatically return to safe operation or be remotely controlled.
13. All electrical connections shall be designed to withstand the electromagnetic forces exerted upon them during short-circuit conditions. This shall be evidenced by calculation.
14. The Battery System shall meet applicable codes and standards (Section 19.0 Codes and Standards) for chemical storage, usage, and spill containment, and the Contractor shall deliver all associated documentation to the Owner.
15. The battery system shall be able to withstand all reasonably foreseeable mechanical shock loads, including transport and installation.
16. The Contractor shall deliver a Battery System capable of topping up battery charge (using a portable generator or otherwise) to prevent damage to battery cells during a period of prolonged downtime at the POI.

4.2 PCS

1. The Contractor shall supply a four-quadrant bidirectional PCS. The PCS can be a standalone, skid-mounted assembly, a combined PCS/MVT skid solution, or a rack-level string-inverter system within the Battery System.
2. The Owner recommends one Battery System per DC Bus to maximize availability, and that every PCS is paired with the same quantity of Battery Systems.
3. The Owner shall meet the requirements of the interconnection agreement, and the Contractor schedule must account for any material modifications necessary.

4. There shall be no cellular modems or external communication devices installed in PCS skids or PCS/MVT skids.
5. Each PCS in the Facility shall be connected to its own dedicated low-voltage winding on the MVT, rather than sharing a single winding among multiple inverters.
6. The PCS shall have weatherproof and tamper-resistant enclosures with a minimum ingress rating of NEMA 3R that is suitable for the environmental conditions specified for the Facility in <u>Section 3.0 Project Design Criteria</u>. Heating and cooling systems shall be included, as required and recommended by the OEM, based on said environmental conditions.
7. The power quality to the grid shall meet the harmonic requirements per IEEE 519 based on the interconnection voltage. The Contractor shall perform pre- and post-energization comparisons of harmonic content on the grid to ensure the system does not exceed IEEE 519 limits. The Contractor shall not be responsible for mitigating harmonic content on the existing network.
8. The PCS shall be provided with Lock-Out/Tag-Out (LOTO) capabilities. Disconnect switches shall be provided so personnel can locally and manually isolate the Battery System from the PCS (DC switch) and locally and manually isolate the PCS from the MV feeder circuit (AC switch), at the PCS level. The disconnect switches shall be gang-operated and lockable in the open position.
9. The PCS shall have an interrupting device capable of interrupting the maximum available fault current.
10. The PCS shall be certified with IEEE 1547-2018 via UL 1741 SB to meet the following requirements:
    A. Voltage Ride-Through (VRT) – Category III Requirements:
        I. Continuous Operation: $0.88 \text{ p.u.} \le V \le 1.10 \text{ p.u.}$ (normal operation, full active and reactive current exchange)
        II. Mandatory Operation (Low Voltage): $0.50 \text{ p.u.} \le V < 0.88 \text{ p.u.}$ (must stay connected and support the grid with active/reactive current)
        III. Momentary Cessation (MC): – $1.10 \text{ p.u.} < V \le 1.20 \text{ p.u.}$ and – $V < 0.50 \text{ p.u.}$ (includes zero-voltage ride-through capability)
        IV. Cease to Energize / Shall Trip: $V > 1.20 \text{ p.u.}$
    B. Frequency Ride-Through (FRT) – Category III Requirements:
        I. Continuous Operation: $58.8 \text{ Hz} \le f \le 61.2 \text{ Hz}$
        II. Mandatory Operation: – $61.2 \text{ Hz} < f \le 61.8 \text{ Hz}$ and – $57.0 \text{ Hz} \le f < 58.8 \text{ Hz}$
        III. Cease to Energize / Shall Trip: – $f > 62.0 \text{ Hz}$ and – $f < 57.0 \text{ Hz}$
        IV. Rate of Change of Frequency (ROCOF) Ride-Through: Must ride through ROCOF up to 3.0 Hz/s
    C. After any ride-through event ends, the DER must restore active power output to ≥ 80% of the pre-disturbance value within 0.4 seconds.
11. The PCS control system shall have voltage control capability with an adjustable voltage setpoint and an adjustable droop functionality. Voltage setpoint limits will also be configurable. The Owner is required to operate in Automatic Voltage Control (AVG) at all times. VAR or power factor control is generally not allowed. Voltage control must be fully commissioned prior to commercial operation.

12. The PCS control system shall have a primary frequency response capability with a configurable droop and MW "headroom" (MW curtailment from current maximum output).
13. The PCS OEM shall supply verified generic dynamic models and PSCAD EMT models for the inverters and plant controller, and include verification documentation.
14. The PCS control system shall have individual PCS pause and restart commands that are available to external controllers via OPC-UA, Modbus, or other generic industrial communication protocol.
15. The PCS control system shall be capable of communications and remote controls via standard industrial protocols – Modbus, OPC-UA, and DNP3.0 are acceptable.
16. The ramp rate (MW and voltage setpoint) of charging and discharging of the BESS Facility shall be programmable or set to a defined value by manually entering a value into the BESS Facility human-machine interface or by the Owner's SCADA control system.
17. The Contractor shall ensure the selected PCS is optimized to maximize power and energy generation for the environmental design requirements specified in Section 3.0 Project Design Criteria. The PCS shall be capable of continuous operation under the full range of site environmental conditions. Final PCS sizing and design shall account for performance impacts resulting from temperature derates. The PCS stations shall be able to provide the full site nameplate rating at the maximum operational ambient temperature identified in this Exhibit, accounting for direct sunlight exposure at the PCS Station.
18. The PCS shall be sized and designed to perform reactive power (VAR) compensation and voltage control to meet PF at the POI based on the site reactive power study (unless capacitor banks are planned). The Owner prefers that the PCS perform reactive power control without supplemental capacitor banks.
19. The PCS shall have grid-forming capabilities to include negative sequence current injection and synthetic inertia capability. The Contractor shall provide options for grid-forming mode functionality.
20. The PCS shall provide ground/ground fault monitoring, protection, and alarms for the grounded or ungrounded DC bus and collection systems.
21. The PCS shall have the ability to withstand an asynchronous connection to the grid.
22. FAT shall be performed for all PCS as required in Section 16.1 Factory Acceptance Testing. FAT records shall be submitted to the Owner for approval.
23. The PCS must meet requirements in Section 19.0 Codes and Standards.

4.3 MVT

1. The MVT shall be a dead-front pad mount, loop-fed design.
2. The MVT shall be provided with primary overcurrent protection with partial range current limiting and Bayonet fuses at a minimum, and a liquid-filled, visible load-break rated gang-operated disconnect switch capable of keeping the loop closed while the transformer is de-energized. If applicable, fuses shall be external and accessible.
3. The MVT shall have a high-side De-Energized Tap Changer (DETC) with five positions, nominal two 2.5% adjustments +/-.

4. The MVT efficiency shall meet or exceed Department of Energy (DOE) targets. MVT shall be rated as 99% efficient or greater at full load, with no-load losses less than 0.25% of the rated MVA.
5. The MVT design shall be capable of continuous step-up and step-down operation and shall include a static shield between high-side and low-side windings. The MVT shall be capable of handling over-voltages up to 10% continuously.
6. The MVT design shall meet all of the PCS OEM requirements, including winding impedance requirements, suitability for operation with pulsed inverters, and maximum voltage to ground.
7. The MVT shall be provided with primary overcurrent protection in accordance with the transformer OEM recommendations and approved means.
8. The MVT must withstand the full ride-through conditions (especially low-voltage ride-through down to 0.0 pu for 0.16 s and high currents during LVRT) per IEEE1547(2022), and must operate continuously within Range A (–2.5% to +5%) and survive Range B excursions per ANSI C84.1 (Voltage Ranges).
9. Molded rubber elbow arresters shall be provided at MVT located at the end of radial circuits. Additional arresters shall be included if identified as required by the Contractor.
10. Secondary containment shall be provided for all MVT. Oil sample ports shall be easily accessible, if applicable.
11. Liquid-filled pad-mount MVT may contain either FR3 or mineral oil insulating fluids.
12. If MV vacuum breakers are used, a snubber circuit is to be connected to the primary of the MVT.
13. MVT shall be equipped with LOTO capabilities.
14. The MVT must have aligned specifications with the MPT to ensure compatibility, efficient power flow, voltage stability, fault handling, and overall system reliability. The primary voltage of the MVT must align with the secondary voltage of the MPT at the substation for seamless interconnection. The project will connect via a dedicated feeder and/or existing bay with a direct substation interconnection (existing infrastructure). Both must support the same voltage schedules and ride-through capabilities. Capacities shall match the system's bidirectional flow without overloading. The phase and winding configurations shall be compatible.
15. FAT shall be performed for all MVTs as required in Section 16.1 Factory Acceptance Testing. FAT records shall be submitted to the Owner for approval.
16. The MVT must meet requirements in Section 19.0 Codes and Standards.

4.4 MVSG

1. The MVSG shall form the central power consolidation and protection node for the POI voltage specified in Section 3.1distribution network BESS Facility.
2. The MVSG shall aggregate power outputs from MVT(s), if applicable, and interface with the existing utility MPT for grid interconnection the POI voltage specified in Section 3.1,
3. The MVSG shall incorporate circuit breakers, disconnect switches, protective relays, and integrated control systems.
4. The MVSG shall be metal-enclosed (or pad-mounted where required), dead-front design, suitable for outdoor installation in a battery storage facility environment.

