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Rev. No	Revised Sections	Date	Rev. by	App. by
A	Initial Issue	4/5/2023	S. Harris, J. Ryan, J. Rippee	C. Elder
B				
C				

1.0 DEFINITIONS

Battery Energy Storage System (BESS)	A complete Battery Energy Storage System (BESS) to be specified, purchased and installed by the Contractor. The BESS consists of the batteries, power conversion system (inverters) and control system.
Contractor	Contractor refers to the Power Through Resiliency as a Service (RaaS) Contractor who is responsible for or proposing to be responsible for the Engineering, Procurement and Construction of the Power Through Solar + Battery Energy Storage BESS.
Customer	The Customer refers to the End-User Host Facility Customer engaging in the Power Through program.
Owner	Owner refers to Entergy; the Owner of the Power Through Assets
Site / Project Site	All parcels of Customer property upon which the Project and its related infrastructure will be located
Special Inspections	Inspections required by Building Code as defined by IBC Chapter 17, typically for structural systems of buildings.
Authority Having Jurisdiction (AHJ)	An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.
Grid Synchronous	A system that has the capability to monitor, access, enable, and automatically take the control action to prevent the voltage and frequency of the battery energy storage output and grid supply from dropping below acceptable values.
Closed Transition	A make before break transfer of power whereby a transfer switch makes a connection to the new power source before breaking its connection with the grid supply.
Supply Response	Installation that provides standby power to the Customer load when there are grid outages and can be used by Entergy as a Demand Response Resource (DRR) to supply power to Entergy's distribution system, as desired.
Demand Response	Installation that provides standby power to Entergy's Customer when there are grid outages and can be used by Entergy as a Load Modifying Resource (LMR) to remove Customer load from Entergy's distribution system, as desired.
Standby Power	Backup solar + battery energy storage system which is located at a customer location to replace the power that is lost during a grid outage.
Resiliency as a Service (RaaS)	Service provided to customers under the Entergy Power Through program whereby Entergy provides solar + battery energy storage at a customer site to provide added power reliability.
Power Conversion System (PCS)	The PCS consists of inverters and control systems which allows DC power from the solar panels and batteries to be converted to AC power to serve

	electrical loads in a facility. The PCS is bi-directional and can also be used to charge the batteries from an AC supply.
Solar PV	A solar energy generation system utilizing photovoltaic (PV) panels
State of Charge (SOC)	The State of Charge of the Battery Energy Storage System (BESS) expressed in percentage. An SOC of 100% represents a fully charged BESS.

2.0 INTRODUCTION

2.1 Purpose

The purpose of this standard is to define the technical requirements for Customer sited supply response/demand response solar + battery energy storage system that will be implemented as part of Entergy's Power Through program.

2.2 Background

Entergy's Power Through is a Resiliency as a Service (RaaS) program whereby, Power Through will provide Entergy-owned supply response/demand response and standby solar + battery energy storage to Entergy's participating commercial and industrial customers. The solar + battery energy storage will be operated to deliver power when needed to maintain Customer reliability and deliver power on Entergy's behalf when favorable market conditions exist. The program will serve customers with a load between 100 kW and 10,000 kW.

2.3 Scope of This Standard

This standard applies to Customer-sited supply response/demand response/standby generation Engineer-Procure-Construct (EPC) Projects that will be implemented by a turnkey Resiliency-as-a-Service (RaaS) Contractor (Contractor) as part of the Power Through program.

This standard defines the requirements for project development, including Project scope definition and permitting responsibilities, and defines the content of the contractors' proposals.

At the conclusion of the project development phase, this standard and contractor-developed, site-specific scoping documents will form the basis of the technical Standard and scoping documents for the contract between Entergy and the Resiliency-as-a-Service (RaaS) contractor.

2.4 Design and Project Scope Definition

2.4.1 Contractor Proposal

The project scope is established during the initial project conception stage. The Entergy Power Through team will initiate a Project Request for Proposal (RFP) at a customer site.

The contractor will then use the site information provided (conducting a site visit if desired/ necessary to gain additional information) to perform a preliminary design necessary to prepare an EPC proposal.

The Contractor shall perform preliminary and conceptual design necessary to produce the project scoping documents and to provide a proposal to Entergy for the project scope. The contents of the Contractor's proposal are defined in this document in RaaS Contractor Proposal Section 10.11.

2.4.2 Design Basis

Section 10.1 contains a Design Basis Responsibility Table. The table provides a standardized template for documenting the design basis of a specific facility. The Design Basis Responsibility Table defines the information that will determine each facility's design basis. The Contractor shall be responsible for obtaining and confirming all information in the design basis responsibility table, including the information provided by Entergy.

2.5 General Project Scope Description and Functional Requirements

The Contractor shall be responsible for engineering, design, procurement, inspection, shipping, delivery, installation, commissioning, and testing, as applicable, of equipment, in accordance with all codes, standards, and governmental regulations applicable, and for ensuring performance under the conditions and to the standards specified herein.

The solar + battery energy storage system shall be designed to operate reliably under the conditions specified in this document without exceeding the specified noise levels.

2.5.1 Generation Capacity and Operating Model/Methodology

Total generation capacity shall be calculated using manufacturer software. Loading shall be based on facility Load Step Sequence, to be provided by Entergy, with a 25% margin applied to the final generation size. The Design Basis Fill-In Table will identify power system voltage, power factor, all loads required to be powered by the solar + battery energy storage system, largest single step load, any special equipment requirements (extreme power factor, mission critical loads, etc.), and available control power voltages for auxiliary power of equipment.

The solar + battery energy storage system will be operated to deliver power when needed to maintain Customer reliability and to deliver power on Entergy's behalf when favorable market conditions exist. The power will be delivered to the Customer (demand response) or Entergy's distribution system (supply response), depending on the design of the system. Entergy will determine if an installation is suited for demand response or supply response after a case-by-case economic evaluation and provide this input to the Contractor.

The rated electrical power generation of the solar system and the electrical power rating and duration of the energy storage system shall be determined on a case-by case basis by Entergy and provided to the contractor.

All Projects will be interconnected "in front of the meter", meaning that the installation will deliver power on the utility (Entergy) side of the meter.

2.5.1.1 Demand Response

A Demand Response system provides standby power to the Customer when there are grid outages and can be used by Entergy as a Load Modifying Resource (LMR) to remove Customer load from Entergy's distribution system, as desired. Operationally, the system shall be designed such that:

- The standby battery energy storage system shall operate upon loss of the utility grid.
- Transfer/switching from utility power to battery energy storage power and transfer/switching back to the utility upon restoration of utility power (after a programmed time delay) shall be completely automatic, with no manual operations required. The battery energy storage system shall automatically connected when the utility supply is lost (after a programmed time delay).
- A closed-transition Automatic Transfer Switch (ATS) shall isolate the facility from the utility during battery energy storage system operation.
- Remotely isolate the Customer from Entergy's distribution system and operate the solar + battery energy storage system to reduce Entergy system load.
- Entergy Power Through intends to operate the demand response battery energy storage system no more than 500 hours per year.

2.5.1.2 Supply Response

A Supply Response system provides standby power to the Customer load when there are grid outages and can be used by Entergy as a Demand Response Resource (DRR) to supply power to Entergy's distribution system, as desired.

- Automatically connect the battery energy storage system when the utility supply is lost.
- Grid synchronous switchgear shall allow the battery energy storage system to run in parallel (synchronized) with the grid or isolate the facility from the grid.
- Remotely operate the battery energy storage system to supply additional power to Entergy's distribution system.
- Entergy Power Through intends to operate the supply response battery energy storage system no more than 500 hours per year.

2.5.1.3 Summary of Contractor Scope

The Contractor shall provide the following equipment, materials, and services, including but not limited to the following:

- Specify solar + battery energy storage system to accommodate existing and planned end-use facility electrical loads in accordance with these requirements.
- Develop the detailed design for the solar + battery energy storage system, including:
  - Mechanical (battery fire protection and HVAC systems)
  - Electrical Design
  - Instrumentation and Control System Design
  - Site Civil and Structural Design
  - Architectural
- Facilitate design review with Entergy Power Through team and Customer personnel.
- Develop and maintain a Project schedule, including weekly updates provided to Entergy.
- Apply for and obtain all required permits.
- Furnish and install all new equipment and systems, including civil/site modifications, foundations, supports, mechanical installation, electrical installation, and other required components for a complete and operable system and in agreement with these guidelines. Perform on-site startup and commissioning of the new solar + battery energy storage system.
- Submit project record drawings, Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) documentation and records and operating and maintenance documentation for the new systems.
- Warranty all services and equipment provided as part of the project, for a minimum of one year.

3.0 PROJECT CODES, STANDARDS, AND REGULATIONS

3.1 Codes & Standards

All work shall be in accordance with the prevailing standards of skill and care of each trade and shall be per the latest codes, applicable laws, and ordinances at the time of permit approval unless noted otherwise below.

Design codes and site requirements vary depending on location of the project site and the type of project. Project sites in front of the meter may be regulated as utility assets similar to an electric meter or substation and designed per National Electric Safety Code (NESC). Project sites behind the meter may be regulated as either utility or customer assets and designed per AHJ defined local building code or National Electric Safety Code (NESC), at Entergy's discretion.

Project sites with behind the meter installations are likely to be regulated by the local building code as dictated by the Authority Having Jurisdiction (AHJ).

During the bid phase of the Project, Contractor shall perform a site code review study to identify applicable codes and site design parameters to be utilized during design of the project. The results of the site code review study shall be used to fill in requested data of Section 10.1 Design Basis Responsibility Study and document the Contractor's design basis. If additional documentation is deemed necessary or appropriate, it may be submitted with the Contractor's bid package for further clarification.

The state, county, or township requirements or any other related codes, standards, or requirements in effect or mandated, shall be consulted frequently to ensure design compliance.

The project shall be based on the latest version of the following codes unless otherwise specified by the Authority Having Jurisdiction (AHJ):

ACI - American Concrete Institute

AEIC - Association of Edison Illuminating Companies

AISC - American Institute of Steel Construction

AMCA - Air Movement Control Association

ANSI - American National Standards Institute, Inc.

ANSI/IEEE 493 - Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems

ANSI/IEEE C37.20.1 - Metal Enclosed Low Voltage Power Circuit Breaker Switchgear

ANSI/IEEE C37.20.2 - IEEE Standard for Metal-Clad Switchgear

ANSI C84.1: Electric Power Systems and Equipment Voltage ratings (60 Hertz)

ANSI Z21.83 - Solar PV Performance and Safety

ARI - American Refrigeration Institute

ASCE - American Society of Civil Engineers

ASCE 7 - Minimum Design Loads for Buildings and Other Structures

ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers

ASME - American Society of Mechanical Engineers

ASME Performance Test Codes (PTC) 50 - Solar PV Performance

ASTM - American Society for Testing and Materials

AWS - American Welding Society

Code of Federal Regulations, Title 44, Section 60.3 - Floodplain Management for Flood-Prone Areas

Code Of Federal Regulations, Title 29, Occupational Safety and Health Administration

IBC - International Building Code

ICEA - Insulated Cable Engineers Association

IEC - International Electrotechnical Commission

IEC 62446 - Grid-Connected PV Systems – Minimum Requirements for System Documentation, Commissioning Tests, and Inspections

IEEE - Institute of Electrical and Electronics Engineers

IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications

IEEE 2030.3 - Standard Test Procedures for Electric Energy Storage Equipment and Systems for Electric Power Systems Applications

Local City, County, and Municipal Codes and Standards

Louisiana State Building Code(s)

NEC - National Electrical Code

NEMA - National Electrical Manufacturers Association

NEMA ICS 10 - Electromechanical AC Transfer Switch Equipment

NESC – National Electric Safety Code

NERC- North American Electric Reliability Corporation

NFPA - National Fire Protection Association

NFPA 99 - Health Care Facilities Code

NFPA 101 - Life Safety Code

NFPA 110 - Standard for Emergency and Standby Power Systems

NFPA 853 - Solar PV Systems Near Buildings

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

NFPA 1221 - Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

NRCA - National Roofing Contractors Association

SMACNA - Sheet Metal and Air Conditioning Contractors National Association

UL – Underwriters Laboratories

UL 1642 – Certification of Lithium-Ion Batteries

UL 1703 – Flat Plate PV Modules and Panels

UL 1741 – Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 1778 - Underwriters Laboratory’s Standard for Uninterruptible Power Systems (UPS) for up to 600 Volts AC

UL 9540/9540A - Standard for Energy Storage Systems and Equipment

4.0 PROJECT SCOPE

4.1 Overview

The overall project scope described in this document is for the implementation of individual supply response/demand response and standby Solar + Battery Energy Storage Systems (Projects) for the Entergy Power Through program. Individual Projects will include the full project execution of the engineering, design, procurement, inspection, shipping, delivery, installation, commissioning, and testing, as applicable for Solar + Battery Energy Storage Projects for Entergy's Power Through program.

4.2 Project Management and Control Requirements

4.2.1 Project Management

Contractor shall appoint a single Project Manager to assume total responsibility for all aspects of the Project from Initiation to Contract Closeout. Contractor's Project Manager shall be responsible for the satisfactory completion of contract administration activities and for the development of an overall plan to organize and conduct the contract administration function.

4.2.2 Project Controls

Contractor shall develop an integrated logically tied Project schedule covering all work scope to be performed by Contractor and any subcontractors for the Project. This integrated logically tied Project Schedule shall contain activities from the entire Project Scope and include the detail appropriate for the management of the Project. Project Controls should include Budgetary Performance and Schedule/Scope Change Requests as per Change Control Process.

4.2.3 Weekly Progress Report – Table of Contents

The Contractor shall provide a weekly progress report consisting of the following information:

- Safety updates
- Work completed since the last report
- Two week look-ahead
- Upcoming outage coordination
- Request for Information (RFI) Status
- Action Item List
- Milestone schedule updates
- Issues/Concerns
- Change Orders for Work Scope Variance
- Progress Photos

4.3 Engineering and Design

This Section addresses the scope of the engineering services to be provided by the Contractor for the Project. Drawing and document submittals are discussed below. These services include the necessary project management, project controls, and engineering to ensure compliance with the Contract and that the control of the schedule for this work is maintained.

4.3.1 General Requirements

Contractor shall perform all design engineering work necessary to procure, construct, test, operate, and maintain the project as described in this document. This includes, but is not limited to, the following items:

- Prepare design documents, size equipment, generate drawings and specifications, and other supporting activities to the degree of detail required to clearly define manufacturing and construction work requirements and minimize design engineering work in the field.
- Prepare calculations as required for Electrical and Mechanical system equipment and material selections. Prepare calculations as required for all concrete, steel, masonry, other structural elements, and Civil/Structural work.
- Develop a site arrangement including provisions for locations of all structures, equipment, and foundations providing for permanent maintenance access considerations.
- Prepare and issue all Civil, Electrical, Instrument and Control, Mechanical, Structural, and Architectural drawings and documentation as required for design, construction, special inspections, and testing.
- Implement Project Management and Project Controls to manage the work and control the schedule for this Project.
- Implement a Quality Assurance/Quality Control Program to ensure the Project will meet all Contract requirements.
- Obtain necessary plan approvals, building permits, and construction permits from appropriate State, County, and Local Authorities. Fees to Building Authorities shall be paid by Contractor. Construction activities shall not commence until the related design documents have been approved by the AHJ. Contractor is completely responsible for the approval process.
- Prepare engineering documents and drawings to reflect the Solar + Battery Energy Storage System “As-Built” at the end of the Project.
- All Civil, Structural, Mechanical, and Electrical design documents that are issued for construction or procurement shall be prepared by, or under the direct supervision of, a registered Professional Engineer (PE) according to the requirements of the AHJ and as required in the State of the installation.
- Entergy reserves the right to review any engineering documents and records produced by Contractor at any time.
- All engineering documents and records produced by Contractor shall be turned over to Owner as part of the technical library upon completion of the project.

4.3.2 Design Deliverables and Reviews

Contractor shall submit timely and descriptive information, which shall adequately convey the system arrangement, operating modes, output performance, emission control, selection of construction materials, and all other information as required by Entergy to determine Contractor adherence to these Standards.

The Contractor shall submit engineering for review by Entergy and the Customer as part of the engineering execution of the work.

Design review documents for each of these milestones are defined below:

Design Review Milestone	**Deliverables**
30% Review (For larger than 2 MW)	Load Calculations for Solar + Battery Energy Storage Sizing
	Design Basis Table
	Overall Site Plan
	One Line Diagram(s) for Solar PV & Battery Energy Storage System (Both AC and DC One Line Diagrams)
	Switchgear Arrangement
	Solar PV Panels and Mounting Details
	Battery Energy Storage Container Plan and Elevation
	Power Conversion System (PCS) Skid Plan and Elevation
	Switchgear Arrangement
	Equipment Specifications
	Control Philosophy
60% Design Review	As listed above with Owner/Customer Comments incorporated
	Foundation Plan
	Grading and Drainage Plan
	Structural Steel Drawings (When Applicable)
	General Arrangement for Solar PV and Battery Energy Storage Equipment
	Fencing Details
	Load Flow and Short Circuit Calculations
	UG and AG cable and raceway drawings
	Grounding Plans
	Communication Network Block Diagram
	Equipment Vendor Prints
90% Design Review	As listed above with Owner/Customer Comments incorporated
	Structural Calculations and Seismic Qualification Reports
	Foundation Drawings
	Electrical Grounding Study
	Arc Flash Analysis
	Relay and Control Settings
	Electrical Schematic Diagrams
	Panel Schedules
	Wiring Diagrams
	Control System Diagram/ Logic Diagrams
	Communication Network Diagrams
	Control Input/Output (I/O) Points List
	Supervisory Control and Data Acquisition (SCADA) Points List
Issued for Construction	As listed above with Owner/Customer Comments incorporated, Issued IFC

4.3.3 Requirements for Technical Documents

4.3.4 Technical Documentation Submittals and Document Control

Contractor shall propose a document control plan, subject to Entergy review and acceptance, to properly manage all project documentation (engineering, procurement, construction, and start-up/commissioning). Project documentation will include documents prepared by Contractor, Contractor's sub-contractors and Entergy's response to these documents. As a minimum, the document control plan shall address the following:

- Structure of the project's numbering systems to handle and uniquely number all the different types of documents to be generated.
- All deliverables shall be submitted with a document transmittal log which states the document name, number, revision, and reason for submittal (i.e., Issue for Review, Issue for Bid, Issue for Construction, etc.)
- A web-based system provided by Power Through shall be used to share project documents. Contractor shall be provided access to this system where all project documents are filed.

