

**SPECIFICATION SECTION 48 17 13:  
BATTERY ENERGY STORAGE SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. The Contract and any design-build bridging documents.
- B. Section 26 00 00: General Electrical Specifications.
- C. Section 48 14 00: Photovoltaic System
- D. Section 48 19 00: Microgrid Control Systems
- E. Other relevant Judicial Council Specifications and Bridging Documents.

*NOTE: Where this specification and other specifications or bridging-documents are in conflict, the more stringent shall apply. Contractor shall identify conflicts and confirm recommended equipment or procedures with the Judicial Council.*

**1.02 CODES & REFERENCES**

- A. The design and installation shall conform to all requirements as defined by the applicable codes, laws, rules, regulations and standards of applicable code enforcing authorities (latest edition unless otherwise noted). The following are key standards that shall be followed. The Engineer or Architect of Record and Contractor shall ensure all applicable codes are followed:
  - 1. ASTM International (ASTM) ([www.astm.org](http://www.astm.org))
  - 2. American National Standards Institute (ANSI), including:
    - ANSI C37, Surge withstand capabilities
    - ANSI C57, Transformer standards
  - 3. California Building Code (CBC), with State of California Amendments
  - 4. California Building Standards Code, Title 24, including:
    - a. Part 3, California Electrical Code (CEC)
    - b. Part 6, California Energy Code
    - c. Part 9, California Fire Code, CFC (including Section 608)
    - d. Part 11, California Green Building Standards Code
  - 5. California Dept. of Industrial Relations, General Industry Safety Orders Section 5185
  - 6. California Office of the State Fire Marshall
  - 7. California Public Utilities Commission, including:
    - Tariff Rule 21
    - Self-Generation Incentive Program Requirements
  - 8. Institute of Electrical and Electronics Engineers (IEEE), including:
    - a. IEEE 693, Recommended Practice for Seismic Design of Substations
    - b. IEEE 1375, Guide for Protection of Stationary Battery Systems
    - c. IEEE 1491, Guide for Selection and Use of BMS
    - d. IEEE 1547, Standard for Interconnecting Distributed Resources with Electrical Power Systems
    - e. IEEE 2030.5 protocol for DERs and microgrids

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- f. IEEE 2030.7-9, Microgrid controller standards
- 9. International Electrotechnical Commission (IEC), including:
  - IEC 62897, Stationary Energy Storage Systems with Lithium Batteries
- 10. International Electrical Testing Association (NETA)
- 11. International Fire Code
- 12. Local Fire Jurisdiction Requirements
- 13. National Electrical Manufacturers Association (NEMA)
- 14. National Electrical Code (NEC)
- 15. National Fire Protection Association (NFPA), including:
  - a. NFPA 70, National Electrical Code
  - b. NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response
  - c. NFPA 791, Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation
  - d. NFPA 855, Standard for the Installation of Stationary Energy Storage Systems
- 16. Judicial Council Specifications and Requirements
- 17. Underwriters Laboratory (UL), including:
  - a. UL 1642, Standard for Lithium Batteries
  - b. UL 1741/1741-SA, Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Systems
  - c. UL 1973, Standard for Batteries for Use in Stationary and Motive Auxiliary Power Applications
  - d. UL 9540, Standard for Energy Storage Systems and Equipment
  - e. UL 9540a, Standard for Thermal Runaway Fire Propagation in Battery Energy Storage Systems
  - f. UL 2900, Standard for Software Cybersecurity for Network- Connectable Products
- 18. Utility company standards and requirements
- 19. All other applicable Codes and Ordinances

B.

Systems must be able to protect themselves from internal failures and utility grid disturbances. As such, systems must be self-protecting for AC or DC component system failures. In addition, systems must be able to protect themselves from various types of external faults and other abnormal operating conditions on the grid.

- C. Systems must be designed to be in compliance with applicable safety standards with regard to construction and potential exposure to chemicals and with regard to module or enclosure resistance to hazards such as ruptures and exposure to fire.