5. The MVSG shall be provided with vacuum circuit breakers or vacuum load-interrupter switches as the primary switching and overcurrent protection devices. Each feeder bay shall include microprocessor-based protective relaying (SEL or approved equal) with instantaneous, time-overcurrent, and ground-fault protection. Visible, gang-operated, load-break disconnect switches shall be provided for isolation and shall maintain loop integrity while individual sections are de-energized. All switching devices shall be rated for full system short-circuit duty and bidirectional power flow.
6. The MVSG shall be equipped with a main bus continuous current rating and short-circuit withstand rating coordinated with the overall plant design. A manually operated, de-energized bus-tie or sectionalizing switch shall be provided where loop or dual-feed configurations are required.
7. The MVSG efficiency shall minimize losses; total power losses (I^2R + core + dielectric) shall not exceed 0.15% of the rated MVA at full load continuous current. Bus and breaker contacts shall be silver-plated or tin-plated copper to ensure low resistance.
8. The MVSG design shall be capable of continuous bidirectional operation (charge and discharge) and shall include surge arresters on all incoming and outgoing circuits. The switchgear shall be rated for continuous operation at 105% of nominal voltage and shall withstand temporary over-voltages up to 110% of nominal voltage.
9. The MVSG design shall meet all PCS OEM requirements, including maximum fault current contribution, rapid reclosing capability (if required), suitability for operation with inverter-based resources, harmonic withstand, and maximum voltage to ground. The switchgear shall accommodate the high dV/dt and high-frequency transients typical of pulsed inverter operation.
10. The MVSG shall be provided with protective relaying and overcurrent protection in accordance with the PCS OEM recommendations, utility interconnection requirements, and IEEE C37.91 / C37.96 guidelines, as approved by the Engineer of Record.
11. Station-class surge arresters (metal-oxide varistor type) shall be provided on all incoming lines, outgoing feeders, and transformer connections. Additional arresters shall be included if identified as required by the surge study or Contractor.
12. The MVSG enclosure shall be rated NEMA 3R or 4X (as required by site conditions) with adequate space for cable entry, termination, and racking. All cable compartments shall include grounding studs and provisions for safe cable testing. Arc-resistant construction (ANSI/IEEE C37.20.7, Type 2B preferred) shall be provided for personnel safety.
13. The MVSG insulating medium shall be vacuum (preferred) or SF6 (if approved). No oil-insulated equipment is permitted inside the switchgear assembly.
14. If vacuum circuit breakers are used, a snubber circuit (RC or RCD type) shall be connected across the breaker terminals or at the connected transformer primary to suppress switching transients.
15. The MVSG must be equipped with LOTO capabilities on all circuit breakers, disconnect switches, and grounding devices. Kirk-key or equivalent mechanical interlocking shall be provided to enforce safe operating sequences.
16. The MVSG must have aligned specifications with the MVT and substation MPT to ensure compatibility, efficient power flow, voltage stability, fault handling, and overall system reliability. The switchgear's voltage rating (BIL) and continuous current rating must match the

substation MPT's secondary voltage and the MVT's primary voltage for seamless interconnection. Both the MVSG and transformers must support the same voltage schedules, ride-through capabilities, and bidirectional flow without overloading. Phase arrangement, winding/terminal configurations, and protective relaying coordination shall be fully compatible.

17. FAT shall be performed for all MVSG assemblies as required in Section 16.1 Factory Acceptance Testing. FAT records, including dielectric tests, mechanical operation tests, control wiring checks, and partial discharge tests, shall be submitted to the Owner for approval prior to shipment.
18. The MVSG must meet all requirements in Section 19.0 Codes and Standards, including (but not limited to) ANSI/IEEE C37.20.2 or C37.20.3, IEEE C37.20.7 (arc resistance), IEEE C37.04, IEEE C57.12.28 (if pad-mounted), UL 1558, and all applicable utility and AHJ requirements.

4.5 Auxiliary Systems

General

1 The Contractor shall provide power from the Substation via a dedicated aux feeder necessary to run BESS auxiliary systems, including distribution of power to the fire alarm panels, lighting, FNEs, etc.

2 The auxiliary power system shall be designed to support the site auxiliary power loading

3 requirements.

4 The auxiliary power system shall be fed from a primary distribution source coordinated by the DSP with the project substation transmission bus as back-up in case of failure of the distribution system. The BESS auxiliary power shall not be derived from any battery system circuit.

5 Metering with a connection to the plant SCADA system shall be provided for the load side of the Auxiliary Power service, including from backup auxiliary sources.

6 The auxiliary feed will be via a fused disconnect from the medium voltage bus of the project substation. Circuit protection will be provided by an MV circuit breaker in the switchgear.

7 The system shall be distributed to the site via MVSG.

8 The MVSG shall have an interlock between the primary distribution feed and the backup transmission feed.

9 The feed shall have a connection via a manual transfer switch for an optional backup mobile generator.

10 The MV auxiliary power system shall be fed to medium voltage transformers, sized to minimize losses and the number of transformers throughout the site.

11 The auxiliary power system design shall include single-line diagrams for the following equipment:

12 MVT, MVSG, distribution panels, and connections to the utility distribution feed and transmission bus feed.

13 Auxiliary load consumption simulations and calculations shall use the weather conditions specified in Section 3.0 Project Design Criteria.

14 A dedicated transformer shall service all equipment on an MV feeder and auxiliary power distribution system.

15 A 480Vac, 3-phase distribution panel must be present for all feeder-related auxiliary power services for the battery system and PCS.
16 The auxiliary power distribution panel or a dedicated generator interconnection panel shall be supplied with quick-connect generator connections.

Auxiliary Metering

1. Auxiliary power shall have a separate utility-owned revenue meter for aux power ("Station Service" or "Auxiliary Service").
   A. Dedicated metering compartment in the MV switchgear or a separate aux transformer secondary panel (utility-sealable).
   B. CTs and PTs (if needed) must be utility-approved and accuracy-class compliant.
   C. The meter must remain powered even when the main BESS breaker is open.
   D. Communication: DNP3 or utility SCADA integration for remote reading (increasingly required).
2. Auxiliary metering shall comply with the DSP and Owner requirements as applicable.

4.6 Spare Parts

1. The Contractor shall provide the Owner a recommended spare parts list for all Contractor-provided materials and equipment (including quantities, prices, OEM part numbers, and identification of all critical spares) for the first ten (10) years after Substantial Completion.
2. The Contractor shall provide the location of spare parts and storage conditions.
3. The Contractor shall provide the Owner with failure analysis from major equipment OEMs, providing anticipated failure rates.

5.0 Controls and Integration

5.1. EMS Controls

General

The Contractor shall procure, install, integrate, commission, and test the EMS system so that it shall be a fully functioning and integrated EMS system.

1. The EMS Control Hardware (controllers shall be designed for the maximum and minimum temperature conditions in Section 3.0 Project Design Criteria.
2. The primary function of the EMS shall be to dispatch real and reactive power from the BESS Facility based on signals or schedules issued by the system operators, utility, Site Controller, or Owner SCADA.
3. The EMS shall be designed to provide for automatic, unattended operation of the BESS Facility equipment as well as manual controls of the BESS Facility equipment.
4. The system shall provide automatic operation, remote operation, and dispatch of the BESS equipment from the local HMI and web portal. All modes of operation and associated setpoints can be remotely adjustable. Interfaces shall allow changes in settings and control modes and shall provide access to necessary Battery System and PCS data.

5. The EMS shall communicate directly with the battery containers and PCS. The EMS shall receive signals from the site SCADA systems, including Substation Real Time Automation Controller (RTAC), TSP Equipment, a dedicated control meter, Owner-provided equipment, and shall monitor and send control signals as necessary to operate the BESS Facility.

Scope of Supply

The Contractor shall provide the following EMS and SCADA scope of supply:

Site-Level FNE

1. The Contractor shall supply a freestanding or panel mount enclosure housing all site-level EMS equipment, to include, as applicable:
    - Site Controller(s)
    - Site-Level Managed Switch
    - Firewall
    - Onsite Server
    - RTAC(s)
    - Communication Equipment
    - Fiber Patch Panel
    - Power Supply / AC Power Distribution / Surge Protection
    - Misc (Terminal Blocks, Cables, Fuses, Circuit Breaker, Wiring, Mounting Hardware, etc.)
    - 4-hour duration UPS
    - TMS
    - Labeling and Documentation
2. An indoor server rack solution can be utilized if there is adequate space within a climate-controlled substation house or control house. If not available, the site-level controls shall be housed in a weatherproof, tamper-resistant enclosure with a minimum NEMA 3R ingress rating, suitable for the environmental conditions specified for the Facility in Section 3.0 Project Design Criteria.
3. Thermal management shall be included, as required and recommended by the OEM, based on the specified environmental conditions, to maintain the equipment within the prescribed operating temperature range.

Unit-Level FNE

1. The Contractor shall supply FNEs to house all PU-level EMS equipment, to include, as applicable:[10]
    - Unit Controller(s)
    - Unit-Level Managed Switch
    - Fiber Patch Panel
    - 4-hour duration UPS
    - Power Supply / AC Power Distribution / Surge Protection
    - Misc (Terminal Blocks, Cables, Fuses, Circuit Breaker, Wiring, Mounting Hardware, etc.)
    - TMS
    - Labeling and Documentation
2. The unit-level controls shall be housed in a weatherproof, tamper-resistant enclosure with a minimum NEMA 3R ingress rating, suitable for the environmental conditions specified for the Facility in Section 3.0 Project Design Criteria.

[10] Unit-level EMS equipment may not be applicable for battery system and PCS equipment governed by a local controller.

3. Thermal management shall be included, as required and recommended by the OEM, based on the specified environmental conditions, to maintain the equipment within the prescribed operating temperature range.

Engineering Design

1. The EMS engineering and design shall incorporate the following features:
    A. The EMS shall be designed to operate the resources and receive control setpoints from the Site Controller or Owner SCADA for plant output.
    B. Compliance with all necessary ISO requirements, as applicable.
    C. The EMS shall be designed to manage and control the plant voltage, real and reactive power, and respond to local measurements to ensure plant output matches the Project setpoints.
    D. Designed to provide for automatic, unattended operation of the BESS Facility.
    E. Designed to provide remote manual operation or automatic operation.
    F. All control modes of operation and associated settings and setpoints to be remotely adjustable.
    G. Integration with any necessary entities that require control for command signals to the BESS Facility equipment via the EMS.
    H. Manage system operation, including issuing commands to the individual PUs.
    I. Integrate with the substation RTAC / Data Concentrator to digest all relevant substation device information, as defined by the Owner, for visualization on the user interface or historization within the EMS. If control of breakers or other substation devices is required by the Owner, the EMS is to integrate a control interface for the devices between the EMS and the Substation RTAC / Data Concentrator.
    J. Aggregate and record all necessary data points from the equipment listed in Table 12: Device Integration within the project historian at 1-second sampling rates. Provide on-premises storage of aggregated data at the time interval as defined by the Owner.
    K. System controls for Battery System charging, discharging, and managing of SOC. The ramp rate of charging/discharging and maintaining a specific state of charge of the Battery System shall be programmable via manual entry into the EMS HMI.
    L. The Contractor shall be responsible for designing a PU-Level and Site Level “Fast stop” function operable via the EMS HMI that issues 0 kW and 0 kVar power commands to the inverter prior to opening the Owner-defined breakers. This fast stop function is not equivalent to an emergency stop (E-stop) or related to a safety stop of the system.
    M. The plant should control the requested MW value at the Meter Point to within 2% after a 4-second settlement period.
    N. The Contractor shall be responsible for the design of the BESS / EMS network, including network topology design, networking infrastructure design and specifications, communication requirements, and interactions of devices on the network, and designation of a project IP schema with associated subnetting / Virtual Local Area Networks (VLANs) that adhere to best practices for network security and segregation where applicable.