4.3.5 Installation, Operation, and Maintenance (IOM) Manuals

The equipment vendor installation, testing, operation, and training manuals shall be provided with descriptions and operating procedures for all systems and equipment furnished by Contractor.

4.4 Mechanical Scope

4.4.1 General Requirements and Description of the Work

This section details the minimum technical requirements for the mechanical systems of the Solar + Battery Energy Storage Project.

The mechanical scope of this project is limited to the integral fire protection and HVAC systems provided as part of the outdoor rated battery energy storage containers.

4.4.2 Mechanical Systems

4.4.2.1 Building Services Systems

This Section 4.2.2.1 and its subsections is a placeholder for future inclusion of requirements for battery energy storage systems to be installed in a building. Building Services Systems are not currently covered as part of this Standard.

4.4.2.1.1 Fire Protection Systems

The outdoor rated battery energy storage containers will be provided with an integral fire protection system. The technical requirements of these systems are contained in Section 10.2 of this Standard.

4.4.2.1.2 Heating, Ventilation, and Air Conditioning Systems

The outdoor rated battery energy storage containers will be provided with an integral HVAC system to heat and cool the batteries during operation. The technical requirements of these systems are contained in Section 10.2 of this Standard.

4.5 Electrical Scope

4.5.1 General Requirements and Description of Work

This section details the minimum technical requirements for electrical systems of Solar + Battery Energy Storage Project.

The Contractor shall furnish all equipment, materials, documentation, testing, inspection, and delivery for a complete solar + battery energy storage system including all standard and special accessories specified herein. The battery energy storage containers system shall be located on Customer property and shall be factory assembled with all circuits completely pre-wired to terminals.

4.5.1.1 Interconnection and Plant System Studies

Contractor shall provide all studies for complete installation of the solar + battery energy storage system and any other provided equipment to Customer electrical system, including but not limited to:

- Solar PV system sizing
- Battery energy storage system sizing
- Transformer sizing
- Cable sizing
- Relay/breaker coordination study
- Relay settings calculation
- Arc flash studies
- Ground grid analysis
- Lightning risk analysis (if applicable)
- Hazardous area classification assessment basis (if applicable)
- AC Station Service calculation
- DC system calculation
- Load Flow studies
- Short Circuit studies

4.5.2 Electrical Systems

4.5.2.1 Customer Facility Load Requirements

Entergy shall provide facility load requirements to Contractor for solar + battery energy storage system sizing. This shall include power system voltage, power factor, all loads required to be powered by the generation system, largest single step load, any special equipment requirements (extreme power factor, mission critical loads, etc.), and available control power voltages for auxiliary power of equipment.

4.5.2.2 Cables

All cable terminations shall be permanently tagged. A permanent nameplate shall be attached near the terminal boxes indicating how the main leads, temperature detectors, block heaters, and any provided space heaters are wired. Cables shall be sized according to NEC. Low voltage cables shall be sized using 75°C rating and medium voltage cables shall be sized using 90°C rating.

4.5.2.3 Raceway

All above grade conduits shall be Intermediate Metal Conduit (IMC) or Rigid Galvanized Steel (RGS) Conduit. Liquid-tight, flexible conduits shall connect the conduit to all loads subject to

vibration, thermal movement, or requiring flexibility to be moved aside during maintenance. Conduits shall be supported by hangers spaced in accordance with NEC or NESC as applicable. Conduit fill shall be in accordance with NEC.

All duct bank conduits (below grade) shall be Schedule 40 PVC encased in concrete envelopes. For fire protection signals, rigid galvanized (above or below grade) steel or IMC (above grade only) conduits shall be used. All fiber optic cable installed in conduit shall utilize an inner duct raceway. Duct bank risers stubbing up inside trenches shall be Schedule 40 PVC. All other duct bank risers shall be rigid galvanized steel.

COMMENT TO BE DISCUSSED WITH ENTERGY – Ground mounted solar PV systems and outdoor battery energy storage systems typically utilize direct buried DC collection system cables. Will this cable installation type be considered for these projects?

All cable trays and components shall be in accordance with NEMA standards VE1 and VE2. The cable trays shall be continuous with lengths interconnected with horizontal and vertical fittings. Cable trays and fittings shall be the standardized products of a single manufacturer designed to permit easy assembly in the field. Cable tray systems shall utilize multiple classes of tray or contain fixed barriers, each of which carries specific cable systems and excludes all others. This separation isolates power cables from control and instrument cables for safety and electrical noise purposes. Cable trays shall be ladder type, except trays for instrumentation cable, which shall be solid bottom. Rung spacing on straight sections shall be nine (9) inches on center per IEEE 422 section 9.3.1. Medium voltage cable trays shall be provided with ventilated top hat covers to avoid additional cable derating for heat effects. Cable tray fill shall be in accordance with NEC requirements.

4.5.2.4 Hazardous Area Classification (if required)

Contractor shall provide such enclosure and fittings for any Class I, Division 2 hazardous location in accordance with NFPA 497 and National Electrical Code (NEC) Article 500 and shall identify this in their proposal. Contractor shall identify any additional equipment and/or component ratings required for installation within this hazardous area.

4.5.2.5 Medium Voltage Systems

4.5.2.5.1 Medium Voltage Bus Connections (greater than 600V)

If a medium voltage power inverter(s) are provided, medium voltage bus connections shall be coordinated with existing power system connections (bus duct, cable, rigid bus etc.). Medium voltage generation neutral grounding system shall be high resistance grounded utilizing neutral grounding resistors or neutral grounding transformers selected to minimize generation ground fault current.

4.5.2.6 Low Voltage Systems

4.5.2.6.1 Low Voltage Bus Connections (less than or equal to 600V)

Solar + Battery energy storage main leads shall be terminated in adequately sized terminal boxes. Cable entry shall be either bottom entry or top entry, which shall be determined by the customer's existing equipment and interface. If bottom entry, cables shall run in duct bank or trench to Customer power system connection point. If top entry, cables shall run in conduit and cable tray to Customer power system connection point. All DC components shall be grounded in accordance with manufacturers recommendations. If high ground fault currents are present high resistance grounding for the DC system and power electronics will be provided to minimize ground current.

4.5.2.7 Switching and Synchronizing System

The Entergy Power Through program will be implemented with either of two (2) interconnection schemes, “Grid Synchronous” or “Closed-Transition”, based on the chosen Operating Model/Methodology.

4.5.2.7.1 Utility System Interface

Entergy shall provide power system voltage and short circuit contribution at the point of interconnection, to be used by the Contractor to size the Automatic Transfer Switch (ATS) or paralleling switchgear.

4.5.2.7.2 Closed-Transition (for Demand Response Systems)

Closed-Transition connections shall be “front-of-the-meter,” where upon loss of utility power or for use in demand response, the automatic transfer switch will switch over to emergency power feed and connect the battery energy storage system to provide power to facility loads. See Figure 1 for typical automatic transfer switch concept.

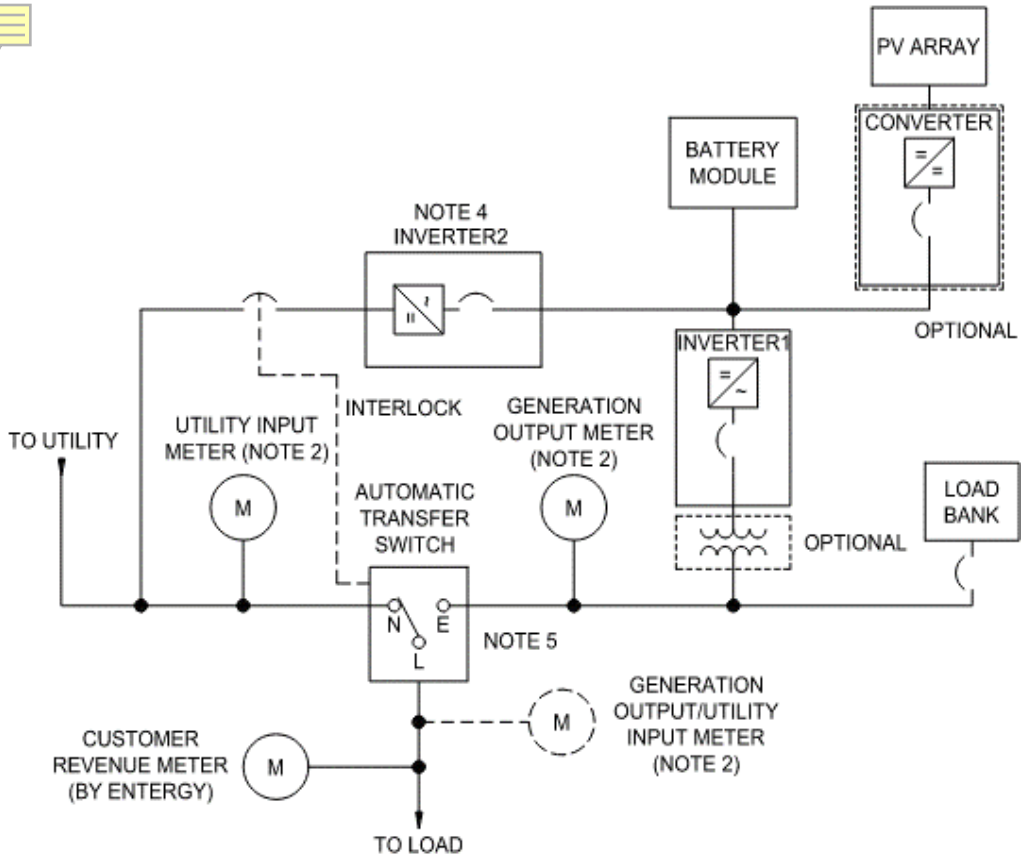

FIGURE 1 TYPICAL ATS CONCEPT

1A. TOTAL LOSS OF UTILITY, FACILITY IS ISLANDING
- ATS SENSES LOSS OF UTILITY, SENDS COMMAND TO BESS CONTROLLER AND SWITCHES TO "EMERGENCY" FEED.
- BREAKER AT BESS CLOSES ONTO DEAD BUS.

1B. UTILITY POWER RETURNS, FACILITY IS RECONNECTING TO THE UTILITY
- ATS SENSES "NORMAL" UTILITY POWER, BESS CONTROLLER SYCS TO UTILITY.
- ATS SWITCHES OVER TO "NORMAL" FEED AND TRIPS OUT BESS BREAKER. BESS CONTROLLER RETURNS TO STANDBY.

2. UTILITY INPUT METER AND GENERATION OUTPUT METER MAY BE REPLACED WITH ONE METER LOCATED ON THE LOAD CONNECTION OF THE ATS, PROVIDED THIS METER MEETS THE SPECIFICATIONS OF BOTH METERS.
3. EQUIPMENT SHOWN AS "OPTIONAL" MAY BE REQUIRED BASED ON OPERATING VOLTAGES AT THE POI, RATINGS OF THE BESS INVERTER, BESS SYSTEM AND OUTPUT OF THE SOLAR PV ARRAY. RATINGS AND CONFIGURATION OF EQUIPMENT TO BE DETERMINED AT LATER DATE.
4. THE INVERTER FOR CONNECTION DIRECTLY TO THE UTILITY WILL BE RATED BASED ON THE OUTPUT OF THE PV ARRAY.
5. WHEN THE ATS IS IN THE "NORMAL" POSITION THE BESS AND PV DC CONTROLLER WILL LIMIT THE POWER OUTPUT TO THE CURRENT AVAILABLE POWER OUTPUT FROM THE PV ARRAY. THE BESS WILL BE IN A "STANDBY" MODE OF OPERATION DURING THIS TIME.

4.5.2.7.3 Grid Synchronous (For Supply Response Program)

Grid Synchronous connections shall be “in front of the meter,” where two operating scenarios exist:

- Supply response in parallel with utility, generation providing power to facility loads and exporting back to the grid.
- Loss of utility, generation provides power to facility loads until utility service returns.
    - Option for PV system to directly connect to the utility to be discussed with Entergy.

See Figure 2 for typical paralleling switchgear concept.

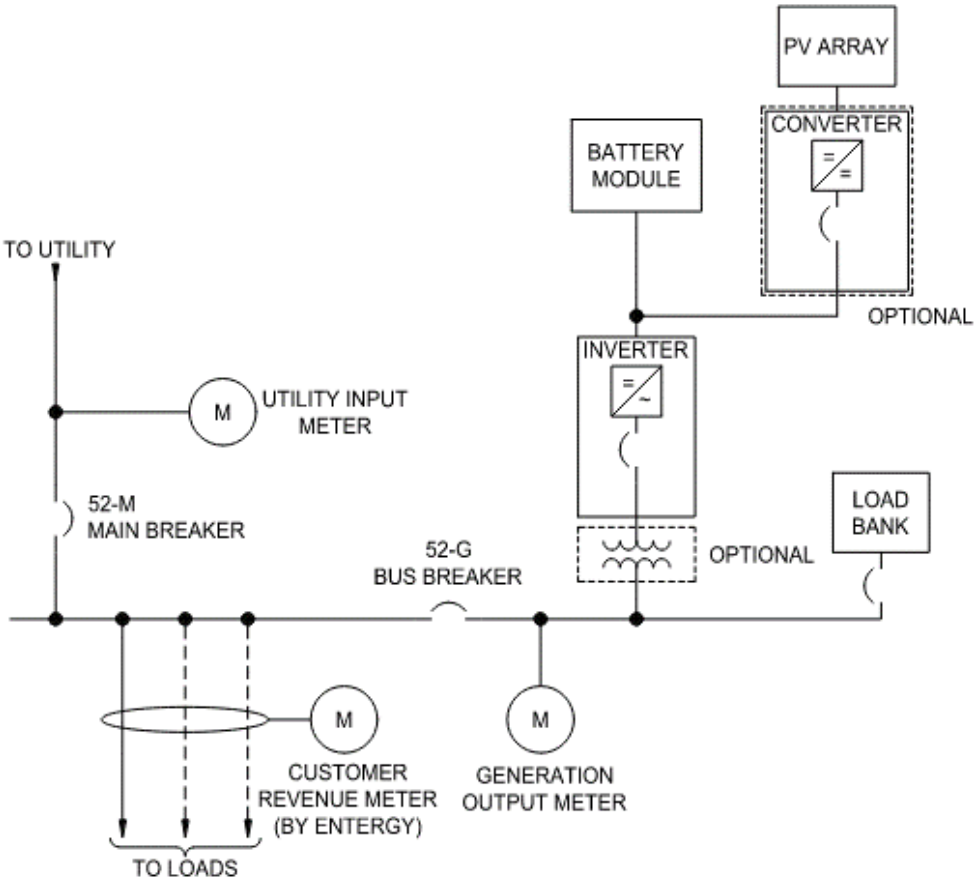

FIGURE 2 TYPICAL PARALLELING SWITCHGEAR CONCEPT

1A. TOTAL LOSS OF UTILITY, FACILITY IS ISLANDING
- TRIP MAIN BREAKER 52-M.
- BREAKER AT BESS CLOSES ONTO DEAD BUS.

1B. UTILITY POWER RETURNS, FACILITY IS RECONNECTING TO THE UTILITY
- BESS CONTROLLER SYCS TO UTILITY.
- CLOSE MAIN BREAKER. IF POWER IS NOT NEEDED, TRIP BESS BREAKER.

2. PARALLEL WITH UTILITY, BESS PROVIDES POWER FOR GRID AND LOAD
- BESS CONTROLLER SYCS TO UTILITY LIVE BUS.

3. EQUIPMENT SHOWN AS "OPTIONAL" MAY BE REQUIRED BASED ON OPERATING VOLTAGES AT THE POI, RATINGS OF THE BESS INVERTER, BESS SYSTEM AND OUTPUT OF THE SOLAR PV ARRAY. RATINGS AND CONFIGURATION OF EQUIPMENT TO BE DETERMINED AT LATER DATE.

4.5.2.8 Lightning Protection System

The outdoor battery energy storage container shall be considered as equipment to be protected in the design of lightning protection studies. If required, air terminals may be installed on top of battery energy storage container and shall be connected to the local grounding system. Lighting protection shall be in accordance with IEEE 998, and studies shall be conducted using the Rolling Sphere Method.

4.5.2.9 Grounding System

A perimeter ground loop shall be installed 3 feet minimum away from BESS, solar and power electronic equipment skids foundation. As required by grounding study, 3/4 inch10-foot copper

ground rods shall be utilized throughout the site. All grounding studies shall include evaluation of bi-directional operations.

A two-hole bronze-grounding pad attached to the battery energy storage container shall be supplied adjacent to the main lead terminal housing and installed on each end of the battery energy storage container steel base frame. The battery energy storage container and ground bus shall be connected to either the existing facility ground grid or local ground loop by grounding leads (pigtails).

A minimum of a continuous 1/4-inch by 1-inch copper ground bus shall be provided for the entire length of the protection and control panel. All equipment requiring grounding shall be connected to the ground bus. A compression or clamp-type connector shall be provided at each end.

A Grounding Transformer (if required) shall be installed and bonded to ground through a neutral ground resistor to limit neutral current per NEC or NESC as applicable for a separately derived system.

4.5.3 Electrical Equipment

4.5.3.1 Automatic Transfer Switch (ATS)

4.5.3.1.1 Closed-Transition Automatic Transfer Switches

For Demand Response systems, Closed-Transition Automatic Transfer Switches shall be “make before break” and shall transfer power between normal utility power and battery energy storage power. Contractor shall provide Closed-Transition Automatic Transfer Switches in accordance with NEC (NFPA 70), NEMA ICS 10, and UL 1008. Transfer switches shall be four poles (switched neutral), four wire, and shall be rated at system voltage and for the BESS and solar array maximum power output and shall have a minimum transfer speed shall be under 10 cycles. Transfer switches shall be provided with auxiliary contacts that close when normal source is interrupted, which shall be used to initiate the starting and stopping of the battery energy storage system.