### **1.03 DEFINITIONS**

- A. AHJ – Authorities Having Jurisdiction

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- B. BESS – Battery Energy Storage System
- C. BMS – Battery Management System
- D. BTM – “Behind-the-Meter”: The energy user’s side of the utility meter.
- E. CT – Current Transformer
- F. DAS – Data Acquisition System
- G. DER – Distributed Energy Resources
- H. EMS – Energy Management System
- I. HMI – Human Machine Interface
- J. MSDS – Material Safety Data Sheet
- K. OPR – Judicial Council’s Project Requirements
- L. OSHA – Occupational Safety and Health Administration (refers to both OSHA and Cal- OSHA)
- M. PCC – Point of Common Coupling
- N. PCS – Power Conversion System
- O. POI – Point of Interconnection
- P. PT – Potential Transformer
- Q. SGIP – Self Generation Incentive Program
- R. SOC – State of Charge or Energy: Nominal Energy Remaining / Nominal Full Pack Energy Available
- S. UPS – Uninterruptible Power Supply

### **1.04 SUMMARY**

- A. "Judicial Council" shall refer to Judicial Council of the State of California, owner of the site(s) where project will be located, regardless of system ownership, and include any representative of the site Judicial Council, such as independent engineers, consultants or inspectors. "Contract" refers to the design-build and/or construction contract and any associated design-build bridging documents, inclusive of requirements outlined in the request for proposals (RFP). "Contractor" refers to the entity performing the work, inclusive of Engineer(s) and Architect(s) of Record for design-build contracts, post construction system operator, and financier.
- B. This is a design -build project and includes the design, construction and commissioning of a complete electrochemical Battery Energy Storage System (BESS). The design, installation and commissioning shall conform to all requirements as defined by the applicable codes, laws, rules, regulations, eligible incentive programs and standards as specified in the Contract.
- C. The BESS system shall be grid connected and “behind-the-meter”.
- D. The BESS system may be AC-coupled or DC-coupled, provided that such arrangement meets all applicable codes, utility interconnection requirements and the specified requirements.
- E. The BESS shall function to provide grid forming, time of use self-consumption, export control, off-grid preparation, power factor correction, harmonic correction, resiliency and/or grid services as defined by the Judicial Council’s Project Requirements in Section 1.06 of this document. In the absence of other requirements in the bridging documents, the Contractor shall work with the Judicial Council during submittal process to develop a clear statement of the

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intended function and operation of the BESS, as well as a commissioning protocol to ensure functional/operational requirements are satisfied.

- F. During the operational period of the BESS, the BESS software/Contractor shall continually optimize the BESS to meet the functional/operational requirements of the system. The Contractor shall not substantially alter the BESS operations, including value streams to the Judicial Council, without written permission from the Judicial Council. Any such alteration shall not reduce non-financial functions of the BESS (e.g., export control, resiliency), shall not reduce Judicial Council savings, and any additional savings shall be shared with the Judicial Council.
- G. The BESS shall include BMS and PCS, which operate to safely and optimally manage the BESS, and ensure code and eligible incentive program compliance. The BESS shall interface with standard Microgrid Control Systems and EMS. The Contractor shall provide this service for the term of contract.
- H. The Contractor shall include all items and all work reasonable required to complete the BESS and microgrid in accordance with the Agreement. If the Contractor is in doubt as to the intent of any portion of these specifications or bridging documents, or necessary information is omitted, the Contractor shall notify the Judicial Council in writing for clarifications or corrections to be provided by addendum.
- I. All shop drawings, and technical specifications shall be submitted, reviewed and accepted by the Judicial Council per the guidelines specified in the Contract and any bridging documents.