O. The Contractor shall provide a minimum of the following deliverables to the project; 30%. 60%, 90%, IFC, As-Built drawing sets, Plant Control Narrative, O&M Manual, Network IP Schema for BESS / EMS, consolidated plant points list, and associated unit and substation completion documentation for the EMS system.
P. EMS redundancy shall be provided through software redundancy (e.g., Watchdog service)
Q. EMS hardware redundancy shall be provided for Ethernet ports and pathways, and for power supplies
R. EMS communications pathways shall be arranged in rings capable of continuing full operation after a single failure.
S. Vendor solution will be capable of integrating with a Utility-provided SCADA system using Ethernet-based and hard-wired (point-to-point) communications. This interface will provide the customer with full monitoring and diagnostic capabilities, as well as basic operating capabilities, for any analog or digital points and alarms available within the Contractor's local control system, to support customer remote monitoring and operation of the facility. Accepted protocols would include Modbus TCP/IP or DNP3.0 TCP/IP transmitted over fiber or copper Ethernet.

Coordination

1. The Contractor shall coordinate with the device OEM/vendors:
    A. Receive and troubleshoot device documentation, including point lists, manuals, and spec sheets, to properly work through the integration process (Owner to provide documents in a timely fashion).
    B. Ensure that the device integration shall allow the EMS to control the BESS Facility such that it meets the system performance requirements outlined in this Scope of Supply and interconnection agreement.
2. The Contractor shall coordinate with the Owner and the Contractor's Engineering, Procurement, and Construction (EPC) contractor, as applicable:
    A. Notify the Owner, as applicable, of any specific device issues it identifies that may impede the ability to meet performance requirements or timeline. In which case, the Owner shall intervene to require the device OEM/vendor to make changes to their device(s) to meet the requirement or remove the requirement from the Contractor's scope of supply.
3. The Contractor shall be required to attend a coordination meeting every week to discuss engineering progress, design deliverables, project schedule, and any other items relative to the project, subject to a predetermined time cap. As it pertains to the Scope of Supply, additional meetings may be necessary to coordinate with other project design teams and Contractors, or to troubleshoot issues throughout the project, and the Contractor is expected to participate in these meetings.

Software Engineering and Development

1. The Contractor shall be responsible for the software engineering, development, and integration services of the following items:
    A. Network configuration and communication, including:
        i. EMS site-level networking equipment to EMS field-level network equipment
        ii. EMS Equipment to all devices listed in Table 12: Device Integration
    B. On-Site EMS equipment installation and integration
    C. Cloud configuration and setup
    D. Remote HMI and Local Workstation and HMI for EMS controls and operation, per Section 5.4 HMI/Historian.
    E. EMS RTAC, if applicable, configuration, development, and integration
    F. Data acquisition system and historian implementation per Section 5.4 HMI/Historian.

BESS Control Modes

1. To safely coordinate control of the system, the EMS shall provide three control modes (remotely adjustable) to coordinate control of the system safely:
    A. Manual Control: Enables operators to command local active and reactive power control of the system in response to conditions in the larger electrical network. This includes placing equipment in a manual stop that prevents remote control or operation during equipment maintenance, manual start of equipment, PU-level controls and power commands, and site-level controls and power commands.
    B. Automatic Control: Enables the EMS to follow commands from the Owner SCADA.
    C. Remote Control: Ability to receive active and reactive power commands from the HMI, ISO, or Owner SCADA.

Applications

1. The EMS shall include the Applications (operating modes) as described in Table 11 – EMS Applications. All modes of operation and associated setpoints are to be remotely configurable via the HMI.

Table 11 – EMS Applications

Mode	Behavior
Real Power	Sets the real power output of the BESS Facility to meet a specified target within 2% after a 4-second settlement period.
Reactive Power	Sets the reactive power output of the BESS Facility to meet a specified target.
Automatic Governor Control (AGC)	Charges or discharges the BESS Facility at a real power level received from the SCADA.

SOC Management	Returns Battery System to a target SOC if the SOC exceeds specified limits. It can also be set to enable and disable on a 24-hour clock cycle.
POI Limiting	The maximum available apparent power at POI determined by the IA that the Project can produce.
Automatic Voltage Regulation (AVR)	AVR at the POI based on the IA voltage or power factor requirements through reactive power dispatching to the plant assets through an associated droop slope.
Primary Frequency Response (PFR)	PFR at the POI based on the IA frequency requirements through active power dispatching to the plant assets through an associated droop slope.

Response Time

1. The EMS shall have a total response time of less than 100 milliseconds.
2. The EMS response time shall be measured from the time of a control trigger is issued to the EMS until the time the PU Controller(s) deliver the command to the PU.
3. The control trigger is any mechanism that drives the EMS to dispatch commands to the PU Controller(s) and may be a setpoint issued to the Site Controller, locally measured deviation that prompts a change, a user change to the local operating mode setpoint, or others.

5.2. Networking and Communications

General

1. The Contractor shall comply with cybersecurity codes and standards in Section 19.0 Codes and Standards.
2. The EMS and SCADA system shall not be procured from or supplied by a company that is designated as a Foreign Entity of Concern (FEOC), under U.S. law, per the U.S. Department of Energy interpretation -at https://www.energy.gov/mesc/foreign-entity-concern-interpretive-guidance.
3. All switches must have the country of origin in the United States of America.
4. The Contractor shall be responsible for collaborating and integrating the Owner's security requirements for the project equipment, including Virtual Private Network (VPN) access, monitoring parameters and tools, and security checks.

Communications

1 The Contractor shall run fiber using a dual ring topology, and cables shall adhere to Section 7.2 Fiber Optic Cables.

2 The Owner shall provide up to 2 hardline Internet Service Provider (ISP) connections. The Contractor (EMS) must be prepared to integrate two hardline ISPs and up to two cellular modem connections. One of the hardline ISPs may be substituted with Starlink Enterprise.

3 The Contractor is to provide, specify, and implement the project ISP connection to the plant and ensure that any redundancy and data transmission rates (both up and down) as required

by the plant control system are met. If additional routers, Wide Area Network (WAN) interfaces, or other ISP requirements are needed, the Contractor will complete the associated design and implementation. The Owner will specify whether a backup cellular connection is required in the event of an ISP failure, and, if so, the Contractor shall determine the best course of action for implementing the backup cellular connection.

4 No less than 90 days before Substantial Completion, the Contractor must provide documentation defining any critical data and access required for operations and maintenance of their supplied equipment for review and approval by the Owner.

Deliverables

1. The Contractor must provide 30%, 60%, 90%, Issued for Construction (IFC), and As-Built Network System Architectural Diagrams, including all relevant IP addresses, corresponding IP Address site map, and VLAN infrastructure, for Owner review and approval.
2. The Contractor must provide a communication block diagram for Owner review and approval.
3. The Contractor shall provide a network drawing package, including but not limited to:
    A. Physical communication diagram, including details on hardware, physical connections, cable types, hardware locations, and device identification numbers
    B. Logical communication diagram, including details on VLANs, protocols, port allocations, IP addresses, and the type of data being transmitted
    C. Rack elevation drawing, including details on rack equipment (with device ID), vertical location, and dimensions
4. The Contractor shall provide a detailed account of the asset inventory, including but not limited to device name and ID, device OEM and model, device physical location, IP address(es), device function/description, firmware, and software version.
5. The Contractor shall provide a document package that includes all configuration files loaded to each of the supplied pieces of equipment.
6. The Contractor shall provide change authorization/configuration management processes to the Owner for review to ensure system changes are properly authorized, documented, and performed.
7. The Contractor shall provide a list of assets requiring remote access, via VPN tunnel, and the associated protocols.

Design and Configuration

1. Site devices shall be deployed with the latest approved and recommended firmware from the vendors.
2. Prior to Substantial Completion, the Contractor shall have all service and security patches for all software and firmware updated to the latest, stable version.
3. All modifications to network design must be approved in writing by the Owner.
4. All supplied network equipment must adhere to Exhibit [●] – Approved Vendor List.
5. All Contractor-provided network assets must be managed and hardened devices.
6. All unused ports shall be disabled.
7. All used ports shall be labeled to describe what is connected (e.g., RTAC-eth1).

8. The Contractor shall remove all software on supplied equipment that is not necessary for the operations and maintenance of the site.
9. Upon completion of commissioning and commencement of commercial operations, the Contractor shall remove all wireless communications (WiFi, cellular, Bluetooth, etc.) and removable media drives (USB ports, disc drives, etc.).
10. Upon completion of commissioning and commencement of commercial operations, the Contractor shall, wherever feasible, design the network equipment such that access can be limited to the KVM switch and/or HMI screen, via lockable racks or otherwise.
11. All Contractor-provided designs must include redundancy or high availability for all network components. The system must not contain a single point of failure.
12. The Contractor shall not use VTP (VLAN Trunk Protocol) unless otherwise approved by the Owner.
13. Unless the system is air-gapped, the Contractor is required to design in segmentation with VLAN's for devices with different functions and control levels. Demilitarized Zone (DMZ) segmentation will be used for third-party vendors.
14. All VLANs shall be terminated and secured at the firewall. Network Access Control List (ACL) will be managed at the firewall.
15. The protocols LLCP and CDP will be turned off by default and only re-enabled for troubleshooting via written approval from the Owner.
16. All Contractor-provided switches must have their own management VLAN's.
17. IP addressing plan for the Contractor-provided equipment will be provided by the Owner.
18. All unencrypted protocols, such as Hypertext Transfer Protocol (HTTP) and Telnet, shall be turned off on all network devices. If the device cannot perform encryption, it must be placed in a DMZ environment.
19. For encrypted communication, SSH, HTTPS, and Websockets shall be the preferred protocols. Internet Control Message Protocol (ICMP) shall also be enabled, typically for testing network communications.
20. For device information, statistics, and metrics, the Owner requires SNMPv3 communication with the best possible encryption from field TCP/IP devices. Devices should be programmed with Read-Only SNMPv3.
21. The Contractor shall harden all devices and back up a last-known stable configuration in the event of a system failure.
22. The Contractor shall track and store all configuration files and software version changes.