4.5.3.1.2 Grid Synchronous (Parallel) Switchgear

For Supply Response systems, Contractor shall provide grid synchronous switchgear (paralleling) in accordance with IEEE C37.20.1 for low voltage systems and IEEE C37.20.2 for medium voltage systems. Switchgear shall be metal clad and shall be mounted in two (2) high designed vertical sections with all specified circuit breakers, instrument transformers, buses, ground bus, instrumentation, relays, meters, necessary control devices, and all other required devices. Switchgear shall be provided with, a main breaker and a battery energy storage system bus breaker. Feeder breakers shall be used where required. Battery energy storage system breakers shall be rated at full output and continuous operation, and the battery energy storage bus breaker shall be rated at total output for all the battery storage containers connected to the switchgear. The battery energy storage bus breaker shall be used to isolate the battery energy storage system for testing. Switchgear shall also be provided with breaker for load bank connection for testing.

Switchgear shall not be required to be arc resistant. Medium voltage switchgear shall be provided with other means of arc-flash mitigation, including but not limited to:

- Fiber point sensors (arc-flash detection) in switchgear breaker and cable compartments.
- Fiber point sensors in PT compartments

- One (1) bus monitor (for arc flash protection) for switchgear bus arc-flash detection. One loop shall be controlled and monitored by the main breaker protective relay.
- Equipment fiber loop monitor for all switchgear breakers.

Low voltage switchgear shall be provided with arc reduction maintenance switches per NEC Article 240.87(B)(3) that, when activated, shall provide local status indication and shall set the breaker trip unit to “no intentional delay”.

4.5.3.2 Protection System Requirements

Complete system protective relaying requirements shall be coordinated and designed during detailed design.

If medium-voltage paralleling switchgear is to be provided, Contractor shall also provide main breaker protective relays, feeder protective relays, and bus differential protective relay in addition to arc-flash protective relaying elements listed in 4.5.3.1.

4.5.3.3 Neutral Grounding Resistor

If required due to fault current and power system grounding at facility, Contractor shall provide a grounding transformer with neutral grounding resistor to protect the BESS systems equipment from short circuit overload and overvoltage in accordance with IEEE C37.101. Neutral grounding resistor shall be provided in accordance with IEEE C57.32.

4.5.3.4 Transformer(s)

4.5.3.4.1 Standby Generation Step-Up Transformer (If Required)

Transformers shall be provided in accordance with IEEE C57.12. Transformers shall be rated for connection to facility system voltage and to the inverter output voltage, and kVA size shall be coordinated between facility Owner, Contractor, and inverter supplier. Outdoor, mineral-oil filled transformers shall consist of a factory coordinated assembly of a low voltage termination compartment, a welded main tank transformer, and a high voltage cabinet with externally clamped high voltage bushing wells for non-load break elbows. Voltage connections shall be coordinated with existing facility and with inverter supplier. Transformer shall be provided with standard accessories in accordance with IEEE C57.12.00, including:

- Liquid Level Gauge
- Liquid Temperature Gauge
- Pressure Vacuum Gauge
- Pressure Relief Devices
- Drain Valve with Sampler
- Upper filter plug/valve which will be located with the bottom of the fitting at the 25C oil level height rather than under the fluid level.

If an oil filled transformer is utilized, the transformer shall be shipped complete with a full tank of oil. Oil filled transformer shall be provided with containment compliant with Customer’s site SPCC plan. Unless otherwise required, a reinforced concrete oil retention basin shall be furnished under the transformer. The basin shall extend a minimum of 5 feet beyond oil bearing parts of the transformer on all sides. The basin shall be sized for 110% of the transformer oil volume plus rainfall from a 25 year 24-hour storm plus 6 inches of freeboard, or 110% oil volume plus 10 minutes of flow from fire hoses at 500 gpm plus 6 inches of freeboard. Containment design shall comply with all EPA and state requirements. The basin

shall have a fiberglass reinforced grating deck or approved equivalent. A 2ftX2ftX1ft sump shall be provided with removable grating section for positioning of a sump pump. An Oil Minder System shall be used as follows: Stancor, Inc Part # OM50TRN/115 - SE-50 Oil-Minder Transformer vault system. SE-50 1/2 HP pump, 115V (All pump, float and probe assemblies are factory wired directly into the solid-state main control with water-tight cable entries, suitable for extension to a remote location). The automatic Oil Minder system can detect oil in the containment pit and high water and signal if the pump is on or high water or oil is detected to the BESS SCADA system shall be provided.

Transformer firewalls shall be designed and installed when required by NFPA 850 and/or Factor Mutual Loss Prevention Data Sheets for transformers of more than 5,000 gallons oil capacity or 200 MVA or greater. Use of firewalls shall be agreed by the Owner prior to their use. Generally, firewalls shall be provided when the space between the transformer oil bearing parts and buildings are spaced less than the minimum clear distance of 50’- 0”.

Termination compartments shall be designed for cable entry from the bottom and shall be sized to the minimum dimensions of IEEE C57.12.34. Transformer high voltage terminals shall be provided with dead-break, non-removable studs. Transformer low voltage terminals shall be provided with lugs for eight (8) 750 kcmil conductors per phase. The neutral bushing shall be fully insulated and have a ground strap connected to the ground bus and sized per NEC 250.66.

A ground bus shall be capable of terminating ten (10) 350 kcmil ground conductors plus four (4) 4/0 AWG grid cables. Two (2) of the 350 kcmil and two (2) of the 4/0 AWG grounding points shall be located in the high voltage compartment. The two ground buses shall either be a continuous ground bus or shall be bonded together with cable having the same ampacity as the bus bar. The ground bus shall be bonded to the tank in either side of the transformer and sized per NEC 250.66. The ground bus shall be located as to allow bottom fed grounding conductors to terminate without impeding bottom fed current carrying conductor access to their termination points.

Copper grounding pads shall be provided at opposite corners of the tank base. If transformer output capacity can be met with a dry-type transformer, Contractor shall provide an option-price for a dry-type transformer. Standby Generation Step-Up Transformers shall be additionally equipped with three windings WYE(HV)-Delta(buried)-WYE(LV) and optional addition of an on-load tap changer if necessary to maintain interconnect voltage requirements. In the event that this transformer is needed for direct charging of the BESS system the following additional design parameters shall be included in the design:

- Rated continuous over-voltage at no-load and rated Hz
    - 10% above rated voltage on the output terminals for Step-Up operation
    - 10% above rated voltage on the output terminals for Step-Down operation at maximum MVA and 80% power factor
    - 110% rated voltage on the input terminals for Step-Up operation at maximum MVA and 90% power factor.
- Rated continuous over-voltage at full-load and rated Hz
    - 5% above rated voltage on the output terminals for Step-Up operation at output terminals

  - 5% above rated voltage on the output terminals for Step-Down operation at maximum MVA and 80% power factor
  - 110% rated voltage on the input terminals for Step-Up operation at maximum MVA and 90% power factor.
- Transformer shall be rated for full load bi-directional project use.
- The minimum final pressure on the windings just prior to placement in the tank is to be 6 N/mm² with a preference of 7.5 N/mm²

4.5.3.4.2 Battery Energy Storage/Inverter Transformers

These transformers shall be rated for solar PV service and designed for continuous bi-directional current flow from the inverters. The transformer low voltage windings shall be per inverter manufacturer's recommendations. Percent impedance voltage shall be according to the inverter manufacturer's recommendation. Battery Energy Storage Transformers shall be designed to allow a loop through configuration.

Transformers shall be configured as Wye high side, Delta low side. This transformer will also require a high side neutral (HO) bushing with ground strap connected to the neutral. The aux transformer will require an electric meter socket. This can be designed into the transformer or a pedestal with a meter socket can be used to meter site aux load. Transformers are required to have load interruption capabilities on the low side to isolate the energy storage equipment (inverters, storage media, etc.).

Liquid filled transformers shall be designed, constructed and tested in conformance with IEEE C57.12.00. Liquid filled transformers shall contain a UL-listed and Factory Mutual Global Approved less-flammable dielectric coolant meeting the requirements of NEC Section 450-23 and the requirements of the National Electrical Safety Code, Section 15. Transformer shall be suitable for indoor or outdoor use as applicable. Routine test results shall be provided to the Owner prior to shipment to the Site. All design shall be in accordance with the requirements listed in Attachment 10.1 of this Specification.

No Load taps shall be labeled per IEEE Std C57.12.34. Full-capacity taps in high-voltage winding:

- Two 2.5% taps above rated voltage.
- Two 2.5% taps below rated voltage.
- Transformer compartments shall have provisions for padlocking.
- High-voltage compartment shall contain terminations for dead-break elbows, and provisions for entrance of multi-conductor high-voltage, insulated, shielded, power cable. Provide terminations with stress relief devices.
- Transformer shall be equipped with a load-break switch that is oil immersed in transformer tank. The handle shall be located on the exterior tank wall. The switch shall be operable without exposure to any live circuits.

Include accessories as follows:

- Dial-type thermometer with contacts for high-temperature warning and alarm levels

- Magnetic liquid level gauge with alarm contact for low level.
- Pressure/vacuum gauge with alarm contacts.

Dry type transformers shall be designed, constructed and tested in conformance with IEEE C57.12.01. Dry type transformers shall be ventilated dry-type cast coil, Class AA suitable for indoor or outdoor use as applicable.

COMMENT TO BE DISCUSSED WITH ENTERGY – Solar and battery energy storage projects typically utilize oil-filled medium voltage transformers that contain a fire resistant and non-hazardous ester fluid instead of mineral oil. These transformers do not require fire barriers or any secondary containment. An example of this ester fluid is FR3 manufactured by Envirotemp.

4.5.3.5 Current Transformers (CT)

Current transformers shall be provided in accordance with IEEE C57.13. All secondary wiring of each current transformer shall be wired using #10 AWG conductors directly to shorting type terminal blocks. Delta or Wye connection shall be made using jumpers on the load side of terminal block. The quantity, ratio, and connection of the current transformers to be provided shall be determined by inverter output. Current transformers shall have thermal and mechanical ratings and insulation class not less than those of the associated circuit breaker.

4.5.3.6 Potential Transformers (PT)

Potential transformers shall be provided in accordance with IEEE C57.13. Potential transformers shall be molded, dry type, provided with current limiting high interrupting capacity primary fuse protection. The quantity, ratio, and connection of the potential transformers to be provided shall be determined by inverter output voltage. The accuracy class shall be rated at 200 VA for 55C rise. A higher VA rating shall be used for a larger burden.

4.5.3.7 Customer Revenue Metering

Customer revenue metering equipment and location shall be provided by and coordinated with Entergy.

4.5.3.8 Solar + Battery Energy Storage Output and Utility Input Metering

Solar + Battery Energy Storage output meter and utility input meter selection and location shall be coordinated with Entergy as required. The BESS controller shall also be capable of providing metering data points. Solar and Battery Energy Storage output and utility input meters shall be Class 10 meters with a 0.2 accuracy class and shall be connected to metering class (revenue grade) CTs with 5A secondaries and metering class (revenue grade) PTs with 120VAC secondaries. Meters shall be able to communicate back to Entergy RTU over Modbus TCP/IP and shall also be provided with digital mass data storage such that a minimum of 60 days of interval data shall be stored. For demand response installations (ATS), inverter output and utility input meters can be replaced with a single meter connected to the load side of the ATS that meets the specifications of both the Battery Energy Storage output meter and the utility input meter.

4.5.3.8.1 Solar + Battery Energy Storage Output Metering

Solar and BESS output meter shall be used to measure the output of the Solar and BESS and shall include the following metered data as a minimum:

- Volts
- Amps
- Incoming/Outgoing Watts (Cumulative)
- Power Factor
- Incoming/Outgoing VARs (Cumulative)
- Incoming/Outgoing Volt-Amperes (Cumulative)
- Frequency
- Kilowatt-Hours
- Power Quality

In addition to instantaneous metered values, meter shall be able to provide cumulative values for watts, VA and VARs.

4.5.3.8.2 Utility Input Metering

Utility input meter shall be used to measure the input from the utility and shall include the following metered data as a minimum:

- Volts
- Amps
- Watts (Cumulative)
- Power Factor
- VARs (Cumulative)
- Volt-Amperes
- Frequency
- Kilowatt-Hours

In addition to instantaneous metered values, meter shall be able to provide cumulative values for watts and VARs.

4.6 Instrumentation and Control Scope

4.6.1 General Requirements

The battery energy storage system shall be provided with a complete, self-contained, control and protection system.

4.6.2 BESS Control System

The BESS controller shall have the following functionality:

- Load sharing (output smoothing) with the solar system
- Synchronization
- Breaker control
- Grid synchronized or island mode operation of the battery energy storage system
- Single point of communication to RTU for all control and monitoring points below

4.6.3 Control Points

The control system shall, at a minimum, accept the following external digital control signals from the Owner's RTU:

- Standby – The battery energy storage system will be maintained in the Standby mode when ready to be connected. The battery energy storage system will draw auxiliary power

during the standby mode to maintain operation of the battery container HVAC system. The battery energy storage system will maintain a State of Charge (SOC) of 100% during the standby mode while it remains prepared to be connected to an active bus. The BESS controller will maintain a requested SOC within +/- 1%.

- Connect – When ready to connect and there is a live bus, the battery energy storage system shall automatically synchronize to the live bus and wait for load commands from the external control system. If there is a dead bus, the battery energy storage system shall automatically close its circuit breaker and energize the bus.
- Disconnect – Upon disconnect command, the battery energy storage system shall disconnect from the bus.
- Grid Synchronized/ Island Mode – When the external circuit is closed the battery energy storage system shall operate in grid synchronized mode. If the external circuit is open the battery energy storage system shall operate in island mode.
- Raise Load – Upon Raise Load command, the battery energy storage system shall increase load. The amount of the step change shall be programmable.
- Lower Load – Upon Lower Load command, the battery energy storage system shall decrease load. The amount of the step change shall be programmable.
- Raise Voltage – Upon Raise Voltage command, the BESS shall increase the inverter output terminal voltage. The amount of the step change shall be programmable.
- Lower Voltage – Upon Lower Voltage command, the BESS shall decrease the inverter output voltage. The amount of the step change shall be programmable.
- Raise Frequency – Upon Raise Frequency command, the BESS shall increase the inverter output frequency. The amount of the step change shall be programmable.
- Lower Frequency – Upon Lower Frequency command, the BESS shall decrease the inverter output frequency. The amount of the step change shall be programmable.
- Permit to Connect – Closure of an external dry contact designated as the Permit to Connect permissive shall be required to allow the battery energy storage system to connect.

The following digital status indications shall, at a minimum, be provided for connection to the Owner's RTU.

- Ready for Remote Connection – An indication shall be provided that it is closed when the battery energy storage system is ready to be connected remotely.
- No Trouble – An indication shall be provided that it is closed when there is no trouble with the battery energy storage system or its associated equipment.

4.6.4 Battery Energy Storage System Performance Monitoring System

Contractor shall supply a Performance Monitoring System. This system will monitor key parameters to allow Entergy to evaluate the performance of the battery energy storage system as well as monitor parameters for maintenance purposes. The system shall monitor the battery energy storage system data and provide maintenance alerts and warning alarms. This data will be passed to Entergy through the remote terminal unit (RTU).

Battery Energy Storage System Monitoring Parameters shall include, but are not limited to:

- State of Charge (SOC)
- Battery Temperatures
- Battery State of Health Parameters

4.6.5 Monitoring Points

The supplier shall provide a list of all available points that can be monitored on the generation system. These points shall be configured in Modbus registers be read by the RTU. The list shall include site controller data and provide analog and digital data points available on each battery container as well as all status and alarms.

4.6.6 Remote Terminal Unit (RTU)

The battery energy storage system control and monitoring panel shall include Modbus TCP communication equipment to allow remote supervisory control and data interchange between the battery energy storage system controller and Entergy's Remote Terminal Unit (RTU). The Contractor shall also furnish fiber-optic conversion equipment for this data link connection if the distance between the Remote Terminal Unit (RTU) and controller will exceed 100m distance. RTU will be supplied by Entergy. (RTU model # TBD)

4.6.7 Security/Surveillance System

[*This section will be kept for future inclusion.]*

4.7 Civil/Structural Scope

4.7.1 General Requirements and Description of Work

All necessary civil/structural systems as defined in these guidelines for a complete and functional generating system to meet Company's intended operations shall be designed, furnished, and erected. The following civil/structural activities shall be complete including, but not limited to, the remainder of this section.

During the bid phase of the Project, the contractor shall prepare a Preliminary Site Plan to depict work included in Contractor Scope of Work. The preliminary site Plan shall address any planned work including but not limited to the following:

- Approximate Location of work
- Arrangement of new equipment and foundations/structures
- Temporary Fence, Trailer, or other Installations
- Finished Fencing, Bollard, and Aesthetic Structures
- Contractor Disturbed Areas
- Existing Facility Demolition or Modification Requirements
- Repairs for Existing Facilities

Design shall be in accordance with the latest edition, including all addendums, of the following codes and standards where applicable:

- ACI 318 Building Code Requirements for Structural Concrete and Commentary
- AISC Manual of Steel Construction
- ACSE Manual No. 113 Guide for Design of Substation Structures
- NESC National Electrical Safety Code
- International Building Code
- State and Local building Codes and Ordinances

4.7.2 Site Conditions

The site conditions to be used as design and performance criteria are as specified in the Appendix 10.2 Design Basis Fill in Table. Any equipment or structures furnished under these Guidelines which will be installed outdoors or is affected by the site design conditions in its design or performance shall utilize these conditions, unless otherwise specified:

- Wind Design - A reference wind velocity in accordance with the applicable codes shall be considered for determining the effect on structures.
- Seismic Design - Seismic design of the units shall be in accordance with the applicable codes.
- Solar PV collection panels - The solar PV collection panels and supports shall be capable of enduring specified normal and abnormal design operating conditions, and site environmental effects of weather, wind, and earthquake without failure for the specified design life of the facility.

4.7.3 Geotechnical Work

Existing site geotechnical reports for the project site shall be made available to the contractor as indicated in Section 10.1. In the absence of adequate existing geotechnical report information, the Contractor shall state the basis of their bid in Section 10.1.

Where required by the Authority Having Jurisdiction (AHJ) a site-specific geotechnical report shall be prepared for the site. In limited cases and as approved by Entergy, Presumptive Bearing Capacity Values provided in the International Building Code may be utilized for design. The contractor shall state the basis of their bid in Section 10.1.