### **1.05 WORK INCLUDED**

- A. The work shall include the design, permits, engineering (civil, structural, mechanical, electrical, software, etc.), scheduling, materials, labor, equipment, installation, testing, commissioning, software, and incidentals necessary to install complete, turnkey, utility-interconnected Battery Energy Storage Systems (BESS) in conformity with applicable codes, eligible incentive programs, and professionally recognized standards.
- B. Submit for review and comment of all O&M manuals, and miscellaneous documentation required to provide a complete installation. Provide all as-built documentation including calculations, software, design drawings, equipment drawings required for the BESS.
- C. Provide and maintain a Schedule for all fabrication, procurement, installation and testing activities for the project.
- D. BESS equipment shall include battery systems, power conversion systems, all associated control and communication interface systems, all switchgear, any auxiliary loads, metering/monitoring equipment, and any equipment necessary to support the intended operation of the BESS and to allow for interconnection with the utility. BESS systems shall consist of all enclosures/skids, pads, fencing, underground conduits, conductors, inverters, switchgear, controls, transformers, protection relays, utility metering, IT/communication equipment, breakers, disconnects, cabling and associated relaying.
- E. The BESS shall be designed to provide automatic, unattended operation of the BESS, The EMS shall update to track changes in utility tariffs to optimize the retail tariff functions of the BESS quarterly.

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- F. The BESS shall be utility grid connected on the Judicial Council-side of the utility meter (behind-the-meter). The Contractor shall be responsible for all required utility company coordination, applications, inspections, and final approval for the complete interconnection of the BESS with the utility company grid, including bi-directional utility meters at each location.
- G. The BESS and associated equipment shall qualify for the Self Generation Incentive Program ("SGIP"). The Contractor shall be responsible for all required utility company SGIP coordination, applications, inspections, and final approval for the maximum eligible incentive for the BESS with the SGIP Large Scale Storage incentive program using the 2021 SGIP Handbook V4. The contractor will also provide annual compliance reporting.
- H. Contractor shall ensure the design, installation and operation of the Project meets all requirements to maximize all available incentives and shall guarantee Judicial Council receipt of incentives for any scope/operations under the control of the Contractor. Contractor shall provide all documentation, coordination, reporting, etc. with entities providing incentives to secure incentives.
- I. The Contractor shall ensure adequate clearance and equipment space within the allotted areas and existing building and site conditions. All equipment and sizes / clearances shall be coordinated with the Judicial Council prior to rough-in.
- J. The Contractor shall provide for the disconnection, disposition, and proper disposal of all existing equipment to be replaced.

#### **1.06 Judicial Council's Project Requirements**

- A. The BESS shall support the following Grid Connected functions:
  - 1. Demand Charge Reduction - Demand Charge Reduction reduces the demand charges (\$/kW) on the monthly electric bill for the maximum demand (non-coincidental) and other relevant demand charge periods. The BESS/microgrid controller shall use "learning algorithms" to gauge when a facility is approaching peak demand to shift some of the energy consumption to battery power to mitigate demand charges. The BESS/microgrid controller shall incorporate solar production to determine when the BESS shall discharge to reduce the demand charges.
  - 2. Time of Use Self Consumption or Arbitrage – Time of use Self-consumption is where PV generation at a time when the Time of Use rate is low, is used to charge the BESS and stored in the BESS and discharged at a time when the Time of Use rate is high. This shall create cost savings when there is a substantial difference between the Time of Use rates throughout the day.
  - 3. Export Management - Export management charges the BESS from the solar PV system to avoid or minimize the export of solar PV energy, or any energy above a defined threshold, to the grid. The energy generated by the solar PV system, which was stored in the BESS, is then discharged to offset grid energy consumption when the solar PV system is generating less than the site is consuming.
  - 4. Off Grid Preparation - Off Grid Preparation prepares the system to transition to Island mode due to an impending grid outage. Off Grid Preparation is triggered with either advanced notice of an announced rolling blackout, announced Public Safety Power Shutoff (PSPS), weather forecasts looking at high wind speeds, and encroaching major storms such as a

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hurricane or typhoon. When the event is detected, the BESS/Microgrid controller evaluates the energy required for the critical loads and prepares the energy assets (including the BESS) for the loss of the grid power and maximizes the available capacity of the BESS for Island mode.

- B. The BESS shall prioritize the order of the below listed functions with the first functions as higher priority.
  - 1. Time of Use Self Consumption
  - 2. Export Management
- C. The minimum BESS nameplate AC power output in kW and BESS nameplate energy storage capacity in kWh are defined in Attachment C1.