Monitoring and Maintenance

1. The network shall have consistent monitoring of appliances, operating systems, configuration, firmware, and CVE (Common Vulnerability and Exposures) using Security Information and Event Management (SIEM) tools.
2. Equipment OEM firmware implementation and software updates/patches must be coordinated in advance with the EMS provider (if a different party from the Contractor) and the Owner.
3. The Contractor shall facilitate a quarterly review of software updates for supplied equipment.
4. The Contractor must comply with periodic cybersecurity risk assessments and audits per the Owner's policies.

5. The Contractor shall perform a quarterly vulnerability scan, as well as an annual penetration test, to comply with NERC Critical Infrastructure Protection (CIP) guidelines. For any vulnerabilities detected in the supplied equipment, the Contractor shall remediate within the time stated below based on the severity of the vulnerability:
    A. Critical = 12hrs from being notified
    B. High = 48hrs from being notified
    C. Medium = 5 days from being notified

Access Credentials

1. All external access after Substantial Completion shall be provided and administered by Owner's Security Team.
2. Prior to Substantial Completion, the Contractor shall remove or disable any accounts that are not needed for normal, maintenance, or emergency operations.
3. All devices shall follow NIST minimum password requirements.
4. Passwords must not be repeated across projects.
5. Passwords should be generated by an approved encryption device.
6. All default passwords shall be removed and replaced with a unique password.
7. All supplied equipment shall have unique passwords for each piece of equipment provided with the best practice level of encryption.
8. Access controls shall enforce role-based access control (RBAC), multi-factor authentication (MFA), and least-privilege principles; default credentials shall be changed, and all access audited with logs retained for at least 12 months.
9. The Contractor shall provide the Owner with an administration mechanism for adding, deleting, and modifying the user role(s).
10. The supplied system(s) shall not allow multiple concurrent logins using the same authentication credentials, allow applications to retain login information between sessions, provide any auto-fill functionality during login, or allow anonymous logins.
11. All logins shall support multi-factor authentication (MFA).
12. At least three simultaneous logins shall be allowed, with user groups determining the level of access and control allowed during simultaneous user scenarios

5.3. SCADA

General

1. The Contractor shall design the SCADA System to adhere to all requirements specified in the IA, interconnection handbooks, and the Owner's specifications.
2. The Contractor shall furnish a SCADA System consisting of, but not limited to:
    A. On-Site SCADA Server
    B. On-Site SCADA HMI and SCADA Local Historian
    C. Remote SCADA HMI and SCADA Remote Historian
2. The SCADA system shall meet all specifications in <u>Section 5.2 Network and Communications</u> and all standards in <u>Section 19.0 Codes and Standards</u>.

3. All software and firmware shall be licensed for use by the Owner. The Contractor shall provide copies of all licenses. All software shall include a minimum of one (1) year of service maintenance, extending one (1) year beyond Project Final Completion, with the option for the Owner to extend for additional year(s).
4. The SCADA System shall communicate with the subsystems via Modbus, DNP3, or OPC application protocol.
5. The SCADA System shall use a satellite-synchronized clock for time synchronization with substation devices.

On-Site SCADA

1. The SCADA Server is required for data acquisition and data transmission, as well as providing the application layer (visual representation) of the complete Project to the Owner, both locally and remotely.
2. The SCADA Server shall provide the data visualization for the complete system in the form of the SCADA HMI (locally) and the SCADA web user interface (remotely).
3. The Contractor shall interface with the devices listed in Table 12: Device Integration. All device communication shall occur over Ethernet or Serial via CAN Bus, DNP3.0, or Modbus TCP/IP.
4. The Contractor shall develop the points list from the devices and necessary configuration files for the EMS RTAC for the Owner's review and approval.

Table 12: Device Integration

Device	OEM Make/Model	Description
Battery System	[TBD]	Enclosure housing the DC Block and all the associated subcomponents, e.g., BMS, TMS, FPS, onboard unit/local controller (if applicable)
PCS	[TBD]	Bidirectional AC/DC converter enabling Battery Systems to charge and discharge from/to the grid
MVT	[TBD]	Step up/down voltage and distribution
MVSG	[TBD]	Protection and isolation of MV equipment
Meters	[TBD]	BESS, substation, settlement/revenue, check meters, and auxiliary meters.
RTACs	[TBD]	Substation (if applicable) and other real-time automation controller(s) for monitoring parameters, operating equipment, and logging data.
Site-Level FACU	[TBD]	Aggregate monitoring and reporting of the fire system.

Off-Site SCADA/Telemetry

General

1. The EMS shall communicate with the Owner's SCADA via DNP3.0 for substation and resource data exchange.
2. The Contractor shall provide all reasonable coordination, including point map development, integration, and point-to-point testing of 3rd-party and external communications pathways, as required to deliver a fully operational system.
3. The EMS shall provide all modes of operation and applications per Section 5.1 EMS Controls / Applications. Operational set-point functionality shall be prioritizable and remotely configurable through the Owner's SCADA system.
4. The EMS shall, if applicable, provide energy data (energy available) to the Owner's SCADA system, including any thermal derate.
5. The ramp rate for charging and discharging the BESS shall be programmable or set to a defined value by manually or remotely entering a value into the EMS, or by the Owner SCADA system communicating a ramp-rate setpoint.
6. The communications link will be established via an IPsec VPN tunnel, providing mutual authentication, end-to-end encryption, and data integrity between both endpoints. Telemetry and telecontrol traffic will be transported over this VPN using the protocol agreed upon by the Owner.

Functionality

1. Real-time monitoring of electrical variables at the POI and overall plant status
2. Telemetry for operational management, optimization, and grid security
3. Telecontrol of active power setpoints within operational limits and subject to battery availability
4. Supervision of limits and capacities to protect the asset's integrity

SCADA Points and Modes

1. The following controls and indications, at a minimum, shall be included for control, data monitoring, alarming, and protective functions in the control system from the Contractor RTAC:

Table 13 – SCADA Points and Modes Integration

Site Status	Site Metering and Auxiliary Metering
• Grid Connectivity	• AGC Discharge Limit
• Communications failure alarm	• AGC Ramp Rate
• Site Fire Alarm	• Site Metering
• Site Fire Alarm System Trouble/Fault	• SOC
• Current Operating Mode	• SOH
• Total Energy Capacity	• Phase Voltages
• Available Energy Capacity	• Average Voltage
• State of Charge	• Phase Currents
• Real Power capability (Discharge)	• Average Current
• Real Power capability (Charge)	• Frequency

• Reactive Power capability • Real Power Ramp Rate • Reactive Power Ramp Rate • Connected PCS Count • Real Power Dispatch Command • Reactive Power Dispatch Command <u>Site Commands</u> • Operating Mode • Manual Real Power Dispatch Command • Manual Reactive Power Dispatch Command • AGC Real Power Dispatch Command • AGC Charge Limit	• Real Power • Reactive Power • Total Power • Power factor • Real Energy delivered (kWh) • Real Energy received (kWh) • Reactive Energy delivered (kVARh) • Auxiliary System Metering • Phase AB Voltage • Phase BC Voltage • Phase CA Voltage

2. Alarm notification via email and text shall be sent to individual user and/or user group(s). The following alarms shall be provided at a minimum:
   A. Feeder Breaker Trip
   B. Interconnection Breaker
   C. PCS Alarms
   D. BESS Alarms
   E. MVT
   F. Loss of Communication to PCS, BESS, Substation, etc.
   G. FACP/Fire Alarm Control Unit (FACU) Alarms

Technical Fields per Signal

For each signal, the technical annex will specify:

1. Address/label within the protocol (Address/Index/Logical Node).
2. Data type (integer, float, or boolean), units, and resolution.
3. Raw range (Raw Lo/Hi) and engineering scaling (Scaled Units).
4. Access (read-only or read/write).
5. Operational notes and validation rules.

Communication and Security Considerations

1. Transport: All signals are exchanged via a point-to-point IPsec VPN between the Owner Control Center and the EMSS/BESS/gateway, with encryption and mutual authentication.
2. Time Sync: The EMS should maintain stable time synchronization (e.g., secure NTP) for traceability and event correlation.
3. Data Quality: Refresh rates will be agreed upon for measurements (1s), and statuses are sent as event-based. Alarms are sent event-based.
4. Operational Integrity: P setpoints will be validated against min/max power limits, SOC, SOH, availability, and grid conditions before application.

5.4. HMI/Historian

Remote HMI

1. The Contractor shall supply, configure, and commission a remote Web HMI. The Remote HMI shall be equipped with screens for the following, at a minimum:
   A. Overall site dashboard and performance
   B. Substation and BESS single-line status page
   C. Battery system status page(s) with all available points and visualizations
   D. PCS status page(s) with all available points and visualizations
   E. Balance of system equipment (MVT, MVSG) status with all available points and visualizations
   F. Meter data, as prescribed by the Owner
   G. Remote operator controls interface enabling preset and manual control modes, P and Q command settings, and parameter adjustment
   H. Preset and customizable reporting for analytics
   I. Display of system-level and OEM-specific alarms to include:
      I. Alarm priority, e.g., Warning/Fault/Status/Fire
      II. Location within Facility
      III. Ability to search alarm history and configure automatic responses and notifications based on trigger settings
      IV. Detailed alarm descriptions and recommended priority are to be provided
   J. Historian access/export page and visualization builder
2. The Remote HMI shall have at a minimum four levels of user access: “Read Only”, “Operations”, “Engineer”, and “User Administrator” (or similar construct) that limit the control and data available to specific users. An Owner representative shall manage authorization for the Remote HMI.
2. Alarm suppression based upon the status of one or more database points shall be configurable to avoid nuisance, repetitive, or false alarms.