If a new geotechnical report is prepared, it shall be prepared by a Licensed Geotechnical Engineer registered in the state of the Project Site. Typical geotechnical reports will include the following; however, the scope of services shall be determined based on the needs of the Engineers performing design of the Project:

- Site suitability for deep and/or shallow foundations to support foundations required.
- Basic excavation and soil compaction requirements.
- Soil Characteristics and Foundation Design Parameters.
- Pavement recommendations.
- Subgrade suitability for fill placement and compaction operations and applicable testing requirements. On a full time, basis by a qualified independent testing agency as directed by the Contractor's licensed professional geotechnical engineer.
- The rate of in-place density testing shall be specified in the earthwork specifications. Representative Optimum Moisture and Laboratory Maximum Density Tests shall be made for each type of material or source of material. Soil Resistivity Testing

4.7.4 Soil Testing

During construction, foundation excavations shall be inspected and approved by the Contractor's licensed professional geotechnical engineer prior to placing concrete. Frequency and type of testing shall be specified by design engineer in accordance with Special Inspection requirements. Upon completion of all earthworks, the Contractor's geotechnical engineer shall certify in writing that the work was placed in accordance with the requirements and provide the backup data including but not limited to: Proctor curves (moisture/density relationship), moisture contents, Atterberg limits, field density checks, sieve analysis, etc. Testing locations

and elevations for all results shall be documented so that their position can be substantiated and relocated if necessary.

4.7.5 Survey Requirements

Any existing site survey for the BESS site shall be made available to the contractor as indicated in Section 10.1. Design Responsibility Table. Site Boundary surveys will generally be required for Project Sites to ensure proper offset and clearance from property lines, rights-of-way, easements, and existing structures. Site Topographical surveys are recommended to be obtained to assist in accurate layout of Project Site as well as to assist in proper grading and drainage. The Contractor shall state the basis of their bid in Section 10.1 Design Responsibility Table.

Surveying and control - This includes establishing and maintaining all survey control points, markers, and monuments required for plan and elevation control of construction activity for the duration of the Project.

4.7.6 Demolition and Repair of Existing Conditions

Design shall remove or alter existing work to prevent damage to any portions of the existing work which shall remain. The Contractor shall repair or replace portions of existing work which have been altered during construction to match existing or adjoining work, as approved by the Owner and/or Customer. At the completion of construction, existing work must be in a condition equal to or better than that which existed before new work started.

4.7.7 Site Preparation & Excavation

Contractor shall obtain digging permits prior to start of excavation, and for locating and marking underground utilities. Contractor shall contact a local utility locating service a minimum of 48 hours prior to excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Contractor shall verify existing utility locations and design alterations or protect as needed to complete the scope of work. The Contractor shall obtain and pay fees required for any grading, excavation, dewatering, or earthwork permit as required AHJ, Owner, and Customer.

4.7.8 Site Grading Drainage and Layout

The existing site soils should be leveled, filled, compacted, and sloped to drain. The site should be graded to accommodate drainage for any disturbed areas. The site surface should have a gentle slope to help drain surface runoff to the edge of the site area and tie into new or existing drainage systems or structures. Subsurface drainage should be considered where feasible. See Entergy Specification # SL1202 for details. The ground outside the equipment foundations shall have a minimum of 5% slope away from edge for the first 10 feet and positive drainage thereafter. The Contractor's geotechnical engineer shall identify if steeper grades are necessary or allowable based on the site’s soil characteristics. Maximum slope shall be 3 horizontal 1 vertical. The final site grade should ensure that water drains away from the equipment. Design grades to meet accessibility requirements where required. All site drainage structures shall be designed for a 100-year, 24 hours storm duration condition unless otherwise required by AHJ.

Floodplain elevations shall be determined for the Project Site location based on FEMA floodplain maps or local ordinances and regulations when more stringent. Top of concrete elevation for foundations shall generally be located one foot in elevation higher than the 100-year, 24-hour storm floodplain elevation. Additional consideration should be given to account for hurricane storm surge or other conditions, where applicable.

The Contractor shall be responsible for dewatering necessary for grading and other subsurface works for the construction of the Project. If temporary construction dewatering is required due to a high-water table, the Contractor shall prepare and present a dewatering plan. The Contractor is responsible for securing all the required information necessary for the design of the system.

The plan shall reflect selective site clearing that preserves existing conditions such as trees and parking. Erosion and Sediment Control Facilities shall comply with Federal, State, and local regulations. The Contractor is responsible for compliance with stormwater NPDES Permit, and Storm Water Pollution Prevention Plan (SWPPP), and NOI/NOT requirements, and for any associated fees and permits.

4.7.9 Fencing, Bollards, and Aesthetic Requirements

All sites shall be protected by Bollards, Fence, or Aesthetic/Sound Barrier Wall at a minimum. Concrete-filled pipe bollards shall be provided where the site is located adjacent to vehicular access including the Customer's periodic maintenance activities. The fence shall be at least eight feet high (seven-foot fabric and one foot of barbed wire) as specified in Entergy Specification # SL0701. Sites may require special consideration such as concrete/brick walls or landscaping features in lieu of chain link fencing.

4.7.10 Structural Design

4.7.10.1 Loading

Applicable site loading shall be determined based on the controlling site design codes. Applicable design code and site-specific load conditions shall be documented in Section 10.1 Design Basis Fill in Table.

4.7.10.2 Concrete and Foundations

Concrete and Foundation designs shall be performed in accordance with the Code and American Concrete Institute (ACI) 318 – Building Code Requirements for Structural Concrete. All foundation design shall be in accordance with the recommendations of the project specific geotechnical report or presumptive values provided by the International Building Code or Local AHJ requirements.

Designs shall include all provisions required to provide a foundation capable of supporting equipment per manufacturer's minimum support criteria and meet local code requirements. Where required, curbing or similar water-tight containment shall be constructed to comply with Spill Prevention Control and Countermeasures (SPCC) requirements.

Nominal concrete foundations shall be (6) inches above finished grade. The minimum concrete foundation above floodplain elevation shall be twelve (12) inches unless otherwise required by Owner, Customer, AHJ, or additional flood considerations.

Inspection and Testing shall be performed by the fabricator or the Installation Contractor's testing lab unless AHJ requires otherwise. Records of inspection and testing shall be available for Owner inspection upon request.

Typical Concrete Specifications	
Concrete & Foundations	fc = 4500 psi (in accordance with ACI 301)
Reinforcing Steel	ASTM 615, Grade 60
Welded Wire Fabric	ASTM A185

Typical Concrete Specifications	
Anchor Rods	ASTM F1554 - Hot Dipped Galvanized
Nuts	ASTM A194, Grade 1, ANSI B18.2 or equal

Foundation bearing capacity and stability shall be checked with all load factors equal to 1.0 (working loads). The minimum factors of safety (FS), the ratio of the resisting to applied forces shall be as follows:

- Deep Foundations
  - Drilled pier foundations FS = 2.0
- Shallow foundations
  - Bearing Capacity failure FS = 3.0
  - Stability (overturning and sliding) FS = 1.5

4.7.10.3 Structural Steel

Structural Steel designs shall be performed in accordance with Code requirements including, but not limited to The American Institute of Steel Construction (AISC) Steel Manual.

Corrosion prevention control measures for structural steel shall be considered during the design process. Steel with exposure to frequent wet-dry cycles, urban/industrial atmospheres, chemicals, ultraviolet light, and high salinity applications should be provided with increased corrosion protection. Generally, exterior steel shall be provided with hot dipped galvanized finish, while interior applications shall be protected by painted finish suitable for the environmental conditions. The minimum lifespan of coating systems shall be twenty (20) years.

Contractor shall provide structural steel base frame to adequately support equipment and/or enclosures and means to level equipment/enclosures. Equipment manufacturer shall provide verification of minimum criteria that base frame and enclosure are designed for and state applicability for site specific load conditions.

Landing platforms and stairs shall be required for walk-in enclosures with a single step height exceeding 7” unless ADA compliant design is required by Customer or Owner. Stairs and Platforms, if required, shall be sized based upon door size, access requirements, and local code provisions. Stairs shall be provided with IBC Compliant Guard and Handrail when exceeding a single step.

Inspection and testing, as required by for Special Inspections, shall be by the fabricator or the Installation Contractor’s testing lab unless AHJ requires otherwise. Records of inspection and testing shall be available for Owner inspection upon request.

Typical Structural Steel Specifications	
Steel – W	ASTM A992
Steel – C, MC, L Shapes	ASTM A36
Steel – Plates	ASTM A36
Steel – Tube	ASTM A500 grade B
Nuts	ASTM A194, Grade 1, ANSI B18.2 or equal

Typical Structural Steel Specifications	
Connections – Bolted	ASTM A325 bolts
Connections – Welded	AWS D1.1

4.8 Architectural Scope

[This section will be kept for future inclusion of interior installation requirements in the event Entergy considers BESS sites which require interior installations.]

5.0 INSPECTIONS, TESTING, COMMISSIONING AND ACCEPTANCE TESTING

5.1 Overview

Factory and field inspections, System check-out, start-up, and testing shall be performed by the Contractor or Contractor's suppliers for all equipment and systems. Contractor is responsible for the coordination of supplier and subcontracted testing personnel.

5.2 Factory Acceptance Testing Inspections and Testing

Factory or Field Tests and Inspections:

The Contractor shall perform tests recommended by the manufacturer and each visual and mechanical inspection and electrical and mechanical test listed below, as specified in NETA Acceptance Testing Specifications.

The Contractor shall report the results of tests and inspections in writing. The Contractor shall record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

5.2.1 Battery Energy Storage System FAT

Battery Energy Storage System Container and Controller:

The Contractor shall develop and submit a factory test plan as part of the design submittals. The Owner reserves the right to witness or have designated representative witness any or all tests at no additional cost. The Contractor shall provide a minimum of 21 days written notice to the Owner prior to each test for North American locations and a minimum of 30 days of notice for other locations. The Contractor shall make all attempts to reduce the number of trips required to the minimum necessary.

As a minimum, sufficient tests shall be conducted to demonstrate that all Battery Energy Storage System controls, protective functions, and instrumentation perform as designed and are in compliance with this Specification. Successful tests performed using actual controls with a digital simulator to represent the Owner's AC system will be deemed to meet the intent of this paragraph. All Equipment to be supplied by the Contractor shall be subjected to routine and design tests in the factory as required under this Specification and applicable international standards for each piece of Equipment.

Equipment with complex interfaces with other equipment, such as the BESS controller, shall be connected and tested as a system in the factory. The tests shall demonstrate full implementation and compatibility with the Owner's RTUs. Control function tests are to include the following at a minimum:

- Verification of each control function
- Verification of each control linearity
- Verification of each control redundancy
- Verification of the monitoring system
- Verification of the protection system
- Verification of the overall system performance for minor and major system disturbances
- Verification of Battery Energy Storage System parallel operation with other controls in the system and control
- stability
- Verification of control equipment performance for auxiliary power supply voltage (AC and

DC)
- Climate tests
- Interference tests
- SCADA I/O to Owner's RTU tests

Contractor shall indicate all factory design and production tests which will be performed on all major components and parts. The test data shall be complete, including drawings, and shall clearly state the quantitative and qualitative performance of the Equipment subjected to the test. The Contractor shall be responsible for compliance with all standard factory test procedures that check the quality and performance of the Battery Energy Storage System. A detailed list of test and procedures shall be submitted in advance of fabrication.

- Battery Cell Tests:

The following testing shall be performed on the battery cells:

  - Amp hour capacity testing.
  - Review UL 1642 Compliance Certificates (if applicable)
  - The Contractor shall propose a test plan for all required cell tests. Required tests may be proposed as a percentage of the cells in production lots. Test data for production lots other than those being supplied for this BESS are not acceptable.

5.2.2 Automatic Transfer Switch FAT

- Certify compliance with test parameters.
- Visual and Mechanical Inspection:
  - Compare equipment nameplate data with Drawings and Specifications.
  - Inspect physical and mechanical condition.
  - Inspect anchorage, alignment, clearances, and grounding.
  - Verify that transfer warnings are attached and visible.
  - Check positive mechanical interlocking amid alternate and normal sources.

- Electrical and Mechanical Tests:
  - Insulation resistance tests
  - Contact pole resistance tests
  - Verify settings and operation of control devices
  - Calibrate and set all relays and timers
  - Check phasing, phase rotation, and synchronized function as needed
  - Perform automatic transfer tests
  - Simulate loss of normal power
  - Return to normal power
  - Simulate loss of emergency power

- Operational and Functional tests:
  - Normal source voltage relay test
  - Time delay upon transfer
  - Emergency source voltage relay test
  - Automatic transfer operation timing
  - Interlocks and limit switch function
  - Time delay and retransfer upon normal power restoration

5.3 Site Acceptance Testing

The following acceptance tests shall be run to document that the performance and functionality of the integrated and installed system meets the design intent, environmental regulatory compliance for emissions and for noise testing.

5.3.1 System Tests

The Contractor shall self-perform or engage a qualified testing agency to perform startup and commissioning tests and inspections. The Contractor shall perform tests and inspections with the assistance of a factory-authorized service representative.

The Contractor shall conduct solar + battery energy storage system acceptance tests to demonstrate that the systems meet the functional and operational intent of the design. Contractor shall coordinate testing with the customer site to minimize interruption of the customer site operations.

Solar PV System

- Conduct a performance test of the Solar PV system in accordance with ASME Performance Test Code (PTC) 50 – Solar PV Performance

Battery Energy Storage System

- Conduct NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test. The NFPA 110 acceptance tests shall be completed as applicable where the battery energy storage system replaces the engine-generator(s) referred to in the test procedure.
- Loss of Utility: Simulate a loss of utility power and either transfer ATS to “emergency” feed or open the site utility feeder breaker (site to go black) to demonstrate the battery energy storage system can power the site. Connect the battery energy storage system automatically. Operate the battery energy storage system until conditions are stable.
- Seamless Transfer (Closed Transition). Transfer the ATS to “emergency” feed and connect the battery energy storage system. Prove the battery energy storage system can supply the site load.
- Grid Synchronous Operation (if supply response design). Connect the battery energy storage system and synchronize to the grid. Vary load to demonstrate operation of the battery energy storage system.
- Coordinate tests with tests for transfer switches and run them concurrently.
- Contractor shall perform 100% load testing of the installation at the rated battery energy storage system load. If there is insufficient customer load to demonstrate the rated battery energy storage system load of the installation, a load bank may be required enabling operation of the unit at desired load points without interrupting the customer’s operation or the utility.

Liquid Filled Transformers

- Verify nameplate data.
- Coordinate and perform instrument transformer tests on CTs with transformer assembly.
- Winding Tests:
  - Transformer Turns Ratio (TTR) at all no-load taps.

  - Megger winding to ground.
  - Megger winding to winding.
  - Set high voltage taps at positions determined by Engineer.

- Check and measure equipment ground; ground shall not be more than one ohm.
- Check insulating fluid for clear or pale amber color and report any variance to the Owner. Other colors may indicate contamination from decomposition of insulation, foreign material, carbon, or other substances.
- Test oil samples from each transformer with standard AC test in accordance with ASTM D1816. Notify the Owner if breakdown voltage is less than 30 kV.
- Check liquid level in tanks, and in bushings of the liquid-filled type, and check nitrogen content in inert gas sealed oil preservation systems.
- Check that all valves are open between the transformer tank and cooling equipment.
- Check operation of cooling equipment and cooling controls before energizing transformer.
- Check calibration of pressure relief device, top oil temperature relay, and hot spot temperature relay.
- Pressure test the sudden pressure relay in accordance with the manufacturer's instructions to verify proper operation of device and electrical contacts.
- Alarm Sensor Testing: induce the device to operate with proper input medium (heat, cooling, pressure, vacuum, voltage, current, etc.) and verify operation of the device at the correct input medium level by monitoring the output contacts with an ohmmeter.
- Annunciator Testing: check each unit of annunciators by closing or opening the trouble contact and observing operation of control board.
- Check all annunciator lamps, bell cutoff, and reset operation.
- Test all gauges including level, temperature, and pressure gauges.

Dry Type Transformers

- Verify nameplate data.
- Winding tests:
  - Transformer Turns Ratio (TTR) at all taps.
  - Megger winding to winding.
  - Megger winding to ground.
- Check equipment ground to assure continuity of connections. Notify the Owner if ground is more than one ohm.
- Check electrical neutral of the transformer. This connection shall be a copper wire connection to the station ground grid.

- Check for proper operation of the winding temperature gauge and cooling fans.
- Set high voltage taps at positions determined by Engineer.
- Check connections for tightness; clean out dust and other foreign material.

5.3.2 Noise Testing

The Contractor shall perform noise testing (if required) of the completed installation and operation across the battery energy storage system load, to confirm that noise emission guarantees have been met across the engine operating load. The Contractor shall measure A-weighted level of noise emanating from the battery energy storage system installation at four locations 25 feet from the edge of the battery containers to demonstrate compliance with contract noise guarantees.

5.4 Post Substantial Completion Testing

The following tests shall be performed after substantial completion.

After Substantial Completion, but not more than 60 days after final acceptance, the Contractor shall perform an infrared scan of each power wiring termination and each bus connection while running with between 90-100% battery energy storage system load. Remove all access panels, so terminations and connections are accessible to a portable scanner.

The Contractor shall perform an additional follow-up infrared scan 11 months after the Substantial Completion Date.

An infrared scanning device shall be used to measure temperature or to detect significant deviations from normal values. The Contractor shall prepare a certified test report that identifies terminations and connections checked and that describes scanning results as well as calibration records of the scanning device. Notations of deficiencies detected, remedial action taken, and observations after remedial action shall be recorded.

6.0 CONSTRUCTION

6.1 General

It shall be the responsibility of the Contractor to design and construct a complete and properly built solar + battery energy storge system in conformity with these supplied specifications and the contractor's design, without any reliance upon Entergy to point out deficiencies of construction. However, in cases where deficiencies are noted by Entergy, such deficiencies shall be brought to the attention of the Contractor who shall properly correct such deficiencies and promptly notify Entergy of such corrections.

Neither the Contractor's Project Manager nor Construction Manager may be withdrawn from the work without due notice being given to Entergy. No such withdrawal shall jeopardize successful and timely completion of the work.