### **1.07 SUBMITTALS**

- A. Submittals shall be provided per specification 01 33 01: Submittals and the following guidelines specific to BESS.
- B. Study Reports and Calculations. The Contractor shall submit all simulation and field test reports. These reports shall contain assumptions, study methods, results, significant findings and conclusions.
- C. Record Drawings – Provide as-built record drawings per Section 01 33 01: Design-Build Process & Submittals and Section 01 77 00, Closeout Procedures.
- D. Testing Plans and Reports
  - 1. The Contractor shall ensure factory testing is performed on the BESS. Where appropriate, tests shall conform to those contained in ANSI, NEMA, ASME, NEC, ASTM and IEEE standards and guides. Where standards are not suitable or applicable, other common industry procedures and mutually acceptable methods shall be used.
  - 2. The batteries, inverters, controls and assembled containers and other major components shall be factory tested. The Contractor shall be responsible for compliance with all standard factory test procedures that check the quality and performance of the BESS equipment/system.
  - 3. Factory Testing of the PCS and Control System - The Contractor shall ensure factory testing of the PCS and Control system. At a minimum, sufficient tests shall be conducted to demonstrate that all controls, protective functions and instrumentation perform as designed and is in compliance with this specification. Successful tests performed on scale models or analog simulators will be deemed to meet the intent of this paragraph.
  - 4. Where PV system Self-Consumption is required in the Project scope, the tests shall demonstrate that the BESS is capable of automatically charging from the PV generation that exceeds the site load and would otherwise be exported to the grid.
- E. Commissioning and Commissioning Reports
  - 1. The Contractor shall submit a Commissioning Plan and conduct commissioning per the manufacturer's recommendations and the standards identified in this specification. The

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Contractor shall work cooperatively with Judicial Council/Judicial Council's representative to develop a formal commissioning plan to demonstrate the BESS performs to the project requirements.

2. Overall System Tests - The Contractor shall demonstrate that the BESS integrates, and coordinates as intended at the factory and on site. At a minimum, the contractor shall demonstrate that all control and management systems, including but not limited to, all levels of battery management system, PCS controls, BMS, microgrid controls, and overall site controls, interact as intended. The contractor shall support any testing required by the utility.
3. Where PV system Self Consumption is required, BESS charges using any energy/power from the PV system that is in excess of the site load, shall be tested and confirmed to meet performance requirements.

### **F. Instruction Books**

1. No later than fifteen (15) calendar days from the date of commissioning, the Contractor shall furnish digital (PDF format) detailed instruction books for each energy storage system furnished for the Project. These books shall contain all illustrations, assembly drawings, outline drawings, wiring diagrams, replacement parts list that includes part number identification, a list of recommended spare parts, and instructions necessary for storing, installing, operating and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall not include instructions that are not applicable.

## **1.08 QUALITY ASSURANCE**

- A. All equipment shall be listed to Underwriters' Laboratories (UL) standards 1973, 1741, 9540, 9540a, and that is applicable to authorities having jurisdiction (AHJ).
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- D. Installer Qualifications – The installing contractor shall be familiar with the equipment to be installed and have the necessary training to install the equipment. If specific state contracting qualifications are required for installation of BESS systems, the installing contractor shall comply with those requirements.

## **1.09 MATERIALS, DELIVERY, STORAGE, AND HANDLING**

- A. All materials shall be delivered new, undamaged and without defects.
- B. All equipment shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.
- C. Appropriate Personal Protective Equipment (PPE) shall be worn when handling the equipment.

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### **1.10 WARRANTY**

- A. All equipment furnished under this Section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of Term. The battery shall be sized to meet a cycle life of at least the Term after substantial completion. Batteries shall maintain at a minimum 75% capacity for the Term. Contractor shall include the full cost of replacement of the battery or such components to achieve the 75% capacity for the Term.
- B. Warranty shall include all parts and expenses to perform necessary work, inclusive of regular software updates over the warranty period sufficient to meet the operational and functional intent of the system.