Local Workstation and HMI

1. A local workstation shall be provided and located in the site control house to allow for all functions necessary to operate and maintain the Project. The Contractor shall supply, configure, and commission hardware and software for the local workstation and HMI.
2. The workstation shall be equipped with a 24-inch, dual-screen LED touch screen display with a pull-out keyboard or pull-out KVM.
3. The Local HMI shall be equipped with all screens and functionality available through the Remote HMI.

Data Acquisition System and Data Retention

1. Under an EMS Service Agreement, relevant Project Data shall be stored via the SCADA Local Historian and SCADA Remote Historian for the duration of the initial service agreement term, and accessible to the Owner via the EMS HMI.
2. The EMS shall store Project Data in the following format:
    A. Timestamp field with all times in UTC, with devices synced to 1ms resolution using NTP or a GPS clock (by others)
    B. Time stamping standard formatting shall consist of HH:MM:SS
    C. Description of the object (e.g., Site Controller, PU, Battery String, etc.)
    D. PU number with the device's unique ID
    E. Parameter value
3. The SCADA Local Historian shall support five (5) years of full data access without requiring backup media to be used.
4. Project Data shall be stored in one (1) second intervals at the local HMI, with one-minute down-sampling acceptable for data older than 90 days, and includes:
    A. Device metrics for ISO/RTO and IA telemetry
    B. Grid measurement and metering devices
    C. EMS operating mode and application history
    D. Current and historical alarm information
    E. PCS information, including, but not limited to, inverter alarms and fault codes, AC/DC current, and AC/DC voltages
    F. BOS equipment per Table 12: Device Integration
    G. All necessary control and warranty data from the battery vendor
5. The SCADA Local Historian shall enable the transmission of data to the SCADA Remote Historian within 15 minutes of the data being measured.
6. The SCADA Local Historian software should be fully licensed for all data points being collected and/or calculated within the SCADA System.
7. The SCADA Local Historian shall also be used in the case of a communications outage to the project site. Once communications are restored at the site, all local Project Data shall be uploaded to the cloud-based storage systems.
8. Following the expiration of the initial EMS service agreement term, the Parties shall be entitled to negotiation and, if applicable, mutually agree in writing on the method for storing Project Data that is older than the duration, in years, of the Initial Term ("Old Data"). The Contractor shall offer price options in connection with managing Old Data, including but not limited to hardware costs, storage fees, data migration, or archival services
9. In addition to points and modes listed in Table 13 – SCADA Points and Modes Integration, the Data Acquisition System (DAS) shall record and store the following points, at a minimum, for control, data monitoring, alarming, and protective functions:

Table 14 - Additional DAS Points

<u>Battery Enclosures</u> • Battery contactor position • Battery alarm status • Battery SOC • Battery String DC Voltage • DC-DC voltage, if applicable • Battery Enclosure alarm status • Battery Cell/Module temperature • Battery Cell voltage • Battery string current <u>PCS</u> • Start and stop status • kW setpoint • KVAR setpoint	• Read applicable analog measurements, alarms, and modes • Current and voltages to be read in three phases • Issued Setpoints, commands from SCADA, and collected feedback • AC and DC disconnect status <u>Transformers</u> • Alarm statuses, temperatures, oil levels, and pressures as applicable <u>Peripheral BESS Equipment</u> • Fiber network switches alarm status • SCADA rack environmental alarm status • SCADA UPS alarm status

5.5 Installation

1. The Contractor is responsible for receiving, unloading, storing, and protecting the EMS Equipment when arriving at their facilities before shipping to the Project Site.
2. When the EMS equipment is shipped to the Project, it shall be the Contractor's responsibility to receive, unload, store, and provide adequate protection for the EMS Equipment.
3. All EMS FNEs shall have a locking plate with a key.
4. The Contractor shall specify, procure, run, install, and terminate all associated field/home run fiber cables and associated terminations to the EMS FNEs.
5. The Contractor shall install an H-Frame structure (or equivalent), if applicable, to mount the EMS FNEs.
6. The EMS FNE(s) shall be shipped with all terminal blocks, fuses, fuse holders, power supplies, AC/DC converters, internal power cables, internal communication cables, and mounting hardware assembled and mounted within the FNE. The remaining components, including the Power Unit Controller(s), networking, and UPS, may be shipped to the Project Site separately. The Contractor shall install the components that were shipped separately in the FNE after the FNE(s) have been mounted at the Project Site.
7. The Contractor shall mount the EMS FNEs, install the below-ground conduit into the enclosure using appropriate fittings, and pull all necessary external fiber, Ethernet, IO, and power cables, as applicable, to support the functionality of the EMS equipment.
8. The Contractor shall provide external power to each of the EMS FNEs as required per the EMS hardware and electrical specifications.

6.0 Interconnection Requirements

1. The net VAR capability from the Project shall comply with the DSP PF/VAR requirements at the POI. Note that the VAR requirement to achieve the specified power factor are required across the operating range – (for example, the VARs required at full to load to achieve 0.95 PF will also be necessary at no load).
2. The Project voltage controller must be coordinated with existing generating plants or VAR devices at the POI and must be optimized to support the POI voltage schedule as prescribed by the DSP.
3. All generator installations shall meet NERC and WECC requirements for LVRT.
4. Inverter-based resources are not permitted to use momentary cessation as a form of Low Voltage Ride Through (LVRT) for voltages outside the continuous operating range.
5. Facilities with equipment operated at 15 kV and above shall be protected against lightning and switching surges.
6. The newly interconnected Project shall not introduce harmonics into the DSP facilities exceeding the limits specified in IEEE 519 Standard for Harmonic Control in Electric Power Systems.

7.0 Power Cables and Collection System

7.1 General

1. The project's underground MV collection system shall be designed to the highest quality standards to ensure maximum reliability and durability over the project's expected lifespan.
2. Power cables shall be sized for the maximum generating load.
3. Power cables shall be rated for 90°C.
4. TXPLE insulation type is preferred for power cables.
5. Power cables shall be high-quality, shielded, minimum 133% insulation-rated, and rated for direct burial. Burial depth shall be a minimum of 36".
6. Control Cables shall have an overall shield, copper, tray, and be UV-rated. CT control cables shall be #10.
7. Domestic cable suppliers are preferred.
8. Circuits shall be a minimum of 10' apart outside the substation.
9. Splices shall be minimized. All splices shall be located in vaults or hand-holes.
10. If cable lengths exceed several thousand feet, special consideration must be made to ensure that the voltage drop does not exceed 5% (Owner standard) and that ferro-resonance will not occur with any transformers in the circuit.
11. Shear-bolt conductor connectors shall be used; do not use crimped or roll spring connectors.
12. Junction boxes shall use the best available sealing measures to prevent ingress of water, dust, ice, or blowing snow.
13. Potential drifting snow for a particular site shall be taken into account when determining the height of junction boxes.

7.2 Fiber Optic Cables

1. Fiber optic cables shall be provided to all generating unit locations.
2. Fiber shall be armored against rodents, i.e., enclosed in armored steel ductwork or utilizing armored fiber optic cable.
3. Fiber optic cables shall be installed to minimize splices.
4. Fiber optic cable run lengths shall be determined before installation, and the longest sections shall be installed first.
5. The installer shall also utilize the longest practical cable spool lengths.

7.3 Wire Management

All wire and cable management methods shall comply with the applicable codes and standards for maintaining and managing wires, including NEC/IEC standards.

1. The Contractor and its subcontractors shall ensure the correct installation of all power and control cabling and their connections between equipment.
2. A comprehensive evaluation of the following requirements shall be undertaken, and installation of all wiring and cables shall conform to best practices regarding wire separation, spacing, bending radii, proper use of cable ties, and avoiding direct contact with metal framing and structures.
3. The following standards, among others, shall be observed:
    A. NEC 300.3(C)(2) – Conductors of Different Systems
    B. NEC 334.30 – Support and Securement Spacing
    C. NEC 338.24 – Cable Bend Radius Requirements for Type USE cable
    D. NEC 60364-5-52:2009, 522.8.3 – Cable Bend Radius

8.0 FACU

8.1 General

1. The Site-Level (Facility) FACU shall comply with NFPA 72 (2025 Edition) for protected premises systems and supervising station systems in energy storage systems (ESS).
2. The FACU shall be listed and approved for its intended use in BESS, meeting compatibility and performance standards.
3. The FACU shall be installed by qualified personnel, with notification to the fire code official before installation.
4. The FACU shall be readily accessible for operation, monitoring, inspection, and maintenance, without requiring special tools or ladders.

8.2 Location and Mounting

1. The FACU shall be installed in a location that minimizes risk of accidental operation, failure due to vibration or jarring, and environmental extremes, within OEM-specified limits for voltage, temperature, and humidity suitable for ESS environments.
2. Mounting height shall position the highest operable part no more than 6 feet above the finished floor and the lowest no less than 15 inches.

3. Early warning fire detection shall be provided as required for ESS hazard mitigation.

8.3 Power Supply

1. The FACU shall have reliable primary and secondary power supplies, including standby capabilities integrated with ESS.
2. Primary power shall be from a dedicated utility branch circuit or engine-driven generator, with no other loads, identified, accessible, protected, and overcurrent-protected.
3. Secondary power shall include storage batteries or Stored Emergency Power Supply Systems (Type O or U, Level 1, Class 4).
4. Batteries shall be marked, safely located, charged to maintain full capacity, recharge within 48 hours, overcurrent-protected, and metered.
5. Generators shall comply with NFPA 110 and NFPA 70 Articles 700/701/702, with fuel storage for at least 6 months plus required capacity.
6. Power supplies shall ensure continuity, automatic transfer, integrity monitoring, and capacity for 24 hours quiescent load plus alarm duration in ESS applications.
7. Surge protection devices (SPDs) shall be provided to limit transients.
8. Remote power supplies shall be identified at the master unit and on drawings.