6.2 Construction Facilities, Services, and Utilities

Contractor shall furnish and maintain temporary construction facilities as necessary to perform the work:

- Temporary Storage: Contractor shall provide facilities at the site for the proper unloading and storage of all plant material delivered to the site. If adequate facilities are not available, such material shall be stored at suitable offsite facilities (e.g., warehouses, storage yards, etc.) as approved by the Entergy.
- Construction Power: Contractor shall be responsible for all temporary power necessary to perform the work. All work shall be in accordance with the National Electric Code (NEC) or National Electric Safety Code (NESC).
- Temporary Lighting System: Contractor shall provide, maintain, and remove temporary lighting necessary to install the Work.
- Site drainage, sedimentation control, and dewatering systems.
- Parking Facilities: Contractor shall coordinate with Customer all parking needs to accommodate the Work.
- Site Security: Contractor is responsible for complying with the Customer's site security requirements.
- Construction Testing Services: Contractor shall self-perform testing or provide for the services of an Independent Testing Laboratory to perform inspections, tests, and other services as required by the Contract Documents. When tests indicate noncompliance with the Contract Documents, laws, standards, regulations, etc., all subsequent retesting required shall be performed by the same testing laboratory and all costs, including rework, shall be borne by Contractor.
- Construction Materials: Contractor shall supply all permanent and temporary construction material, equipment, tools, consumables, instruments, etc., necessary for the construction of the project.
- Site Environmental Compliance and Protection: Contractor shall implement and maintain all required environmental procedures including erosion protection, noise abatement, wastewater discharge, Storm Water Pollution Prevention Plan (SWPPP), and any other items required to ensure compliance with all governing authorities.
- First Aid Services: Contractor shall be responsible for and make arrangement for offsite first aid transportation and treatment as necessary during the construction of the project.

6.3 Safety

The Contractor and the Contractor's operations shall comply with the Contractor's and Entergy's safety and environmental rules and policies and all applicable laws and parts of Federal DOT, EPA, and OSHA (Occupational Safety and Health Act) regulations, as well as state and local laws and regulations.

All contractors and subcontractors shall have completed PowerSafe training including PowerSafe Observer/Spotter and Human Performance. Contractor shall comply with contract requirements as it relates to Entergy's contractor safety standards including compliance with Entergy's Avetta safety system. Contractor shall upload safety metrics periodically in Avetta and Entergy safety systems.

Each contractor shall designate a competent representative to carry out its safety program. This responsible individual's name will be given to the Entergy Power Through the Contract Manager.

Each Contractor shall maintain accurate accident and injury data. Contractors will cooperate in accident investigations, including submission of a comprehensive report of the accident to the Entergy Power Through Contract Manager. Events are to be reported immediately and verbally by the contractor to the Entergy Power Through Contract Manager are:

- Near misses with a potential of serious injury or death, within 48 hours.
- Serious accidents or injuries, immediately (See Fatality & Serious Injury Reporting Process).
- Fatalities – immediately (See Fatality & Serious Injury Reporting Process).

Contractor's personnel that fail to comply with the safety requirements will be considered unqualified to perform services or work at Entergy Power Through worksite(s). The Contractor will not reassign any personnel to work on Entergy Power Through premises that have been identified as unqualified or removed from any worksite for violating any specified requirements or rules.

All Contractors assigned to Entergy Power Through sites are required to attend a Contractor Safety Orientation and be briefed annually as a refresher at the worksite or other appropriate facilities.

The Contractor shall not use, spill, or dispose of any solvent, cleaner, or chemical on Entergy Power Through sites or while on Entergy property, unless the product is approved by Entergy Safety and Environmental group and used according to each specific manufacturer's instructions. The Contractor shall comply with all Federal, including OSHA CFR 1200, state, and local regulations for all such materials.

The Contractor shall maintain all requisite lights, guards, temporary walkways, bridges, etc., for the protection of his work, for the safety of the public and of the employees who may be engaged on the work. The Contractor shall furnish and install hard barriers to prevent inadvertent or unauthorized access to trenches or excavations. Trenches in vehicular traffic areas shall be covered with traffic-rated steel plates.

When the Work is to be performed near energized facilities, extreme caution shall be exercised and direct controls to be used by the Contractor and all sub-contractors to avoid injury to personnel, damage to the equipment or loss of power supply to the Entergy Customers.

The Contractor shall ensure that street traffic is not unnecessarily impeded by the construction. The material stored during construction shall be piled such that it will not unnecessarily block

the entrance to buildings, driveways, or hydrants. At no time shall any material be stacked within 15 feet of a hydrant, and it shall not block any catch-basin or gutter thereto. Necessary steps should also be taken to protect existing structures, buildings, etc., alongside the street.

6.4 Drug, Alcohol, Weapons, and Firearms Policy

Contractor shall inform their employees, including any subcontractor, performing services on Customer's premises, of Customer's and Entergy's policies relative to drugs, alcohol, weapons, and firearms, as stated below. Individuals found in violation of this policy shall be removed from Customer premises immediately and, when appropriate, such violation will be reported to the proper law enforcement agencies.

- The use, possession, transportation, or sale of illegal drugs and narcotics by Contractor employees while on Customer's premises is absolutely prohibited.
- The use, possession, or transportation of firearms and other weapons by Contractor employees while on Customer's premises is prohibited unless specifically authorized by Customer.
- The use, possession, or transportation of intoxicating beverages by Contractor employees while on Customer's premises is prohibited.

6.5 Fire Prevention and Protection

Only work procedures which minimize fire hazards to the extent practicable shall be used. Combustion debris and waste materials shall be collected and removed from the site each day. Good housekeeping is essential to fire prevention and shall be practiced by the Contractor throughout the construction period. Contractor shall follow the recommendations of the "Manual of Accident Prevention in Construction" by the Associated General Contractors of America regarding fire hazards and prevention.

6.6 Security

Contractor is responsible for security of the BESS materials, tools, and equipment necessary to execute the BESS. At the end of each shift, materials and tools are to be stowed in a locked job office or trailer and equipment is to be parked with keys inaccessible.

6.7 Cleaning Up and Housekeeping

Contractor shall always keep work areas in a neat, clean, and safe condition. Upon completion of any portion of the work, Contractor shall promptly remove all their equipment, construction materials, temporary structures, and surplus materials not to be used at or near the same location during later stages of work. Upon completion of the work and before final payment is made, Contractor shall at his expense satisfactorily dispose of all unused materials, rubbish, and other equipment and materials belonging to Contractor or used in the performance of the work; and Contractor shall leave the premises in a neat, clean, and safe condition. In the event of Contractor's failure to comply with the foregoing, the same may be accomplished by Entergy or Customer at Contractor's expense. Energized Facilities Contractor is responsible for requesting underground facility locate (811) prior to the start any excavation or subsurface work. The Contractor may encounter existing energized facilities, operating machinery, and systems, which must remain energized and functional during the execution of the Work. Contractor shall coordinate all Work in these areas with the Customer.

During construction, the Contractor shall establish a lock-out/tag-out procedure for all Work in energized electrical panels and gear.

Contractor shall be completely responsible for the safety and protection of his personnel, Customer's personnel, and the public on the site of the Work and shall employ all methods necessary to achieve such safety and assure continuity of all service systems encountered. These methods shall include, but not be limited to, providing barriers, guard structures, insulating guards and sleeves, warning signs, and prevention of unauthorized access to service system areas.

6.8 Mitigation and Restoration

The following steps shall be taken to minimize impacts during BESS construction.

Soils:

- Limiting soil disturbance to active construction areas
- Stabilization of construction areas with mulch, hay bales, and silt fences during construction within Customer's property.
- Control of storm water runoff through drainage swales and berms
- Restoration with seeding and vegetation of completed area(s)

Ecological Resources:

- Control of construction generated dust through watering of exposed areas and/or vegetation
- Implementation of erosion and sedimentation control measures (silt fences, hay bales, mulching)
- Water Resources
- Contractor shall manage storm water runoff during the construction phase.

Noise:

- The Contractor shall comply with applicable construction noise requirements as dictated by the municipality of the BESS.

6.9 Environmental Permitting

Contractor will be responsible for obtaining all necessary Permits. The Contractor will also be required to pay any fees and taxes that may be required by state and local entities. The Contractor shall, at Customer's request, furnish satisfactory evidence of compliance with all rules and regulations of governmental bodies having jurisdiction.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

7.1 General

Contractor shall prepare and follow an integrated Quality Assurance/Quality Control (QA/QC) Program including, but not limited to, design, construction, installation, materials, equipment, checkout, start-up, and initial operation. The QA/QC programs of the Contractor and its subcontractors shall be enforced to assure that the project is of good quality.

Contractor's QA/QC programs shall strictly apply to all subcontractors and suppliers in the Resilience as a Service Program. Periodic audits of subcontractor's QA/QC programs shall be conducted by Contractor's QA/QC group.

Throughout the Project, Entergy may audit elements of Contractor's and its subcontractor's QA/QC programs to ensure compliance. Contractor, its subcontractors, and suppliers shall allow Entergy access to their facilities, data, and personnel as may be required by Entergy to perform QA/QC audits.

The solar + battery energy storage system installation contractor shall be an authorized representative who is trained and approved by manufacturer.

7.2 Documentation

The Contractor shall maintain and provide all inspection and test records, data, calculations, drawings, diagrams, manuals, specifications, and other project information as requested by Entergy.

All QA/QC documentation shall be compiled in a project data book issued to Entergy at the completion of the project. The QA/QC documentation shall include:

- Original Equipment Manufacturer Specifications and Installation and O&M Manuals
- Factory Acceptance Test (FAT) Reports
- Construction Inspection and Test Records
- Commissioning Testing Records
- Site Acceptance Testing Reports Post Substantial Completion Test Records

8.0 RESPONSIBILITIES

The Managers of the Power Through Business Unit and the Entergy Contract Manager are responsible for assuring that the project execution is in accordance with this standard.

9.0 ACKNOWLEDGEMENTS

None

10.0 ATTACHMENTS

10.1 Design Basis Responsibility and Fill-In Table

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
1	**1. GENERAL**			
2	Site Location		_____	
3	Facility Type (Commercial, Hospital, Assisted Living, Nursing Home, Data Center, Industrial, Governmental)		Commercial ☐ Hospital ☐ Assisted Living ☐ Data Center ☐ Industrial ☐ Governmental ☐	
4	Facility Address		_____	
5	Facility Owner Name		_____	
6	Existing Facility Gen Sets (Yes/No)		YES ☐ NO ☐	
7	Requested Operating Configuration - Demand Response Supply Response		DR ☐ SR ☐ _____	
8	Electric Utility Name - ELL: Entergy Louisiana LLC		ELL ☐	
9	Minimum <u>Net</u> Output Required (At Inverter Terminals)	kWe	_____	
10	Installation Location (Outdoor)		_____	
11	Sound/Weather Enclosure, Other – Cold Weather, Impact Resistant for Hurricane Prone Region		Enclosure ☐ Insulated ☐ Heated ☐ Impact Resistant ☐	Enclosure ☐ Insulated ☐ Heated ☐ Impact Resistant ☐
12	Exterior Paint Color		_____	
13	Security Requirements		_____	
14	Protection Requirements		_____	
15	Aesthetic Requirements		<u>Project Specific</u>	
16	Existing Gen Set Indoors Installation Layout (if applicable)		[If appliable]	
17	Facility One Line Diagram		[Attach]	
18	Electrical Tie-In Location		_____	

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
19	Disturbed Wetlands Present (Site Observation)		Yes ☐ No ☐	Yes ☐ No ☐
20	Flood Risk Determination: 100-Year, 24Hrhr Storm Floodplain Elevation or Design Storm Surge Elevation (IBC Section 1612, https://msc.fema.gov/portal/home)		Elevation Known: ☐ List: _____ Not Floodzone: ☐	Design Elevation: ☐ List: _____ Not Floodzone: ☐
21	Existing Geotechnical Investigation Availability (If Available),		Yes (See Appendix) ☐ No ☐	Existing Adequate: ☐ Contractor to Provide: ☐ Presumptive Parameters: ☐
22	Existing Site Survey Availability (If Available)		Yes (See Appendix) ☐ No ☐	Existing Adequate: ☐ Contractor to Provide: ☐ Not Required: ☐
23	Existing Site Plan (If Available)		Yes (See Appendix) ☐ No ☐	Submitted Preliminary Site Plan with Bid: Yes ☐ No ☐
24	Site Building Code and/or NESC			State/Local Building Code: ☐ List: _____ NESC: ☐
25	Building Code Design Risk Category (IBC Table 1604.5)			NESC Risk Category: ☐ IBC Risk Category: ☐ List: _____
26	Snow/Ice Load (Snow: IBC Section 1608, Ice: ASCE 113 Fig 3-3)			Ground Snow Load: ☐ List: _____ Ice Load Thickness: ☐ List: _____
27	Ultimate/Basic Design Wind Speed (IBC Section 1609 or ASCE 113 Fig 3-2)			Ultimate Windspeed: ☐ List: _____ Basic Windspeed: ☐ List: _____

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
28	Wind Exposure Category (IBC Section 1609.4)			Category B ☐ Category C ☐ Category D ☐
29	Hurricane Wind-Borne Debris Region (IBC Section 1609.2)			No ☐ Yes ☐
30	Seismic Site Soil Classification (IBC Section1613.2.2)			Class A ☐ Class B ☐ Class C ☐ Class D ☐ Class E ☐ Class F ☐
31	Seismic Design Category (IBC Section1613.2.5)			Category A ☐ Category B ☐ Category C ☐ Category D ☐ Category E ☐ Category F ☐
32	Soil Allowable Bearing Capacity (Geotech Report or IBC Table 1806.2)			Known: ☐ List: _____ Presumptive: ☐ List: _____
33	Soil Frost Depth (Geotech Report or Local Ordinances)			Known: ☐ List: _____ Presumptive: ☐ List: _____ Frost Protection System: ☐ List: _____
34	**2. SITE STANDBY GENERATION POWER SYSTEM NEEDS**			
35	Facility Peak Demand	kW/kWH	_____	
36	Facility Peak Demand (Adjusted for future capital projects)	kW/kWH	_____	
37	Demand rating life expectancy	Years	_____	

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
38	Facility Load Profile		_____	
39	Site critical missions and activities and associated critical power demand?		_____	
40	VFDs, Soft Starters on-site		_____	
41	Large Motors		_____	
42	Inverter Interconnection Voltage		_____	
43	Critical Power Demand (Adjusted for future capital projects)		_____	
44	Power Quality Needed		_____	
45	Any past outage events, durations, what happened, lessons learned?		_____	
46	Security Requirements		_____	
47	Protection Requirements		_____	
48	Aesthetic Requirements		_____	
49	**3. ENVIRONMENTAL CONDITIONS**			
50	Applicable ASHRAE Weather Station			
51	Outside Design Maximum Dry Bulb Temperature	°F	_____	
52	Outside Design Minimum Dry Bulb Temperature	°F	_____	
53	Outside Normal High Dry Bulb Temperature	°F	_____	
54	Outside Normal Low Dry Bulb Temperature	°F	_____	
55	Site elevation above sea level	ft	_____	
56	Equipment Seismic Rating			_____
57	**4. RATINGS**			
58	Rated Net Output (At Inverter Terminals)	kWe		_____
59	Power Factor			_____
60	Minimum Rating	kVA/kVAH		_____
61	Nominal Rated Operating Voltage	Vac/dc		_____
62	Minimum Allowable Operating Voltage	Vac/dc		_____
63	Maximum Allowable Operating Voltage	Vac/dc		_____
64	Rated frequency	Hz		_____

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
65	Minimum Allowable Operating Frequency	Hz		_____
66	Maximum Allowable Operating Frequency	Hz		_____
67	BIL Rating	kVp		_____
68	Rated Voltage Variation, % of Rated Voltage			_____
69	Steady-State Voltage Regulation		_____	
70	Frequency Variation, % of Rated Frequency		_____	
71	Maximum Load Step		_____	
72	Maximum Voltage Dip Allowed During Maximum Load Step		_____	
73	Primary Phase Cable Connections		_____	
74	Primary Ground Cable Connection		_____	
75	Current Transformers:		_____	
76	Terminal Side		_____	
77	Neutral Side		_____	
78	Voltage Transformers		_____	
79	Neutral Grounding Resistor		_____	
80	Auxiliary Power Supply (Power Supplied by Others)	V/PH/Hz	_____	
81	Available Fault Current		_____	
82	**5. BATTERY ENERGY STORAGE SYSTEM**			
83	Battery Technology			_____
84	BESS Net Capacity (at inverter terminals)	kW/kWH		_____
85	BESS Roundtrip Efficiency	%		_____
86	BESS Parasitic Losses	kW		_____
87	BESS Power Factor Range	P.U.		_____
88	Battery Manufacturer			_____
89	Battery Container Manufacturer			_____
90	Number of Battery Containers			_____
91	Battery Container Capacity	kW/kWH		_____
92	Battery Container Fire Protection / NFPA 855 and UL 9540A Compliance	Y/N		_____
93	Battery Container Dimensions	in/ft		_____
94	Battery Container Weight	lbs		_____

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
95	Battery Container Auxiliary Power Required	Y/N		_____
96	Battery Container Auxiliary Power Voltage	V		_____
97	Maximum Battery Container Auxiliary Power Supply	kW		_____
98	PCS Manufacturer			_____
99	Inverter Rating	kW		_____
100	Number of Inverters			_____
101	Inverter Dimensions	in/ft		_____
102	Inverter Weight	lbs		_____
103	Inverter Cooling Method			_____
104	Load bank provided for testing	Y/N		_____
105	**6. SOLAR PV SYSTEM**			
106	Panel Mounting Configuration – Ground/ Roof/ Carport			_____
107	Annual AC Production at Inverter Terminals	kWH		_____
108	Annual DC Panel Production	kWH		_____
109	Panel Manufacturer			_____
110	Number of Panels			_____
111	Panel DC Output Voltage	V		_____
112	Maximum Power (Pmax/Watt)			_____
113	Panel Efficiency			_____
114	Number of Axis’s			_____
115	Inverter/Converter manufacturer			_____
116	Inverter/Converter Power Rating	kW		_____
117	Inverter/Converter Input current rating	A		_____
118	Inverter/Converter Input Voltage rating	V		_____
119	Inverter/Converter Output Voltage rating	V		_____
120	Inverter/Converter Output current rating	A		_____
121	Number of Inverter/Converters			_____
122	**7.COMMUNICATION**			_____
123	Solar + BESS Communications			
124	Remote Terminal Unit (RTU)		_____	
125	Communication Protocol		_____	

ID				
		UNITS	**Entergy Request For Proposal (On behalf of customer**	**Contractor/Gen Set OEM RFP Response Fill in Data and Verify Entergy Provided Info.**
126	Control Points			_____
127	Monitoring Points			_____
128	**8.NOISE LEVEL**			
129	Maximum Exterior Noise Level at 3 feet in any direction from unit	dB	_____	
130	Far Field Noise Limits	dB @ XX ft	_____	

10.2 Battery Energy Storage System (BESS) Technical Requirements

10.2.1 General

The rated power output (kW), storage duration (Hours) and storage capacity (kWH) of the BESS is contained in Section 10.1.