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS FOR ALTERNATE DESIGN PROPOSALS**

- A. Manufacturers shall provide equipment that meets all current industry, utility company, and incentive required standards and all performance criteria set forth in the bridging documents and Contract.
- B. The Judicial Council seeks equipment from proven, industry leading manufacturers in solid financial standing, producing tier-one (financeable) equipment.

### **2.02 EQUIPMENT AND MATERIALS FOR ALTERNATE DESIGN PROPOSALS**

- A. BESS Systems Shall Meet the Following Minimum Requirements:
  - 1. BESS system capacity as indicated in the Cost Proposal Form in Attachment C for each project site. The battery shall be electrochemical.
  - 2. At least three of the same systems proposed for this Project (including cells/modules, overall design and software systems), have been installed in a behind-the-meter arrangement with a utility in the United States.
  - 3. The battery shall be from a proven technology designed for the type of service described by this specification and the bridging documents. For the purposes of this specification, proven technology shall be defined as having been in successful commercial service in similar applications for a period of time sufficient to establish a service life and maintenance history.
  - 4. Only BESS that are commercially available or for which suitable (not necessarily identical) replacement components can be supplied on short notice throughout the Project life shall be allowed.
  - 5. Efficiency shall be:
    - i) Minimum 80% AC round trip EXCEPT for redox flow batteries
    - ii) Minimum 60% AC round trip for flow battery technology
  - 6. The usable capacity shall be a minimum of 75% of its nominal rating at the end of the Term. A scheduled replacement of BESS components is permissible to achieve this requirement provided that the Contractor clearly includes the cost of the replacement as part of the warranty/operational costs in their proposal.



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### **B. CYCLE LIFE**

1. BESS manufacturer must state depth-of-cycle limitations and the product shall be sized such that the depth of discharge corresponds to a cycle life meeting the warranty requirements.
  2. For purposes of estimating and demonstrating cycle life, cycles are defined in terms of energy charged and discharged from the BESS. Additional details are to be included in the Contractor's warranty terms and conditions.
  3. The Contractor shall provide a graph or set of graphs that displays the relationship between depth of discharge, SOC% and the corresponding number of cycles available within the system's life.
- C. BESS shall be designed to withstand seismic events for the designated Project seismic zone. For areas of high seismic risk, BESS shall be seismically qualified in accordance with IEEE 693 High Seismic Qualification Level and shall include means to restrain cell movement during seismic events.
- D. The Contractor shall have overall responsibility for the safety of the electrical design and installation of the battery.
- E. The BESS design and installation shall be modularized and connected in a manner that enables adequate access for easy field removal and replacement of failed modules or equipment. Access areas shall conform to all applicable codes and facilitate access by maintenance personnel. As applicable, the racks shall provide sufficient clearance between tiers to facilitate required maintenance, including testing and inspection, and replacement.
- F. All racks and metallic conductive members shall be solidly grounded.
- G. Incorporate disconnect switches for AC and DC power disconnect in compliance with applicable codes and utility requirements.
- H. Ambient temperature range have been determined by the Contractor and appropriate for the Project location. The BESS has been designed to operate and maintain sustainable operating temperatures within the Project's ambient temperature range.

### **2.03 BESS MANAGEMENT SYSTEMS**

- A. The battery management service provider must be approved for use by the BESS manufacturer and any applicable utility and incentive programs.
- B. The battery management system and battery management service shall be listed for UL 1741 Power Control Systems (PCS) Certification Requirement Decision (CRD).
- C. The battery management service shall update the BESS functions with the applicable tariff information, including but not limited to energy charges, demand charges, time of use intervals, and demand response programs within 24 hours of when the new Tariff, TOU period, or demand response program is implemented.
- D. The Contractor shall provide a subscription of battery management services for the term of the contract from the selected battery management service provider. The battery management service subscription must be transferable to the Judicial Council.