8.4 Wiring

1. All wiring, circuits, and pathways shall include pathway classes (A or X), survivability levels (2 or 3), and shared pathways compatible with ESS installations.
2. Wiring shall follow NFPA 70 Article 760 for fire alarm systems, Article 770 for optical fiber, and be fire-resistant per Articles 760/728 or OEM specifications.
3. Conductors shall be free of unintentional grounds.
4. For cybersecurity-protected systems, SL2+ pathways shall use metal raceways or armored cables.
5. Mechanical protection shall be provided for secondary circuits and batteries, with insulation against faults or shorts.
6. Both copper and optical fiber conductors are permitted for interconnections.

8.5 Signage and Labeling

1. Circuit identification and accessibility shall be permanently marked, with red markings indicating "authorized access only".
2. Batteries and chargers shall have location identifications.
3. Documentation cabinets shall be labeled "SYSTEM RECORD DOCUMENTS".
4. Impairments and system status shall be documented and labeled.
5. Labels shall be verified during visual inspections.

8.6 HMI

1. The FACU HMI shall be equipped with a screen or lights with a numbering system to indicate the location of an alarm within the Facility and provide any amplifying information available

from the EMS at the fire alarm system. The FACU HMI location and specifications shall be coordinated with the Owner and the fire code official.

8.7 Cybersecurity

1. The FACU shall incorporate cybersecurity measures as prescribed in Section 5.2 Networking and Communications.

8.8 Documentation

1. Shop drawings shall include scaled floor plans (with scale, ID, north arrow, legend per NFPA 170, devices, power disconnects, risers, pathways), riser diagrams, control unit diagrams, typical wiring diagrams, narrative/sequence of operations, and calculations (battery, voltage drop).
2. Design documents shall be prepared by qualified professionals, covering criteria, pathways, and ambient levels.
3. Completion documents shall include statements, manuals, as-built drawings (updated for modifications), Record of Completion (signed by stakeholders), software backups, and third-party verification.
4. Minimum documentation shall include narrative, risers, plans, sequence, data sheets, instructions, calculations, drawings, and software.
5. Records shall be retained (tests for at least 1 year, available to AHJ, archived).

8.9 Commissioning

1. Commissioning shall include preparation of test plans covering acceptance, reacceptance, and periodic testing, including impairments.
2. A Record of Completion shall acknowledge system features and be signed by the Contractor, installer, supplier, service provider, and AHJ.
3. As-built (record) drawings shall show actual locations, devices, and wiring.
4. Contractor contact information shall be provided to the OEM during testing.

8.10 Testing

1. Functional testing of the FACU shall verify functionality, signal priorities, and initiation, with IDC/SLC/NAC performance.
2. Testing shall be performed by qualified personnel for acceptance, reacceptance, and periodic checks.
3. Systems shall be restored to normal after testing.
4. Power continuity, transfer, and integrity shall be tested.
5. Quarterly cybersecurity threat evaluations and annual updates shall be conducted.
6. Annual certificate verification shall be performed.
7. Test records shall use specified forms, with network plans including credentials/logs reviewed annually.

8.11 Inspection

1. Visual inspections shall check the FACU for damage, proper wiring, power supplies, and labeling.
2. Inspections shall handle impairments during outages.
3. Qualified personnel shall perform visual examinations for condition, location, and damage.
4. Notify the Owner and AHJ within 8 hours of impairments, with records retained for 1 year.
5. Annual verification of certificates and contacts shall be required.

8.12 Maintenance

1. Maintenance shall follow OEM instructions and the Code, performed by knowledgeable personnel.
2. Cleaning, battery replacement, software updates, and repairs shall be conducted.
3. Charger repairs shall occur before 50% battery depletion, with failures triggering trouble signals.
4. Generators shall be maintained per NFPA 110.
5. Cybersecurity maintenance, including updates and notifications, shall be carried out.
6. Notification of service termination shall be provided, with tools that comply.

9.0 Overhead Lines

1. All overhead power lines, conductors, poles, and associated hardware shall comply with the latest edition of the National Electrical Safety Code (NESC) and the interconnecting utility's overhead construction standards.

10.0 Physical Security

10.1 General

1. Physical Security system shall comply with NERC recommended best practices, NFPA 70, and Owner Cybersecurity Requirements.
2. The Contractor shall provide a comprehensive security system for the plant, consisting of fencing, gate access, monitoring devices, and an IP security camera system with remote monitoring.

10.2 Construction Fencing

1. The Contractor shall furnish perimeter fencing and signage in accordance with AHJ and Owner requirements. Perimeter fencing must be fully installed before energizing the facility. The Contractor should plan to begin fencing installation as early as practicable.
2. Perimeter fencing shall be at least 6' tall. Depending on local/county codes, fencing may require a 6" space below it to allow small animals to cross underneath. Posts shall be set in concrete where needed to support tension, corners, and gates.

3. Gates shall be a minimum of 24’ wide controlled access gates (swing gates or motorized gates). Posts, gate frames, braces, rails, stretcher bars, truss rods, tension wire, hardware, and fasteners shall be of galvanized steel.
4. The main site entrance gate shall be designed to accommodate construction, operations, maintenance, and emergency vehicles. The gate shall be motor-operated and controllable in accordance with Owner requirements. Gates shall be provided at the project entrance(s) with padlocks.
5. Each fenced array shall include two gates designed to accommodate emergency vehicles—specific gate locations to be determined based on AHJ and Owner approval.
6. All fence material and components shall be galvanized, unless otherwise noted.

10.3 BESS Fencing

1. Security fencing around the perimeter of the BESS is required:
   - A. Perimeter barrier: 7 ft high chain-link, expanded metal, or anti-climb mesh.
   - B. Top guard: “Y” or “V” arm with 6 strands of barbed wire + center roll of razor wire (local code permitting).
   - C. Gates: Must match fence height and strength; cantilever slide gates or swing gates with the same anti-climb/top-guard features; vehicle gate 20 ft wide for equipment access.

10.4 Doorway and Gate Monitoring

1. Remote open/closed position indication shall be provided for all entryways into the substation control enclosure.
2. Remote open/closed position indication shall be provided for all other perimeter gates (vehicle or personnel).
3. Magnetic contacts shall have a NEMA 6 rating.
4. All magnetic security contacts shall tie into the facility SCADA for alarming and HMI indication.

10.5 Security Camera System

1. The Contractor shall provide a motion-activated, color, IP security camera system, which shall communicate over dedicated fiber optic links within the facility, to provide monitoring of all access points and critical infrastructure.
2. Cameras shall be provided as follows:
   - A. PTZ/fixed cameras shall be provided for the substation and shall provide coverage of all gates into the substation, doors into the control enclosure, and all major equipment within the substation.
   - B. Cameras shall allow for visual position verification of all medium and high voltage switches.
   - C. PTZ/fixed cameras shall be provided to view all entryways into BESS facility including any vehicle or man gates and the main access gate.
   - D. PTZ/fixed cameras shall be provided to view fence lines and BESS containers.

3. Cameras shall allow for visual observation of all externally mounted visual strobes.
4. All cameras shall be of hardened construction for a minimum protection rating of NEMA 4 and shall be capable of continuous operation within a -40°C to 50°C temperature range.
5. Security camera resolution and frame rate shall be adjustable up to a minimum of 640 x 480 at 30 frames per second. Cameras shall be equipped with low-light technology to enable night vision and shall have a minimum optical zoom of 25x.
6. The IP camera system and Digital Video Recorder (DVR) shall include time stamping for any event and shall be synced to the plant SCADA time server. The DVR server shall allow for live viewing of camera feeds from any security camera in the Facility, as well as retrieval of stored recordings.
7. The security camera systems shall include all provisions to be viewed from the plant SCADA system, both locally at the HMI and remotely, as well as remotely via a separate web interface.
8. All video security system equipment, including cameras, shall be powered from a backup UPS.
9. The camera servers shall provide:
    A. Automatic video capture commands to the camera server for gate/door limit switch operation.
    B. Automatic generation of alarms in the SCADA HMI facility for camera motion detection, and camera/server trouble.
10. All camera server alarms shall be user-configurable and capable of being disabled and acknowledged via the camera server and facility SCADA HMI.
11. Security cameras shall interface via the Facility fiber optic network with a substation-hardened, IEC 61850-3, IEEE 1613, C37.90-compliant, digital video recorder (DVR)/camera server, which shall be installed in a 19-inch equipment rack in the substation control enclosure. Additional servers, if required by security camera communications network design, shall also be provided by the Contractor and shall comply with the requirements provided herein. Each recorder shall have a minimum of 2 TB of internal/external data storage capacity. DVRs shall be equipped with user-configurable analytic functions, including tripwire, motion detection, and camera tampering detection, with future additions.

10.6 Site Lighting

1. An overall site lighting plan shall be provided to include site entrances, any required lighting at Battery System, PCS, and balance of system units, and the substation.

11.0 Civil/Structural Design

11.1 Civil/Structural Design Guidelines

1. The structural and nonstructural components of all enclosures, free-standing structures, and structural equipment supports shall be designed and constructed to withstand the effects of earthquake motions and seismic loading in accordance with the requirements of the State of Washington Building Code and the currently adopted version of ASCE 7 with supplements No. 1 & 2, and adhering to the-site specific geotechnical report with the following parameters:

2. Risk Category IV (critical asset similar to substation equipment)
3. Seismic Design Category D
4. Site Soil Class D, unless otherwise determined by the Geotechnical Engineer
5. Importance Factor 1.5
6. All material, methods, and equipment shall be designed to the ‘High Seismic Qualification Level’ in accordance with IEEE 693 Standard.
7. The snow, rain, wind, and ice design variables shall be obtained from the online resource called the “ASCE Hazard Tool.”
8. Allowable soil bearing capacities shall be based on the site-specific geotechnical report.
9. All metal in direct contact with the soil shall be designed to resist corrosion for the lifetime of the system of 30+ years.
10. All equipment and system foundations shall be of sufficient strength and stiffness to support anticipated load combinations imposed by site conditions.
11. Building and equipment foundations shall be designed using static analysis techniques, assuming rigid elements and a linear soil pressure distribution, such that allowable settlement and bearing pressure criteria are not exceeded. Foundations shall be designed in accordance with IBC codes using the appropriate factors of safety and ACI 318 (Building Code Requirements for Structural Concrete). Concrete foundations shall comply with ACI 318 requirements for reinforcement detailing, concrete strength, durability provisions, and load combinations as applicable to the foundation type and loading condition
12. All structures and buildings must meet all of the current applicable codes and regulations adopted by the AHJ. They must conform to the International Codes published by the International Code Council (IBC, IFC, IPC, IMC, etc.).
13. Reinforced concrete structures shall be designed and constructed in accordance with IBC codes. Concrete work shall conform to the requirements of ACI 301 “Specifications for Structural Concrete” and ASTM A615 “Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.”
14. The Contractor shall provide typical anchorage drawings and indicate if anchorage is included in their scope of supply.
15. Anchor bolts, if applicable, shall conform to ASTM F1554 Grades 36, 55, and 105 and hot–dipped galvanized for outdoor applications, ASTM A153 with nuts conforming to ASTM A563, Grade A or Grade DH heavy hexagon zinc-coated, ASTM A153 class C. Washers shall conform to ASTM F436 or ASTM A36 plate washer, zinc-coated ASTM A153. Anchor bolt sleeves, if required, shall conform to ASTM A501.