The BESS shall include outdoor rated battery energy storage containers, power conversion ystems (PCS), pad-mount transformers, cabling, shelters, all associated control and communication interface systems, all switchgear and other interconnection equipment and any auxiliary loads necessary to support its operation to the point of interconnection with the utility.

COMMENT TO BE DISCUSSED WITH ENTERGY – It is recommended that the battery storage configuration be limited to outdoor rated battery storage containers with integral HVAC and fire protection systems to limit the risk of fire during battery charging.

The Contractor shall select the battery technology, however, Lithium Iron Phosphate (LFP) batteries must be used if Lithium-Ion battery technology is to be utilized.

COMMENT TO BE DISCUSSED WITH ENTERGY – LFP batteries generate significant less heat when charging than other types of Lithium-Ion batteries. This results in less fire risk from overheating.

All loads necessary to operate and protect the BESS, such as controls, cooling systems, fire suppression (if applicable), fans, pumps, and heaters, are considered auxiliary loads internal to the system.

The “Point of Interconnection” shall be defined per the Scope of Work and indicated in Figures 1 & 2 (pages 16 & 17) of this Specification.

10.2.2 Storage Capacity

The BESS shall be rated in terms of net power and energy delivered to the Point of Interconnection (POI). All system loads and losses, including wiring losses, losses through the contactor/static switch, power conversion losses, auxiliary loads, and chemical/ionic losses are considered internal to the project and ratings are net of these loads and losses as measured (or calculated if not measured) to the Point of Interconnection.

In such cases where auxiliary loads (such as cooling systems) are periodic in nature, ratings may be described for conditions in which these loads are active in the worst-case conditions (or alternatively provide sufficient supplementary information such that ratings under these worst-case conditions may be easily determined).

10.2.3 Battery Energy Storage Containers

The Contractor shall provide outdoor rated battery energy storage containers to house the batteries. The battery energy storage containers shall be designed to comply with the local building codes including but not limited to seismic events, wind loads or other controlling criteria. The battery energy storage containers shall be designed with the appropriate insulation to meet local building codes and ensure an energy efficient operation of the HVAC and/or ventilation system.

10.2.4 Battery Energy Storage System Cooling Systems

The Site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including the batteries and PCS. There may be several separate heat removal systems to accommodate the particular needs of BESS components and subsystems (e.g., PCS, transformers). The heat removal and/or cooling system may include vapor-compression cooling system or other conventional environmental conditioning equipment. Final rejection of all waste heat from the BESS shall be to the ambient air.

Sizing of the cooling system shall be sized for end-of-life energy storage medium heat loss information. Total energy storage medium heat dissipation shall account for all installed batteries including any provisions for energy storage medium augmentation throughout the BESS life.

Air handling systems shall include filters to prevent dust intrusion into the BESS. Exterior wall make-up air inlet louver shall be sized to avoid water penetration. HVAC system(s) efficiency and control requirements needs to comply with applicable local and national codes. HVAC system(s) for energy storage cooling shall include three or more stages. Sufficient redundancy shall be considered in the design such that no single component failure will shut-down the system.

HVAC and ventilation systems shall be seismic braced/anchored. All design shall be in accordance with local and national seismic design requirements.

10.2.5 Battery Energy Storage System Fire Protection

The Contractor shall provide fire protection system for the complete BESS to meet all applicable codes including the current version of NFPA 855 “Standard for the Installation of Stationary Energy Storage Systems” and the latest approved revision of the applicable local fire protection codes.

EPC contractor shall comply with NFPA coordination, design, installation, commissioning, testing, training and startup requirements. This shall include all other requirements as outlined in this specification. Fire Protection system design shall include, but not be limited to, the following:

- Emergency vehicle access and fire hydrants per applicable local and national codes;
- Hazard Mitigation Analysis (HMA) to defend and gain alignment for the system design with all key stakeholders before the design is finalized (e.g. risk mitigation for runaway prevention);
- Battery energy storage container design in accordance with NFPA requirements for location, separation, materials of construction, ventilation, smoke or flammable conditions detection, fire suppression, communications/alarms, training, commissioning, permitting, and documentation
- The fire protection system shall provide supervised addressable relays for HVAC shutdown. The HVAC Engineer shall design and specify startup and testing services to support the interface with the Fire Protection System and ensure that the HVAC is de-energized as designed. Alarms shall clearly annunciate location of detected condition by individual container.

- Startup and testing of the Fire Protection System will be provided by the fire protection contractor in accordance with NFPA requirements.

Contractor will provide the potential combustion products and quantities for the batteries (or other storage media) selected to be used with the BESS system.

10.2.6 Ratings

The following are fundamental BESS unit ratings. Note that power, energy, and ampacity ratings apply through the full operating temperature range, as defined for the Site unless otherwise noted.

10.2.6.1 AC Voltage

Nominal interconnection voltage is contained on Section 10.1

10.2.6.2 Round-trip Efficiency

The roundtrip AC-AC energy efficiency, measured at the Point of Interconnection, shall be provided and include parasitic and auxiliary losses under worst case conditions prescribed in the FAT Plan.

The calculation is as follows:

$$\boldsymbol{\eta = \frac{kWh_{out}}{kWh_{in}} \times 100\% = \frac{(rated\ discharge\ power) \times (discharge\ time)}{(rated\ charge\ power) \times (charge\ time) + losses} \times 100\%}$$

In which the discharge time is from a fully charged to fully discharged energy storage, and charge time is from a fully discharged to fully charged energy storage. If the auxiliary power is provided by a separate connection from the energy storage, these measured values should be reflected in the losses term in the equation.

10.2.6.3 Parasitic Losses

The total Energy Storage System unit losses shall be determined for standby operation, including power electronics and any environmental controls such as HVAC systems.

10.2.6.4 Self-Discharge

Contractor shall provide self-discharge characteristics.

10.2.6.5 Basic Insulation Level

The Energy Storage System AC system equipment shall have a Basic Insulation Level (BIL) in accordance with IEEE standards for each piece of equipment.

10.2.6.6 Inrush Capability

It may be advantageous to the Owner for the BESS to have short time overload capabilities. This may occur for power system disturbances in which both real and reactive power is required for a short period of time to control both frequency and voltage excursions.

The Contractor shall provide a curve showing the inherent overload capability (if any) of the BESS as a function of time. It is not a requirement of the Specification to design specific overload capability into the BESS.

When islanded, the Energy Storage System shall also have capability for 1.5 x rated MW and 1.5 x rated MVA for one minute. This inrush duty will be four times per hour on top of continuous, full load.

10.2.6.7 Auxiliary Voltage

Auxiliary voltage will be site specific and as listed on Section 10.1.

10.2.6.8 Power and Energy

System ratings are defined in kVA (AC) and kWH (AC) as measured at the Point of Interconnection.

10.2.6.9 Design Ambient Temperature Range

Reference Section 10.1 for site specific information.

10.2.6.10 Audible Noise

The maximum sound level generated from the BESS and any associated equipment supplied by the Contractor under any output level within the BESS operating range, shall be limited to levels specified by Applicable Laws. The Contractor shall comply with all Applicable Laws that may apply to the BESS installation as determined by the jurisdiction applicable to the site.

The Contractor shall make audible noise measurements before and after commissioning of the BESS for the purpose of verifying adherence and compliance with the local ministerial ordinance and requirements. The measurements shall be made at various locations using a Type 1 sound level meter that complies with the requirements of ANSI S1.4-1983 “American National Standard Specification for Sound Level Meters.”

10.2.6.11 Broadband Interference

The Contractor shall take necessary precautionary measures to ensure that there will be no mis-operation, damage or danger to the BESS due to broadband interference and effects. The Contractor shall ensure that there are no discharge sources from the BESS and related equipment that could cause interference with radio and television reception, wireless communication systems, or microwave communication systems per the 47 CFR Part 15. The Contractor shall propose any necessary mitigation to ensure that communication is not adversely affected.

The Contractor shall make measurements before (or with all equipment de-energized) and after commissioning of the BESS for the purpose of verifying compliance with the broadband interference requirements.

All broadcast signals, radio noise, television interference and broadband interference measurements shall be made with instruments that comply with the latest revision of ANSI C63.2, “American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz - Specification.” IEEE Standard 430, “IEEE Standard

Procedures for the Measurement of Radio Noise from Overhead Power Lines and Substations" defines the measurement procedures that shall be used.

10.2.6.12 Interference and Harmonic Suppression

The (Power Conversion System) PCS shall not produce Electromagnetic Interference (EMI) that will cause mis-operation of instrumentation, communication, or similar electronic equipment within the BESS or on the Owner system. The PCS shall be designed in accordance with the applicable IEEE standards to suppress EMI effects.

The BESS must meet the harmonic specifications of IEEE 1547 and IEEE 519 and comply with requirements outlined in the Energy Storage Integration Council (ESIC) technical specifications spreadsheet located in Appendix G. Harmonic suppression may be included with the PCS or at the BESS AC system level. However, the Contractor shall design the BESS electrical system to preclude unacceptable harmonic levels in the BESS auxiliary power system.

10.2.7 External AC Power Interface(s)

10.2.7.1 Termination

All terminations and locations of terminations shall be pre-approved by the Owner and specified in the appropriate submitted drawings. The BESS shall comply with any applicable owner interconnection standard.

10.2.7.2 Isolation/Disconnect

The BESS shall be equipped with a means to isolate the PCS. This may be accomplished through a lockable breaker.

An interconnection isolation disconnect switch shall be placed directly on the line side of each metering section. The disconnect switch shall be lockable and have a visible break. The device does not have to be rated for load break nor provide over-current protection. The Owner shall have full access and control over this device.

A LV source side isolation contactor shall be provided. The disconnect breaker shall be lockable and have a visible break. It shall be capable of breaking the full rated power of the system. The contactor will be operated by the BESS controller and will also have provisions to be operated manually. The utility will have full access and control over this device.

10.2.7.3 Use for Auxiliary power

The auxiliary power system shall include, but is not limited to, all step-down transformers, breakers, fuses, motor starters, relaying, panels, enclosures, junction boxes, conduits, raceways, wiring and similar equipment, as required for the BESS operation.

10.2.7.4 Power Quality Metering and Telemetry

Contractor shall provide its own Current Transformers (CT) for protection and internal metering, and controls for BESS operation. Contractor to provide local utility compliant metering and telemetry. Contractor to provide Potential Transformer (PT) connection points for

synchronization and telemetry. Contractor to provide one revenue grade power quality meter that meets relevant Utility and Owner requirements, installed on the line side of the main breaker to validate system performance.

10.2.8 System Protection Requirements

Protection and coordination for the BESS including batteries, DC combiner panels, inverters, AC combiner panels, transformers, auxiliary systems, and switchgear (where applicable) shall adhere to IEEE 242.

Protection relays and ancillary devices, such as PTs and CTs, for the interconnection shall be utility grade and shall meet the minimum requirements specified in IEEE C37.90 (latest edition) including requirements for EMI and surge withstand according to applicable standards for the intended location of the BESS. A complete protective relaying system based on Industry Standards shall be a part of the AC system. The protective relaying and metering shall be integrated with the BESS control system and a communications channel provided to the Owner's SCADA system. However, integration into the BESS control system shall not circumvent normal protective relaying functions.

10.2.9 Coordination of Controls

The Contractor shall provide a communications channel with Owner relaying at the interconnection distribution switch. This communications channel will provide permissions to island and black start.

10.2.10 Instrument and Control Wiring

In general and where practicable, control and instrumentation wiring shall be designed and installed to minimize any and all electrical noise and transients. All cabling shall be new and continuous for each run; splices are not acceptable. All conductors shall be copper.

All cabling which may be exposed to mechanical damage shall be placed in conduit, wireway, overhead tray, or other enclosures suitable to the Owner. Wires shall have identifying labels or markings on both ends. The labels shall identify the cable tag, and opposite end destination. Each wire in the system must have an accompanied drawing and location reference.

Control and instrumentation wiring shall be separated from power and high voltage wiring by use of separate compartments or enclosures or by use of separate wireways and appropriate barrier strips within a common enclosure as required by the NEC.

BESS and PCS control and instrumentation system wiring shall be bundled, laced and otherwise laid in an orderly manner. Where cable is in wiretrays, waterfalls shall be used, as necessary. Wires shall be of sufficient length to preclude mechanical stress on terminals. Wiring around hinged panels or doors shall be extra flexible (Class K stranding or equivalent) and shall include loops to prevent mechanical stress or fatigue on the wires.

Cable insulation material shall be thermoset composition rated for 90˚C during normal operation. Insulation and jackets shall be flame retardant and self-extinguishing and shall be capable of passing the flame test of IEEE Standard 383 or IEEE 1202. Raceway and cable systems shall not block access to equipment by personnel.

10.2.11 Modular Replacement

The BESS PCS, control, batteries and current sensors shall be connected in a manner that enables field replacement. It is expected that most maintenance will be accomplished while maintaining partial service. The physical and electrical arrangement shall permit module replacement with the isolation breaker/contactor closed and the PCS disconnected.

Owner shall not be required to provide additional space or resources to accommodate the energy storage medium module replacement or supplementation. Contractor shall reserve the appropriate spacing and clearance per NESC into the design of the BESS to accommodate energy storage medium module replacement and supplementation.

10.2.12 Physical Characteristics

The BESS shall meet all applicable OSHA, NEC, IEEE, ANSI, and NFPA requirements for electrical and fire safety.

The BESS shall be designed to minimize footprint and volume. The BESS may also be designed to include subsurface components or modules, provided relevant operating and environmental factors normally addressed for submersible equipment are considered to assure full life-cycle performance requirements are met.

The BESS components located outdoors shall be contained within weatherproof, tamper resistant, metal enclosures suitable for mounting outdoors on concrete pads with a minimum NEMA 3R rating. NEMA 3R: Types 3R, 3RX: Rain-tight, sleet-resistant. Indoor or outdoor use. Same protection as Type 1, but adds a degree of protection against ingress of falling dirt, rain, sleet and snow; also protects against damage due to external ice formation. Rust-resistant. The “X” designation indicates corrosion-resistance.

Any enclosures shall be dust tight to at least the NEMA 3R rating, except as designed to allow forced air exchange with the atmosphere.

BESS Modules PCS, and controls shall be accessible and removable for replacement. The BESS shall be designed to operate with minimal maintenance for at least five years.

A nameplate shall be provided including:

- Manufacturer Name
- Connection diagram
- BESS ratings; Power, energy, voltage, BIL
- Specimen data; serial number, date of manufacture
- The nameplate shall meet the requirements of IEEE C57.12.00

All necessary safety signs and warnings as described in ANSI Z535-2002 (entire series from Z535.1 through Z535.6) shall be included on the building, shelter or each enclosure. All necessary signs and warnings for identification of hazardous materials as described in NFPA 704 shall be included on the building, shelter or each enclosure.

10.2.13 Cycle Life

The BESS must be designed to achieve a minimum lifetime of 20 years. End-of-life is defined as when the ESS reaches 80% of the rated capacity at the time of installation. If the BESS is subject to capacity degradation, the design must accommodate future augmentation or replacement as required to maintain rated capacity, taking into consideration the specified operating profile.

The Contractor shall provide a graph or set of graphs that displays the relationship between depth of discharge, discharge energy throughput, operating temperature, C-rate, resting state-of-charge, and other relevant parameters and the corresponding capacity degradation experienced by the ESS.

Cycle counting shall be accomplished by applying a filter for each of the specified depth of discharge levels, or based on other methodology proposed by the Contractor and agreed to by Owner. Contractor shall propose a methodology for tracking all other parameters that effect BESS capacity.

10.2.14 Battery Management System

As a subcomponent of a BESS, a Battery Management System shall be included to manage the operational health of the BESS, provide cell-by-cell diagnostics information and assure safe and optimal performance of the ESS as an interconnected asset to the Owner's electrical system. Primary functions include but are not limited to:

- Monitoring:
- State of Charge
- State of Health
- Voltage/Current
- Temperature
- Energy Throughput
- Maximum charge/discharge current or power
- Balancing
- Cell voltage
- Warning and alarms
- Internal protective measures
- Logs of operations
- Management of any software versions
- Provide data exchange to the BESS Controller

10.2.15 Power Conversion System

The Power Conversion System (PCS) shall be listed to UL 1741 Supplement A. The PCS shall be capable of operating in all four power quadrants at rated power.

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

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

The control of the PCS shall be integrated with the overall BESS control system. However, the PCS also shall include all necessary self-protective features and self-diagnostic features to protect itself from damage in the event of component failure or from parameters beyond safe range due to internal or external causes. The self-protective features shall not allow the PCS to be operated in a manner that may be unsafe or damaging. Faults due to malfunctions within the PCS, including commutation failures, shall be cleared by the PCS protection device(s) or external protection devices.

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

The PCS system shall include provisions for disconnection on both the AC and DC terminal(s) for maintenance work. Conductor separation must adhere to the requirements of the Owner's Generator Interconnection Handbook, the Owner's Distribution Interconnection Handbook, or IEEE recommendations. These disconnects shall be capable of being locked open for maintenance work. Any PCS capacitors shall be provided with bleeder resistors or other such means of discharging capacitors to less than 50 volts within five minutes of de-energization per UL1741 requirements.

The PCS or energy storage system must have DC bus pre-charging functionality or other means of arc mitigation during switching of the DC disconnect devices.

Outdoor located PCS electronic compartments shall be NEMA 4 and the overall enclosure rating shall be NEMA 3R. PCS shall meet IEEE 519 for harmonic content. Total harmonic distortion shall not exceed IEEE 519 requirements.

PCS cooling system shall not be susceptible to particle contamination and require minimal maintenance. The PCS shall be furnished with nameplates or stickers that are suitable for the environment. Nameplates shall be located so as to be visible with equipment installed and operating. Each nameplate shall indicate the following information:

- Nameplate ratings
- Component name
- Manufacturer's name
- Serial number
- Year built (or may be found in a reference document based on serial number)

10.2.16 BESS Controller

The BESS shall include all necessary software applications and supporting hardware required to meet the specified functional requirements. Software algorithms, external data input capabilities, and user interfaces shall provide for user specified variable input or set point

values, as well as external data value streams required by programs directing the BESS operations.

The BESS shall include the necessary communication and telemetry hardware, and support communications protocols, to effectively provide the required services. No single mode of failure shall result in loss of power to the control and data acquisition module. The control shall include provisions for an orderly and safe shutdown in the absence of utility power.

10.2.16.1 Operations and Control Functions

The BESS controller shall be the primary dispatching location for local monitoring and control command functions, and is responsible to perform the following by priority in this order:

- Protect itself (isolate for any internal fault)
- Remain within power constraints (transformer and BESS ratings)
- Remain within frequency constraints
- Remain within voltage constraints
- Remain within operating temperature constraints
- Isolate in response to system anomalies
- Charge/discharge Real Power and Reactive Power in response to BESS controller programs or external commands
- Communicate status and diagnostic data

The BESS controller shall respond to commands issued remotely or locally, including but not limited to:

- Change Modes (charge, discharge, etc.)
- Startup/Shutdown
- Change Status (enable/disable)
- Reset Alarms
- System Reset/Restart

The BESS controller shall respond to the following modes of operation:

- BESS controller must be able to transition from one mode to any other mode without ceasing operation (current source to voltage source mode changes, excluded). Changing of output from an existing inverter setpoint to any other setpoint as a transition step (example, returning inverter to zero output) before executing next command will be considered unacceptable.
- BESS controller must be able to transition from one setpoint within a given mode of operation to another setpoint within the same mode without ceasing operation. Changing of output from an existing inverter setpoint to any other setpoint as a transition step (e.g., returning inverter to 0 output) before executing next command will be considered unacceptable.
- BESS controller must be able to accept and validate a given setpoint command prior to executing a given operation mode. For example, if the Owner sends a command for the BESS to discharge at 1.0 MW in constant real power output mode, the controller must

be able to validate and accept the 1.0 MW setpoint prior to it initiating constant real power output mode. Setpoint validation will vary depending on the control mode command but may include limits associated with state of charge, facility ratings, ramp rates, system operating conditions, etc.

- BESS controller must be able to switch from current source mode to voltage source mode and back via a single remote-control point ("VSI Mode"), as well as a local point on the Human Machine Interface (HMI).
- BESS controller must be able to operate inverter breakers/contactors via remote control points ("Start" equals one is close command for breakers/contactors and "Start" equals zero is open command for breakers/contactors), as well as a local point on the HMI.
- BESS controller must be able to reset all applicable system alarms via a remote-control point.
- BESS controller must be able to conduct real and reactive power operations completely independently of one another until the apparent power limit of the asset is reached.
- BESS controller shall allow for the prioritization of either real power setpoints over reactive power setpoints or reactive power setpoints over real power setpoints once the apparent power limit of the asset is reached. Prioritization shall be indicated via remote commands from the Owner.
- BESS controller shall allow the operator to "Idle" or "Standby" real or reactive power from the system while still operating the other.
- BESS controller shall NOT have a real power mode command which ceases any reactive power mode operation or vice-versa.
- BESS controller shall consider assign a positive sign convention to system real power output information when the system is discharging (real power).
- BESS controller shall assign negative sign convention to system real power output information when the system is charging (real power).
- BESS controller shall assign a positive sign convention to system information when the system is injecting reactive power (acting like a capacitor). This should be considered a leading Power Factor (PF).
- BESS controller shall assign a negative sign convention to system information when the system is absorbing reactive power (acting like an inductor). This shall be considered a lagging PF.
- BESS controller sign convention for real and reactive power commands shall match the desired convention assigned to system information reporting. In other words, positive real power commands refer to discharging, negative real power commands refer to charging, positive reactive power commands refer to injecting vars, and negative reactive power commands refer to absorbing vars.
- Specific to the Target State of Charge or Energy (SOC) operational mode, the Controller shall ensure the system reaches the commanded SOC setpoint and then not dispatch the system until after the SOC falls outside the commanded SOC deadband.

10.2.17 Permissive Operational States

As stated in the functional requirements, the Owner will permit the use of the BESS in specific operational states remote signals. The BESS must be able to integrate with the dispatch center

to allow for and acknowledge each operational state. A command table must be submitted by the Contractor and approved by the Owner prior to the acceptance of the controller and factory acceptance test.

10.2.18 User Settable Limits

User settable limits shall be provided for the parameters listed below. These limits should have the capability to be changed either through the HMI and/or a remote setpoint. If a limit is reached an alarm or warning should alert the operator to the condition:

- Global Real Power Limit
- Global Reactive Power Limit
- Global Apparent Power Limit
- Mode-Specific Real Power Limit (unique limit for each mode)
- Mode-Specific Reactive Power Limit (unique limit for each mode)

The BESS controller shall enforce whichever limit is most restrictive for the current mode of operation, either the mode-specific limit or the global limit.

10.2.19 Human Machine Interface

A local HMI shall be provided to permit local monitoring and control. All settings must be viewable and settable, statuses viewable, operating parameters viewable, and logs configurable and viewable. Local password protection is required. Different login accounts shall be set up to allow for a hierarchy of operators: (i.e., observer: read, operator: read/write, admin).

Meaningful control buttons and indicating lights shall be provided for monitor and control status and operations. All control and alarm functions available remotely shall also be available locally.

A data entry screen shall be provided in the HMI to allow input of all user settable parameters, such as ramp rates, real and reactive power limits, power factor limits, etc. This data entry screen shall require admin login rights. Display screens shall be developed for each of the control modes. Each screen shall display the mode, setpoint(s), actual value(s), deviation(s) from setpoint, and any applicable limits or configuration parameters.

The HMI shall include alarm screens, including alarm summaries, alarm details, and alarm logging. Alarms screens shall be provided for balance of plant type information (HVAC, fire alarms, UPS, etc.) in addition to energy storage system information.

An Emergency Stop (E-Stop) button or equivalent shall be provided in the HMI to allow the operator to quickly shut down a unit. The E-Stop button shall have the ability to open contactors/breakers to the inverter and batteries isolating the DC and AC potential.

10.2.20 Remote Operations

The BESS shall provide a single interface with which the Owner can communicate. All commands, feedbacks, information, statuses, and alarms from all system components or subsystems (fire suppression and/or HVAC included) should be conveyed via said interface.

Single interface must have a minimum of four fiber ports and four copper ports or a network switch which provides the specified number of ports.

The BESS controller shall be able to respond to manual commands that are issued remotely by an external supervisory controller using a secure internet-based protocol. Commands sent to the BESS controller may come from other applications within a larger Distributed Energy Resource hierarchy.

The BESS shall remain functional in the absence or loss of communication from the remote controller. The BESS shall continue its current mode of operation for a set time period (variable setting, 15-minute default). On expiration of the time, the BESS shall standby.

During an interruption to communications, the remote controller will make repeated attempts to re-establish communications at a set time interval (variable setting, default of five minutes). When communications have been re-established, the BESS and remote controller shall make any necessary updates to resume performance.

A “Local/Remote” control function shall be provided in the HMI so that the operator may allow or inhibit remote commands. The BESS controller shall log the source of each command (i.e., HMI/Operator Name, Remote). The source of the current active command shall also be displayed in the HMI.

10.2.21 Monitoring, Data Logging, Alarms, and Status

10.2.21.1 Alarms

- Alarms shall be provided for all critical energy storage system parameters
- Alarms shall be provided for all critical balance of plant system parameters
- The operator shall be able to assign criticality or importance to alarms and filter the alarms so that only the most critical are displayed on the HMI.
- Operator shall have the ability to acknowledge alarms.
- An alarm log with time stamps shall be provided.
- Details or help screens shall be provided for each alarm.
- An alarm matrix shall be provided to show the relationship and hierarchy of all alarms.

The BESS controller shall provide relevant status information, for feedback to the utility supervisory control system. The telemetry points should include:

- Operation Control
- Operation Status
- System Information
- AC/DC Status
- Counters
- Status
- Device Status and Error Codes (Alarms)
- Data Logging:
  - Log of Operations for one year on-site. Life-of-BESS duration for off-site log.
  - Historical data and trending for one year on-site for a limited set of parameters as-

agreed with the Owner. Life-of-BESS duration for off-site data.

10.2.22 Control Modes

The following sections describe the control/operational modes and sources of commands for the BESS.

COMMENT TO BE DISCUSSED WITH ENTERGY – The following are the control modes provided by most battery energy storage suppliers as part of their standard scope of supply scope at no additional cost. It is recommended that that the BESS be purchased with these additional control modes that could be implemented in the future.

10.2.22.1 Offline

The BESS should open the storage media breaker/contactor(s), inverter AC output breaker/contactor(s), and de-energize non-critical power supplies. It should physically isolate the inverter output from the grid, not just provide a zero output, to prevent interaction with the grid (nominal auxiliary load contactors may continue to serve these loads). This mode includes both normal shutdown and system trips requiring reset.

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

- Emergency trip operation.
- AC circuit breaker trips that isolates the BESS from the grid.
- Smoke/fire alarm and suppression operation.
- Control logic trouble.

10.2.22.2 Standby

The BESS controller should close the inverter AC output contactor after synching, but neither charge nor discharge, and only draw necessary auxiliary load.

When the BESS controller is in Frequency Response or Contingency Reserve modes, it may spend long amounts of time in standby mode. The BESS is expected to maintain a state of charge of 100% (or other SOC setpoint as provided from the Owner’s controller) and be prepared to respond to a signal for discharge within the specified time. The BESS controller will maintain a requested SOC within +/-1%.

10.2.22.3 Frequency Response

The BESS shall charge or discharge in response to an analog signal, received from the Owner’s plant controller, while maintaining a defined target SOC over time.

The BESS must respond from a standby state to a request for frequency response within two seconds of receiving the command. From that time, the BESS output must ramp at a rate of 25 kW per second until the full rated MW output of the system is achieved. The full rated MW output shall be maintained for three minutes following which the output will ramp down at a rate of 25 kW per second.

10.2.22.4 Active Power Regulation

The BESS shall charge or discharge in response to an analog signal to mitigate load swings on the connected utility grid. Whenever load is quickly increased or decreased, the system should work in the opposite direction to counteract the rate of change and smooth the net output.

The BESS must be capable of performing regulation according to Area Control Error (ACE) signals. The control for this service will originate from the Owner's plant controller. The BESS must be able to respond to these MW signals within four seconds or less. Response is defined as the time from the BESS controller receiving a MW setpoint until that steady-state MW output is achieved.

The BESS shall be capable of both positive (supplying) and negative (absorbing) MW setpoints, which may be of any magnitude up to 100% of the system's real power rating. Over time, these MW setpoints are intended to be energy neutral (no net gain or loss in energy). Under active power regulation, the allowable SOC range shall be kept between a minimum of 50% and a maximum determined by the BESS's rated SOC limit. In the event battery SOC is at a level where the requested setpoint (either positive or negative MWs) cannot be met, the BESS controller shall respond only to MW setpoints for the polarity it can achieve. The BESS will resume responding to MW setpoints of both polarities once the battery SOC has returned to an acceptable range.

10.2.22.5 Reactive Power Regulation

The BESS will respond to kVAR setpoint requests from the Owner's plant controller within four seconds. Setpoints may be constant or variable kVAR outputs in order to maintain voltage using closed-loop proportional integral control. The BESS must be able to regulate kVAR to within +/- 1% from 100 kVAR up to its full nameplate rating. The kVAR controller will reside within the BESS's control system. Setpoints for kVAR output will originate from the Owner's plant controller. Depending on the service(s) being requested at any given time, the BESS may be asked to provide reactive power regulation while simultaneously being in standby for another service such as frequency response or spinning reserve. Reactive power regulation should be operable simultaneously with other services, provided that the MVA rating of the system is not exceeded.

The only limitation for providing this service must be the overall MVA rating of the BESS.

10.2.22.6 Voltage Regulation

The BESS shall provide capacitive or inductive VARs at varying levels according to an analog or digital control signal to maintain a defined voltage level. Voltage deviation should be controlled within +/- 1% of the desired setpoint value.

The BESS shall also provide for closed loop proportional integral voltage control. Under this service, the Owner's plant controller will act as the closed loop controller. The BESS's controller will receive kVAR setpoints from the Owner's plant controller.

10.2.22.7 Automatic Generation Control

The BESS shall be capable of Automatic Generation Control (AGC) similar to that of rotating machinery. The BESS output will be controlled by a remote signal from the Owner's plant controller. The BESS voltage and frequency controls shall regulate the output based on appropriate Owner selectable droop settings. The operation in the AGC mode shall be limited by the Contractor specified discharge limit for the storage media. Following operation in the AGC mode, the BESS shall ramp-down linearly to zero output at an Owner selectable rate.

10.2.22.8 Renewables Following

The BESS must be capable of using fast, relatively low magnitude real power outputs to mitigate the intermittency of renewable generation and normal load. The BESS will receive real power setpoints, both positive and negative, from the Owner's plant controller on a sub-second frequency. The BESS must respond to these setpoints in no more than 0.7 seconds.

10.2.22.9 Blackstart and Intentional Islanding

The BESS shall be able to operate without the utility reference voltage and frequency in response to an external analog or digital signal to supply power to the connected loads once disconnected from the grid. Additionally, the BESS shall be able to synchronize and reconnect back to the utility.

The BESS must be capable of performing blackstart and creating an intentional island of the distribution feeder. Contractor is responsible for providing control power as necessary to the BESS via separate UPS. This requirement excludes environmental systems (HVAC). The BESS must be capable of regulating voltage and frequency, closing into a dead bus, and serving load up to its full nameplate rating. The BESS should be capable of transitioning from an offline state to serving load within one minute under intentional islanding conditions. Voltage regulation must be within +/- 1% of nominal and frequency regulation must be 60 Hz +/- 0.1%. In this state, the BESS must be capable of serving load for one hour.

Intentional islanding will be requested for certain types of utility outages that do not involve a downstream fault. Customer owned devices will determine if conditions allow for an intentional island. Prior to intentional islanding, the feeder will go to a fully de-energized state. Owner's equipment will determine whether or not to intentionally island within one minute. This includes any distribution switching that may be required. Once the determination is made to island and distribution switches are properly configured, an intentional islanding request will be sent from Owner's plant controller to the BESS's control system.

10.2.22.10 Target SOC

The BESS should charge according to its own optimum method considering available power limits to reach a defined SOC value. If the system SOC falls below the stated SOC dead band, the system shall charge to reach the desired set point.

The Contractor shall design the charging system to ramp up from zero to the maximum demand at an Owner selectable ramp rate to avoid shocking the system and allow generation to easily follow load. The Contractor shall provide a curve showing how demand from the Owner system varies with time throughout the charging cycle. The BESS control system shall allow the Owner dispatcher to remotely initiate this mode. The maximum demand required by

the charging cycle shall be Owner selectable, but shall not exceed the Contractor specified charge rate. The Contractor shall provide data showing how the recharge period varies as maximum demand decreases.

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

10.3 Solar PV System Technical Requirements

10.3.1 General

The Contractor shall provide a total “turnkey” Solar PV System including all necessary equipment, materials, design, manufacturing, and installation services for the installation of a Roof-Mounted, Ground-Mounted, or Carport-Mounted Grid-Tied utility-interactive Solar PV system. This Solar PV System will be connected to a Battery Energy Storage System and share a common Power Conversion System (PCS). This configuration is commonly referred to as a DC Coupled Solar + Battery Energy Storage System where the Solar PV System and Battery Energy Storage system utilize the same inverters.

The contractor shall prepare a system summary detailing each location, applicable equipment/size, and predicted system energy production (kWh). With regard to any building-mounted system, the contractor shall evaluate roof conditions and may remove the existing roof system and replace it with either an integrated roof/PV system or a new roof with a PV system installed. The Solar PV System shall meet all requirements of this Section and other specifications included that apply.

10.3.3 Ratings

The Contractor shall provide a Solar PV System that produces the minimum kilowatt-hour (kWh) alternate current (AC)/year at the point of interconnection (POI) listed in Section 10.1.

10.3.4 Scope

The contractor shall perform all professional services as necessary to provide a complete design package, including the requirements outlined in this statement of work. The contractor shall install the Solar PV system such that it is operational and compliant with all applicable standards, building codes, Entergy interconnection requirements, and any State and Local requirements. The contractor shall include specifications, calculations, and drawings in the design package and submit it to for review and approval. After approval by of the final design package, the contractor shall provide all necessary construction services to successfully complete the PV system installation, testing and commissioning.

10.3.5 Design Requirements

10.3.5.1 Design Guidelines for Rooftop PV

Contractor shall develop a design for a new rooftop PV system.

- The mounting system shall minimize roof penetrations and may include building-integrated roof PV or fully ballasted. The mounting system design shall meet applicable local building code requirements with respect to snow, wind, and earthquake factors.
- Conduit penetrations shall be minimized.
- If the system is not building-integrated or membrane-sealed, the system shall be fixed-tilt (minimum 5-degree tilt for flat roof or flush mounted for sloped roof) with an orientation that maximizes annual energy production.
- All roof access points shall be securely locked at the end of each day.

- The system layout shall meet local fire department, code, and ordinance requirements for roof access.

10.3.5.2 Design Requirements for Ground-Mounted PV

The contractor shall develop a design for a new ground-mounted PV system. It is the responsibility of the contractor to assess site topography and review geotechnical report to estimate costs related to project installation.

- The mounting system shall be either directly anchored into the ground (driven piers, concrete footers, etc.) or ballasted on the surface without ground penetration. The mounting system design needs to meet applicable local building code requirements with respect to snow, wind, and earthquake factors.
- Panels' orientation or azimuth shall be within 20–30 degrees of due south.
- Panels' tilt shall be based on site latitude and wind conditions.
- Ground cover and vegetation management shall be included in the proposal.
- The stormwater management and erosion control management plan shall be included in the proposal.
- Chain link fencing and gate shall be included in the proposal.
- All lines interconnecting PV arrays to the POI shall be underground.

10.3.5.3 Design Requirements for Carport PV

The contractor shall develop a design for a new carport PV system. It is the responsibility of the contractor to assess site topography and geotechnical attributes to estimate costs related to the project installation.