11.2 Earthwork

1. Compacted or engineered fill and aggregate base shall be compacted to 95% of maximum density in accordance with ASTM D1557-12e1. All graded areas shall have a compacted subgrade prepared before any construction. All earthworks shall be in accordance with the recommendations in the site Geotechnical Report.
2. Erosion control measures shall be employed to reduce erosion of slopes and siltation of off-site outfalls and tributaries. Measures taken shall comply with local AHJ requirements.

11.3 Spare Parts Storage

1. Unless otherwise indicated by the Owner, the Contractor shall specify an on-site storage container for tools and spare parts.
2. The container should be sized appropriately to house all recommended tools, emergency equipment, and spare parts needed for the project.

11.4 Site Access Roads

1. Access roads will be required for each battery system area, PCS, laydown area, substation, and office area. Access roads shall be designed and located in accordance with the site layout. These roads will be permanent Project features used to operate and maintain the facility after construction.
2. Access roads shall be designed to the following criteria:
    A. At a minimum, for all project roads, horizontal and vertical geometry shall be determined based on the design vehicle necessary to deliver the largest piece of planned equipment. The AASHTO Green Book shall be consulted for the design vehicle's turning radius.
    B. Main access roads to the substation and office area shall be a minimum of 20 ft wide with 4 ft compacted shoulders and a minimum inside turning radius of 130 ft. These requirements may be reduced with Owner approval, subject to the specified main power transformer and other factors. The maximum vertical grade of substation roads shall be 5%.
    C. Interior access roads to battery containers, inverters/PCS, laydown areas, etc. shall be a minimum of 16 ft wide with 4 ft compacted shoulders. Road turning radius shall be a minimum of 30 feet and dead-end roads shall include a turnaround area. Grade in the direction of travel shall not exceed 12% and a change of slope on the vertical curve shall not exceed 1% every 50 ft.
    D. All roads shall be of all-weather design and surfaced with Type A Grade 1-2 aggregate.
    E. Roads shall be designed to self-drain and have a cross-fall not exceeding 2%.
    F. All creeks, ditches, culverts, and watercourses within the roadbed shall be drivable.
    G. Tie-in points with state highways will be minimized to the extent possible and designed in accordance with State Department of Transportation Standards.
    H. County roads improved for use as access roads will be designed in accordance with County design standards.

11.5 Laydown Area

1. Temporary laydown areas shall be established for receiving and handling project materials during construction.
2. Locations of laydown areas shall be approved by the Owner to suit project needs best. The surface shall consist of compacted soil or crushed gravel.
3. Laydown areas shall be designed to self-drain and have a cross-fall not exceeding 2%.

11.6 Civil/Structure Design Drawing Package Deliverables

Structural Drawings

1. The structural drawing package shall be stamped by a state-licensed PE/SE and include, at a minimum, the following deliverables:
    A. General Notes
    B. Site Plan
    C. Foundation Plans
    D. Foundation Details
2. Where a Preliminary Geotechnical Report is used in the preliminary design, it shall be superseded by the Final Geotechnical Report as soon as it becomes available.

Civil Drawings

1. The civil drawings package shall be stamped by a state-licensed PE and include, at a minimum, the following deliverables:
    A. General Notes
    B. Topographic Survey
    C. Existing Conditions and Demolition Plans
    D. Environmental features, limits of disturbance, and no-build areas
    E. Erosion Control Plans (temporary/permanent)
    F. Erosion Control Details
    G. Grading and Drainage Plans (including cut and fill volumes)
    H. Roadway Geometrics and Plans
    I. Construction Details (fences, gates, driveways, entries, and other features)
    J. Landscape and Irrigation Plans (if applicable)
    K. Flood Depth Plans (if applicable)
    L. Scour Plans (if applicable)

12.0 Environmental and Permitting Requirements

1. The Contractor shall avoid/minimize/mitigate environmental impacts as required by AHJs.
2. Unless otherwise agreed, the Contractor shall be responsible for obtaining all project permits and regulatory authorizations as required by the applicable governing agencies.
3. The Contractor shall provide the following deliverables, at a minimum:
    A. Wetland and water body delineation
    B. Cultural and archeological resources survey
    C. Wildlife/biological impacts, including rare/threatened/endangered species surveys in compliance with USFWS and other regulatory requirements
    D. Site contamination assessment
    E. Weed survey to identify any site areas infested with state or locally listed weeds
    F. Visual impacts assessment
    G. Noise study
    H. Property boundary surveys and title reports

I. Transportation delivery route assessment
J. Economic impact study
K. Site restoration and revegetation plan

13.0 Required Engineering Studies

1. The Contractor shall provide a list of planned engineering studies, results for studies completed to date, and a schedule for completion of remaining studies.
2. The Contractor shall perform site suitability studies, if applicable, including site-specific temperature and wind speed data.
3. The Contractor shall perform civil engineering studies (topography, geotechnical, hydrology, etc.)
4. The Contractor shall perform the following electrical studies and analysis:
   A. Short Circuit Study: The Contractor shall conduct or coordinate a complete site study using Etap, inclusive of the substation scope of work. The short-circuit analysis shall include the collection system circuits and the secondary values of the PCS. The short-circuit analysis and study shall be used in the Contractor's electrical designs to support the relay coordination study and equipment specifications. Draft and Final Etap project files and libraries shall be made available to the Owner.
   B. Arc Flash Study and Labeling Plan: The Contractor shall conduct or coordinate a complete site study in Etap, inclusive of the substation scope of work and all Project equipment (per NFPA 70E and IEEE 1584). The study shall provide the worst-case arc energy in cal/cm^2 and the short circuit clearing time. Draft and Final Etap project files and libraries shall be made available to the Owner. The labeling plan shall include label layout and language, and a label placement plan with equipment elevation drawings.
   C. DC Short Circuit and Arc Flash Calculation: The Contractor shall conduct or coordinate a study of the DC systems (per NFPA 70E).
   D. Load Flow Study: The Contractor shall conduct or coordinate a complete site study in Etap, inclusive of the substation scope of work, and auxiliary power system, to include load flow, voltage drop, reactive power, and system loss study (per IEEE 399). Draft and Final Etap project files and libraries shall be made available to the Owner.
   E. Transient Analysis Study: A transient analysis study, if required, shall include fault current analysis and transient overvoltage studies.
   F. Protection Coordination Study: The Contractor shall conduct or coordinate a complete site study in Etap, inclusive of the substation scope of work, including a relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, and fuse curves. Draft and Final Etap project files and libraries shall be made available to the Owner.
   G. Harmonics Study: The Contractor shall conduct or coordinate a complete site study, inclusive of the substation scope of work (per IEEE 399).
   H. Grounding and Step and Touch Potential Study: The Contractor shall conduct or coordinate a complete site study, inclusive of the substation scope of work.

I. Overvoltage Analysis and Insulation Coordination Study: The Contractor shall conduct or coordinate a complete site study (per IEEE C62.82.1).
J. Overcurrent Protection Device Coordination Study: The Contractor shall conduct or coordinate a protection coordination study for the BESS plant design, including PCS protection, to be coordinated with the substation protection coordination study
K. Reactive Compensation Study: The Contractor shall conduct or coordinate a complete site study based on battery system and PCS technical inputs per the interconnection study.
L. Lightning Risk Assessment: The Contractor shall conduct or coordinate a lightning risk assessment, if applicable (per NFPA 780).
M. Additional IA Studies: The Contractor shall conduct or coordinate additional studies, if applicable, per the IA.

14.0 Project Maintenance Plan

1. The Contractor shall submit a proposed preventative and corrective maintenance plan that includes the following details:
    A. Counterparty legal entity name, if different than Contractor
    B. Subcontractors
    C. Regular and overtime rates
    D. Invoice and payment terms
    E. Planned equipment preventative maintenance activities (task, periodicity, and expected downtime)
    F. Vegetation management
    G. Excluded services and rates for excluded services
    H. Templates for agreements, as applicable for the Owner review

15.0 Project Quality Assurance and Control

1. An Owner-approved quality assurance and control plan shall be established and maintained for all project phases, including supply and handling of parts and materials, design, construction, testing, and commissioning. The plans shall ensure that the Project complies with all contractual documentation and standards referenced therein, as well as with prudent industry practices and all applicable permits and laws.
2. The Contractor and/or its subcontractors shall provide adequate QA/QC inspectors to carry out and document the inspection and testing of all project activities. All inspectors shall be highly qualified and experienced with energy generation projects of similar technology, scope, and size. A detailed inspection record with signed acceptance of each QA/QC procedure shall be maintained and made available to the Owner throughout the project. The Owner shall observe and witness QA/QC activities at its discretion and may provide its own QA/QC representatives.

16.0 Commissioning and Testing

16.1 Factory Acceptance Testing

1. Factory acceptance testing shall be performed on all major equipment and on other materials and components as specified.
2. FAT procedures shall be provided in advance for the Owner's review.
3. The Contractor shall provide at least two weeks' prior notice of FAT. The Contractor shall be responsible for the inspection and testing of the Work, including:
    A. Factory inspection and testing of components, systems, and equipment
    B. Factory performance testing of systems and equipment
4. FAT plan and test reports shall be provided to the Owner.