- Carport PV shall be tilted at a minimum of 5 degrees to allow for drainage and reduce soil buildup.
- The carport PV shall be at least 9 ft clear in all locations.
- Lighting shall be provided under each carport. This lighting shall be efficient (e.g., light-emitting diode, LED) and allow for adjustable times for illumination with photocell controls to turn the lights on at dusk and off in the morning prior to daylight.

All lines interconnecting PV arrays to the POI shall be underground.

10.3.6 Performance Criteria

The following performance criteria shall be met for all arrays:

- The power provided shall be three-phase compatible with the standby power distribution system.
- The proposal shall provide an estimated energy delivery for each array, for each month of the year, and for the total for the year at the delivered voltage.
- The standard test condition (STC)-rated power value, slope, and orientation will be entered into PVsyst (using the nearest weather file to determine estimated energy delivery in kWh AC. A default value for the system losses of 14% shall be used.
- The PV array shall mean one or more PV modules having the same orientation and on the same maximum power point tracking (MPPT) system. Every array with differing orientation shall have a separate MPPT system.

- All proposed/implemented PV array locations shall be shade-free from 9 a.m. to 3 p.m. (solar time). The contractor shall provide documentation of shading calculations for exterior extents for each proposed array. These calculations may be modified for shading obstructions that will be removed and mitigated as part of the project.
- All PV hardware components shall be either stainless steel or aluminum. PV structural components shall be corrosion-resistant (e.g., galvanized steel, stainless steel, composites, or aluminum).
- The project, including supports and power conductors, shall not interfere with roof drains, water drainage, expansion joints, air intakes, existing electrical and mechanical equipment, existing antennas, and planned areas for future installation of equipment shown on drawings.

The contractor will provide the following calculations:

- PVsyst software calculation (or other Owner approved solar PV calculation software)
- System energy production calculation showing estimated monthly and yearly energy output for each array
- If rooftop PV arrays are proposed, include roof structural loading calculations. These calculations shall specifically address roof loading from the PV array and confirmation that the loading does not exceed existing roof framing capacity as determined by the analysis.
- If carport PV arrays are proposed, include carport structural loading calculations. If existing carports are to be used, these calculations shall specifically address existing carport loading from the PV array and confirm that the loading does not exceed existing carport capacity as determined by the analysis.

10.3.7 Code Compliance

The installation and equipment shall comply with applicable building, mechanical, fire, seismic, structural, and electrical codes. Only products that are listed, tested, identified, or labeled by Underwriters Laboratories (UL), Factory Manual (FM), Electrical Testing Laboratories (ETL), or another nationally recognized testing laboratory shall be used as components in the project. Non-listed products are only permitted for use as project components when a comparable useable listed component does not exist. Non-listed products proposed for use as components must be identified as such in all submittals.

The publications listed below form a part of this document and are hereby incorporated by reference:

- National Electrical Code (NEC)
- UL 1703 Flat – Plate PV Modules and Panels
- UL 1741 – Standard for Static Inverters and Charge Controllers for Use in PV Power Systems
- FM Approved – Fire Protection Tests for Solar Component Products
- International Electrotechnical Commission (IEC) 62446 Grid-Connected PV Systems – Minimum Requirements for System Documentation, Commissioning Tests, and Inspections

Other technical codes that shall apply include:

- American Society of Mechanical Engineers (ASME) Performance Test Codes (PTC) 50 (solar PV performance)
- American National Standards Institute (ANSI) Z21.83 (solar PV performance and safety)
- National Fire Protection Association (NFPA) 853 (solar PV systems near buildings)
- Institute of Electrical and Electronics Engineers (IEEE) 1547 (interconnections)
- American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI)-7 – ASCE – “Minimum Design Loads for Buildings and Other Structures”
- National Roofing Contractors Association (NRCA)

10.3.8 Solar Module Array Requirements

PV modules shall be a commercial, off-the-shelf product, and UL-listed. The PV modules shall be properly installed according to manufacturer’s instructions, the NEC, and as specified herein.

The solar electric system shall produce the minimum annual AC energy output. If the system is proposed to produce more than the minimum required energy output to reduce the cost per delivered kWh, then the system shall produce the “proposed” energy. The output will be adjusted if the actual yearly solar insulation received is less than that indicated by the approved solar PV calculation software. A normalizing calculation will be made to correct the output, so a contractor is not penalized for an extremely cloudy year.

System wiring shall be installed in accordance with the provisions of the NEC. All modules installed in a series string shall be installed in the same plane/orientation. Panel installation design shall allow for the best ventilation possible of panels to avoid adverse performance impacts.

Provide a panel manufacturer’s warranty as a minimum: No module will generate less than 90% of its specified minimum power when purchased. PV modules shall have a 25-year limited warranty guaranteeing a minimum performance of at least 80% of the original power for at least 25 years. Measurement made under actual installation and temperature will be normalized to standard test conditions using the temperature and coefficients published in the module specifications. PV modules that do not satisfy this warranty condition shall be replaced.

10.3.9 Construction Drawings

Provide drawings for each discipline required (architectural, structural, electrical, etc.), with separate plans for new work and demolition as well as special types of drawings where necessary, such as enlarged plans, equipment curbing and flashing details, roof penetration details, etc. Drawings shall clearly distinguish between new and existing work.

Each drawing shall indicate project title, project number, array identification and location, architect/engineer (A/E) firm, A/E’s address and/or phone number, contract number, drawing title, drawing type, drawing number, and key plan. A cover sheet shall be provided and shall include a list of the drawings, legend, vicinity map, and location map in addition to all items required for each drawing. Each A/E submission shall be clearly dated and labeled (e.g. 75% Design Development Submission, 100% Check Set Submission, Construction Document Submission, As-Built Drawings, etc.). Each drawing sheet submitted shall include a graphic scale in the lower right-hand portion of the sheet. The final set shall be stamped by a licensed

engineer for the state in which the PV system is located. At a minimum, the following drawings are required:

- Site plan including utility locations and connections – showing staging and phasing requirements
- Electrical plans – including single line diagram and utility interconnection
- Electrical details
- Roof plan and/or carport plan – showing the full layout of the system and detailing any obstacles that must be permanently or temporarily removed or relocated
- Array support and mounting details
- Any drawings that may be required to install a complete project
- Waterproofing details

Specifically address the means to keep any existing buildings accessible and operational by means of relocation and/or phasing.

10.3.9 Inspections and Tests

The contractor shall perform inspections and tests throughout the construction process, including: existing conditions/needs assessments, construction installation placement/qualification measurements, and final inspections/tests performance certification.

All inspections and tests to verify documented contract assumptions, establish work accomplishment, or certify performance attainment shall be witnessed by the Owner and/or its construction management (CM) representative.

To ensure compliance with provisions of the NEC, an inspection by a licensed electrical inspector is mandatory after construction is complete. Unless otherwise identified, manufacturer recommendations shall be followed for all inspection and test procedures. The NEC inspection shall be conducted by an independent third-party electrical inspector familiar with PV systems. Provide qualifications of the proposed third-party inspector for review and approval prior to conducting the NEC inspections.

Tests shall include a commissioning of the array. Commissioning shall be performed for the entire PV system. This data shall be used to confirm proper performance of the PV system.

Inspections/tests shall result in a written record of data/observations. The contractor shall provide two copies of documents containing all test reports/findings. Test results shall typically includes: item/system tested, location, date of test, test parameters/measured data, state of construction completion, operating mode, contractor test equipment description, and measurement technique.

10.4 Electrical Tie-In Location Drawings (By Customer)

10.5 One Line Diagram (By Customer)

10.6 Geotechnical Engineering Report

Include Existing Geotechnical Engineering Reports when available.

10.7 Environmental Site Conditions

Site ambient conditions applicable for a given site shall be taken from an ASHRAE weather station in closest proximity to the facility with similar elevation. The necessary values applicable to solar + battery energy storage system installations are to be researched and stated by the Contractor as part of the fill in table in Appendix 10.1 are the following:

1-Outside Design Maximum Dry Bulb Temperature

2-Outside Design Minimum Dry Bulb Temperature

3-Outside Normal High Dry Bulb Temperature

4-Outside Normal Low Dry Bulb Temperature

5-Site Elevation Above Sea Level

The specific values corresponding to the information above is shown on an example weather station data sheet on the next page, annotated with the numbers 1-5 above.

ASHRAE weather station information is from the following website:

https://www.ashrae.org/technical-resources/bookstore/weather-data-center

The Station Finder application from the website above allows a user to search for the closest weather station on an interactive map.

A basic annual subscription to the Weather Data Viewer also available from the link above allows access to climatic design information for weather stations.

2017 ASHRAE Handbook - Fundamentals (IP)

LITTLE ROCK AFB, AR, USA

WMO#: 723405

Lat: 34.917N Long: 92.150W ⑤ Elev: 311 StdP: 14.53 Time Zone: -6.00 (NAC) Period: 90-14 WBAN: 03930

Annual Heating and Humidification Design Conditions

	Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB	
				99.6%			99%			0.4%		1%			
		99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
(1)	1	18.1	22.2	6.1	7.6	25.1	11.5	10.0	26.8	21.5	48.9	19.4	48.1	4.7	300

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

	Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
			0.4%		1%		2%		0.4%		1%		2%			
			DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
(2)	7	20.4	90.8	77.3	97.0	77.5	94.3	77.2	81.3	91.7	80.1	90.7	79.0	89.5	8.3	190

	Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Extreme Max WB
	0.4%			1%			2%			0.4%		1%		2%		
	DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
(3)	78.9	151.9	85.3	77.3	143.9	84.7	76.4	139.3	84.1	45.0	91.6	43.8	90.5	42.6	89.3	90.5

Extreme Annual Design Conditions

	Extreme Annual WS				Extreme Annual Temperature				n-Year Return Period Values of Extreme Temperature							
					Mean		Standard Deviation		n=5 years		n=10 years		n=20 years		n=50 years	
	1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	(n)	(o)	(p)		(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)
(4)	18.3	16.0	13.5	DB	④ 10.0	102.5 ⑤	4.8	4.1	6.5	105.4	3.7	107.8	1.0	110.1	② -2.5	113.1 ①
(5)				WB	9.2	83.7	4.2	2.1	6.2	85.2	3.7	86.4	1.4	87.6	-1.7	89.2

Monthly Climatic Design Conditions

				Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
(6)	Temperatures, Degree-Days and Degree-Hours	DBAvg		62.2	40.8	46.0	53.4	62.6	70.1	79.1	82.4	81.4	73.6	63.0	49.9	42.5
(7)		DBStd		16.73	9.92	10.06	9.75	8.17	6.75	4.96	4.86	5.17	6.49	7.80	9.04	9.60
(8)		HDD50		966	317	176	75	6	1	0	0	0	0	5	112	274
(9)		HDD65		3135	753	533	376	140	32	0	0	0	11	133	458	699
(10)		CDD50		5405	31	64	182	384	626	872	1005	975	709	407	109	41
(11)		CDD65		2098	1	2	18	68	191	423	540	510	269	70	5	1
(12)		CDH74		22905	3	14	149	596	1709	4627	6508	5879	2623	768	28	1
(13)		CDH80		10844	0	0	20	126	540	2229	3463	3107	1137	220	2	0
(14)	Wind	WSAvg		5.6	6.1	6.3	7.1	6.8	5.6	5.3	4.9	4.5	4.6	4.9	5.5	5.6
(15)	Precipitation	PrecAvg		50.70	3.50	3.90	4.80	5.20	5.30	3.40	3.40	2.90	3.50	4.50	5.20	5.10
(16)		PrecMax		79.20	8.40	9.80	10.60	11.80	12.90	7.80	9.40	6.00	8.60	15.20	12.80	13.90
(17)		PrecMin		36.60	0.40	1.20	1.90	0.60	1.10	0.90	0.60	0.30	0.50	0.40	1.10	0.70
(18)		PrecStd		9.20	1.90	1.80	2.00	2.70	2.60	1.80	2.00	1.50	1.90	3.30	3.00	2.80
(19)	Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures	0.4%	DB		72.5	76.2	82.3	87.4	91.0	100.0	104.0	104.2	99.0	89.8	77.2	71.0
(20)			MCWB		62.5	62.7	65.0	69.1	73.0	77.1	77.8	76.8	75.8	69.9	63.3	63.4
(21)		2%	DB		67.0	71.6	78.6	83.7	88.3	96.0	99.8	100.0	93.7	85.6	73.7	66.9
(22)			MCWB		59.8	60.6	63.8	67.5	72.5	77.3	78.1	76.9	74.3	68.1	63.7	61.2
(23)		5%	DB		62.9	67.5	74.0	80.9	85.9	93.1	96.8	96.9	90.2	82.1	70.2	63.1
(24)			MCWB		56.2	58.2	62.2	66.3	72.1	76.6	78.1	77.2	73.6	67.3	62.5	58.5
(25)		10%	DB		58.2	63.3	70.2	77.4	83.0	90.8	94.0	93.5	86.7	78.7	66.1	58.7
(26)			MCWB		51.1	55.4	59.8	65.0	71.0	76.2	77.9	77.2	71.8	65.8	59.5	53.6
(27)	Monthly Design Wet Bulb and Mean Coincident Dry Bulb Temperatures	0.4%	WB		65.5	67.3	70.7	73.4	78.0	81.3	83.0	82.9	79.3	75.3	69.8	65.6
(28)			MCDB		71.3	72.9	76.5	81.7	84.6	92.3	92.7	92.9	90.6	83.0	73.4	68.7
(29)		2%	WB		62.2	64.3	67.1	71.2	75.8	79.7	81.2	81.4	77.8	72.5	67.2	63.2
(30)			MCDB		65.5	68.4	75.0	79.2	83.8	90.2	92.1	91.3	87.6	79.3	70.7	66.3
(31)		5%	WB		58.1	60.6	64.4	69.4	74.4	78.5	80.1	80.1	76.3	70.4	63.8	59.5
(32)			MCDB		61.6	65.1	71.2	76.7	82.3	88.8	91.3	90.1	85.3	77.4	68.2	62.5
(33)		10%	WB		51.4	56.7	61.4	67.6	72.8	77.6	79.0	78.8	74.8	68.4	60.3	54.9
(34)			MCDB		56.1	61.0	68.2	74.7	80.3	87.7	90.2	88.8	82.9	75.4	65.5	57.1
(35)	Mean Daily Temperature Range	5% DB	MDBR		19.5	21.1	21.1	22.5	20.6	20.2	20.4	21.6	22.6	25.0	21.6	18.0
(36)			MCDBR		26.6	27.4	26.0	24.9	23.3	22.9	23.5	25.4	26.3	29.2	26.0	22.8
(37)			MCWBR		19.4	18.3	14.9	12.6	10.0	8.3	7.0	7.5	9.8	14.4	16.6	18.0
(38)		5% WB	MCDBR		20.5	22.0	21.0	19.5	19.3	19.8	21.0	20.8	20.5	21.8	20.0	19.2
(39)			MCWBR		18.2	18.0	14.4	12.0	9.9	8.4	8.1	8.4	8.9	13.2	15.8	17.8
(40)	Clear-Sky Solar Irradiance	taub			0.320	0.327	0.360	0.398	0.428	0.455	0.488	0.482	0.411	0.358	0.333	0.314
(41)		taud			2.495	2.469	2.406	2.298	2.277	2.214	2.166	2.161	2.347	2.471	2.496	2.519
(42)		Ebn,noon			281	292	289	282	273	265	255	254	269	277	273	276
(43)		Edh,noon			27	30	35	41	43	45	47	47	37	30	26	25
(44)	All-Sky Solar Radiation	RadAvg			777	957	1313	1672	1786	2019	1952	1850	1549	1199	865	679
(45)		RadStd			60	113	104	104	146	164	105	105	103	170	99	72

Nomenclature: See separate page

10.8 Equipment Seismic Rating

10.9 Permits

[Compilation of Applicable Permits by Contractor]

10.10 List of Acceptable Manufacturers for Main Equipment

[To Be Determined]

10.11 RaaS Contractor Proposal Requirements

Prospective RaaS Contractors (Bidders) shall submit proposals that demonstrate their ability to provide the services and define the scope, approach, and schedule to perform the work. The proposal shall include the following information in the order shown below to allow for a consistent evaluation of proposals. Contractors shall prepare and provide proposals at their own cost.

1 COVER LETTER: Summary of proposal contents including references to relevant sections of the proposal that bidder would like to highlight in their bid.

2 QUALIFICATIONS OF CONTRACTOR AND KEY PERSONNEL: Bidder shall provide information on recent and relevant or similar services. Bidder shall identify the Project team organization, including planned subcontracted resources, identifying their defined role, expertise, and capabilities. Bidder shall provide key team member biographies and resumes in an appendix.

3 PAST PERFORMANCE: Provide three (3) client references within the past five (5) years including contact name, firm, phone number, email, and summary of the scope of services provided.

4 APPROACH: Describe the scope of the Project and the approach to perform the work. This section should state how the bidder proposes to interface with Entergy throughout the course of the Project including periodic status meetings and design reviews.

5 SCOPE OF WORK: Bidder shall provide contract scoping documents defining the basis of their proposal including the following:
   a. Project narrative defining the Project site, key Project features.
   b. Site Plan including planned contractor construction laydown areas
   c. One Line Diagram
   d. Site visit photos
   e. Solar + Battery Energy Storage System specifications
   f. Terminal point list identifying contractor terminal points
   g. Redline of this document stating exceptions and clarifications
   h. Completion of contractor fill-in data in the design basis responsibility table (Section 10.1)
   i. Level 1 Project Schedule including Entergy and customer interfaces necessary to progress the work efficiently
   j. Statement of proposed “Optional Scope”

6 FEE PROPOSAL: A fee proposal shall be provided and shall contain the following information:
   a. A firm, fixed total price for completion of the services.
   b. Unit pricing to be used as a basis for pricing additional work as may be required for scope additions or deletions.

c. A detailed breakdown of the total price for the services which includes the following line items as a minimum:

	Quantity	Units	Price ($) (Labor & Materials)
Solar PV System		Qnty	
Battery Energy Storage System		Qnty	
Switchgear		Qnty	
Concrete		C.Y.	
Structural Steel for Access/Support		Ton	
Conduit		L.F.	
Cable Tray		L.F.	
Cable		L.F.	
Engineering & Design Services		Hours	
Total			