16.2 EMS Acceptance Testing

1. The Contractor shall perform a BESS EMS Site Acceptance Test (SAT) for verification of all data points and BESS EMS performance, with the Owner present at the time of the test.
2. The Contractor shall provide at least 30 days' prior notice of the BESS EMS SAT.
3. The Contractor shall work with the Owner to develop EMS/SCADA test procedures that shall be used to determine whether the EMS has successfully satisfied requirements. Tests will include, at a minimum:
    A. Communications
    B. Data Verification Test
    C. Battery Enclosure FACP Test
    D. Unit Startup
    E. Unit Shutdown
    F. PCS Emergency Shutdown and Restart
    G. Battery System Metering Verification
    H. Remote Power Setpoint Tracking

16.3 Site Acceptance Testing

1. The Contractor shall perform a SAT to verify site-wide functionality and performance.
2. The Contractor shall work with the Owner to develop Performance Test Procedures that shall be used to determine whether the BESS has successfully satisfied the required performance criteria under the contractual operating parameters (e.g., SOC, depth of discharge, C-Rate, temperature bands, ramp rates, etc.). Testing shall include, at a minimum, as applicable:
    A. System Startup
    B. System Shutdown
    C. Emergency Shutdown and Restart
    D. Remote Power Setpoint Tracking
    E. Maximum Discharge Capacity Test
    F. Maximum Charge Capacity Test
    G. Reactive Power Test
    H. Data Resolution Test

I. AGC Test
J. Voltage Regulation Test
K. Reactive Power Capability and Minimum Power Factor Test
L. Curtailment Test
M. Energy Capacity Test
N. Power Capacity Test
O. RTE Test
P. ISO Tests, if applicable

17.0 Project Records and Deliverables

1. The Owner shall take ownership of all studies, drawings, and other critical data, including assembly/installation/operations/maintenance manuals, equipment, and component specification sheets, and MSDS, when the project is complete. All drawings shall be provided to the Owner in electronic format. All program files from studies and related materials shall be provided.
2. The Contractor shall provide document deliverables per Exhibit [•] Contractor Deliverables.

18.0 Project Subcontractors

1. All subcontractors, design consultants, and other third parties engaged by the Contractor shall be experienced in similar projects and highly qualified for their assigned scope of work. A list of all planned third parties and subcontractors shall be provided to the Owner for review and approval. The Owner reserves the right to reject proposed subcontractors based on qualifications, references checks, and safety history.
2. The Contractor and subcontractors must meet prevailing wage and apprenticeship requirements per the Inflation Reduction Act - https://www.irs.gov/credits-deductions/frequently-asked-questions-about-the-prevailing-wage-and-apprenticeship-under-the-inflation-reduction-act.

19.0 Codes and Standards

19.1 General

1. The Contractor is responsible and accountable for following codes, standards, regulations, and test plans listed below based on the current adopted versions at the Notice to Proceed (NTP). The following list is not exhaustive, and the Contractor is responsible for following all state, local, federal, and AHJ requirements and best practices at all times.
2. In the event conflicts arise between the codes, standards of practice, specifications or OEM recommendations described herein and codes, laws, rules, decrees, regulations, standards, etc., of the locality where the equipment is to be installed, the more stringent code shall apply.
3. The Owner may provide specific internal or external technical standards to be referenced during the design process.

19.2 Battery System and Fire Safety

Applicability[11]	Standard
Cell	UL 1973:2022 v3 - Standard for Batteries for Use in Stationary and Motive Auxiliary Power Applications – CALB
Rack	UL 1973:2022 v3 – Standard for Batteries for Use in Stationary, Vehicle, Auxiliary Power and Light Electric Rail Applications – CALB
Cell	IEC 62619:2022 - Safety requirements for secondary lithium cells and batteries for use in industrial applications
Cell	UN 38.3 - Certification for Lithium Batteries
System	UL 9540 – Standard for Energy Storage Systems and Equipment – CALB
Cell	UL 9540A v4 - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems - Cell[12]
Pack	UL 9540A v4 - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems – Module
Rack	UL 9540A v4 - Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems – Unit
System	NFPA 855 v2026 - Standard for the Installation of Stationary Energy Storage Systems
System	NFPA 69 - Standard on Explosion Prevention Systems
System	NFPA 68 - Standard on Explosion Protection by Deflagration Venting
FSS-Smoke Detector	UL 268 – Smoke Detectors for Fire Alarm Signaling Systems
FSS-Heat Detector	UL 521 - Heat Detectors for Fire Protective Signaling Systems
FSS-FACP	UL 864 – Control Units and Accessories for Fire Alarm Systems
FSS-Ventilation	UL 507 – Electric Fans
FSS-Flammable Gas Detector	UL 61010 EN - Standard for Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements
BMS	IEC/UL 60730-1 Automatic Electrical Controls - Part 1: General Requirements
BMS	IEC 62443 Security for Industrial Automation and Control Systems
Site	NFPA 72 National Fire Alarm and Signaling Code
System and Site	IFC 2024 International Fire Code
Site	NFPA 70 National Electrical Code
System and Site[13]	Provisional - NFPA 800 Battery Safety Code

[11] Rack, unit, and string are commonly interchanged across codes and standards and mean the same thing. Module and pack are also interchangeable.
[12] Note: UL9540A is not a code or standard but rather a performance test. UL9540A testing was completed at the cell, pack, and rack levels, with favorable results.
[13] Battery system and site must comply with NFPA 800 once published. Provision code to be referenced during the interim.

Applicability[11]	Standard
Enclosure	UL50E Enclosures for Electrical Equipment, Environmental Considerations
TMS	ASHRAE Guidelines
UPS	UL 1778 - Uninterruptible Power Systems (UPS) for up to 600V A.C.

19.3 Balance of System

Applicability	Standard
PCS	UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
PCS	UL 1741-SA - Supplement A (Introduced to align UL 1741 with the IEEE 1547-2003 standard, adding specific interconnection requirements for DERs. It includes tests for unintentional islanding, voltage and frequency trip settings, and synchronization Note: Applicable only to distribution system-connected resources
PCS	UL 1741SB - Certification Required for Grid Support Energy Storage Inverters and Converters Note: Applicable only to distribution system-connected resources
PCS	IEEE1547-2018, IEEE1547.1-20201.8s- Standard for Interconnecting Distributed Resources with Electric Power System Note: Applicable only to distribution system-connected resources
PCS	IEEE 519-2022 - IEEE Standard for Harmonic Control in Electric Power Systems
MVT	UL 891-2025 - Standard for Safety for Switchboards
MVT	IEEE C57.12.00-2015 - Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
MVT	IEEE C57.12.80-2010 - Standard Terminology for Power and Distribution Transformers
MVT	IEEE C57.12.90-2021 - Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
MVSG	IEEE C37.20.2-2022 IEEE Standard for Metal-Clad Switchgear
MVSG	ANSI/IEEE C37.20.7 EEE Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults
MVSG	IEC 62271-200 High-Voltage Switchgear and Control Gear
MVSG	ANSI/NEMA SG 4 American National Standard for Alternating Current High-Voltage Circuit Breakers
System / Plant / PCC	IEEE 519 Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
System / Plant / PCC	IEEE1547-2018, IEEE1547.1-20201.8s- Standard for Interconnecting Distributed Resources with Electric Power System Note: Applicable only to distribution system-connected resources

19.4 Cybersecurity

Applicability	Standard
Control System and SCADA	NERC Critical Infrastructure Protection (CIP)
Control System and SCADA	ISO/IEC 27001 Information Security Management
Control System and SCADA	ISO/IEC 27019 Information Security, Cybersecurity and Privacy Protection
Control System and SCADA	IEC 62443 Enhancing Cybersecurity for Industrial Automation and Control Systems
Control System and SCADA	NIST 800-82 Guide to Industrial Control Systems (ICS) Security
Control System and SCADA	NIST 800-53 Security and Privacy Controls for Federal Information Systems and Organizations

19.5 Local Regulations

Regulations
• All applicable DSP, TSP, and WECC guidelines. • Wyoming Statutes Title 37 (Public Utilities) • Wyoming Administrative Code Title 023 Chapter 3 (Electric Utilities) • Colorado State Code: 4 CCR 723-3 — Rules Regulating Electric Utilities • County and Municipal Codes as applicable.

19.6 General Codes, Standards, and Regulations

Codes and Standards
• ACI - American Concrete Institute • ACMA - Air Moving and Conditioning Association • AISC - American Institute of Steel Construction • AISI - American Iron and Steel Institute • ANSI - American National Standards Institute • ASCE -American Society of Civil Engineers • ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers • ASME - American Society of Mechanical Engineers • ASNT - American Society for Nondestructive Testing • ASTM - American Society for fTesting and Materials • AWS - American Welding Society • CMAA - Crane Manufacturers Association of America • CTI - Cooling Technology Institute • FM - Factory Mutual • HEI - Heat Exchange Institute

Codes and Standards
• IBC - International Building Code • ICEA - Insulated Cable Engineers Association • IEEE - Institute of Electrical and Electronics Engineers • ISA - International Society of Measurement and Control • ISO - International Standards Organization • LPC - Lightning Protection Code • MBMA - Metal Building Manufacturers Association • NACE - National Association of Corrosion Engineers • NEC - National Electric Code • NEMA - National Electrical Manufacturers Association • NESC - National Electrical Safety Code • NFPA - National Fire Protection Association • OSHA - Occupational Safety and Health Administration • PFI - Pipe Fabrication Institute • RMA - Rubber Manufacturers Association • SSPC - Steel Structures Painting Council • TIMA - Thermal Insulation Manufacturers Association • UFC - Uniform Fire Code • UL - Underwriters Laboratories • UMC - Uniform Mechanical Code • UPC - Uniform Plumbing Code

19.7 Additional Regulations That May Apply

Codes and Standards
• Americans with Disabilities Act • Comprehensive Environmental Response, Compensation, and Liability Act • Clean Air Act and Amendments • Environmental Protection Agency Regulations • Federal Aviation Administration Regulations • Noise Control Act • Occupational Safety and Health Act • Occupational Safety and Health Standards • Resource Conservation and Recovery Act • Safe Drinking Water Act • Solid Waste Disposal Act • Superfund Amendments and Reauthorization Act • Toxic Substances Control Act