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- E. The BESS management systems have been designed to provide for automatic, unattended operation of the BESS. The control system design can provide for local manual operation or remote operation.
- F. BATTERY MANAGEMENT SYSTEM (BMS)
  - 1. As a subcomponent of the Project, a Battery Management System (BMS) provides data to operators in real time via a system dashboard/control interface and shall be included to manage the operational health of the BESS and assure safe and optimal performance of the BESS as an interconnected asset to the Judicial Council's electrical system.
  - 2. The ESS system shall have an available Application Programming Interface ("API") that can send charge and discharge requests by the Judicial Council and its authorized representatives. Access to the API will be preferable through an "Open API" specification such as OpenADR 2.0B.
  - 3. BMS shall provide the following monitoring information:
    - a. State of Charge (usable kWh and % of total capacity available for discharge)
    - b. Cell Charge Level
    - c. Stack Charge Level
    - d. Module Charge Level
    - e. State of Module Health
    - f. DC Voltage/Current – DC voltages and current at battery terminals
    - g. Temperature – BESS Enclosure temperature and ambient air temperature
    - h. BESS Status (Charging/Idle/Discharging, Non-Island/Island, Normal/Fault)
    - i. BESS Warning and alarms
    - j. BESS Logs of operations and alarms
    - k. Over-the Air management and upgrade of any software versions
    - l. Cyber Security management of the device itself
    - m. Notifications and Alerts
      - i) Transition from Non-Island to Island mode or from Island to Non-Island mode.
      - ii) Fault Conditions
- G. BESS Data Acquisition System (DAS) and monitoring system shall meet the following requirements:
  - 1. BESS DAS shall comply with IEEE 2030.5 protocol for DERs and microgrids.
  - 2. Where BESS is paired with a PV system, BESS shall provide reporting on the same cloud-based platform as the PV system wherever commercially feasible. BESS may have a separate monitoring and cloud-based platform to fulfill all monitoring requirements listed in this section, however key BESS operating parameters including BESS charge and discharge data shall be provided on the same platform and time-interval as the PV system.
  - 3. Cellular data shall be used for communications with the DAS/metering systems and cloud-based platforms. In the absence of cellular service availability, the Judicial Council may, at its own discretion, provide internet connections on a site-by-site basis. The data service shall be provided for the term of the contract.

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4. The BESS vendor shall have the capability to remotely monitor the BESS and independently and be automatically alerted to BESS alarm conditions without relying on personnel to communicate that such alarm conditions exist.
5. Monthly timescale on the monitoring platform to be aligned with utility billing cycle where possible.
6. Monitoring at a minimum shall provide the following real-time and logged parameters on a maximum 15-min interval or less.
  - a. BESS Status (Charging/Idle/Discharging, Grid Connected/Island, Normal/Fault)
  - b. Instantaneous and accumulated power output (kW and kWh) for both BESS and Site Load
  - c. State of Charge (usable kWh and % of total capacity available for discharge)
  - d. BESS Warning and alarms
  - e. BESS Logs of operations and alarms
7. DAS shall provide Judicial Council and/or Judicial Council's representative cloud-based access to all data through an open data exchange protocol (FTP Push or API) at no additional cost to Judicial Council or Judicial Council's representative. Data shall, at a minimum, include energy consumption and discharge data, inverter production data, inverter AC power data, inverter current data, inverter voltage data, state of charge, and alarm status readings. All data shall be available over multiple timescales, ranging from 15-minute (or less) intervals to annual intervals and shall include both real-time and historic data.
8. DAS shall provide all reporting required to obtain incentives.
9. DAS Monitoring / Alarms systems must meet the following requirements.
  - a. Determine if the BESS is in imminent danger of failing to meet specified performance levels or potential safety hazards exist.
  - b. Determine if the BESS can no longer meet the specified performance criteria or safety hazards exist.
  - c. Contractor and O&M provider shall have the capability to respond to alarm conditions and provide required service to correct such alarm conditions within four hours from the inception of the alarm condition.
  - d. Judicial Council and/or Judicial Council's representative shall be able to choose whether to receive the same alerts as the Contractor.
  - e. The vendor shall include, in the Operation and Maintenance Manual, the recommended corrective action and maintenance procedures for each alarm level or observed condition provided.
10. This Project may participate in grid service markets as identified in the bridging documents, Contract or during design. The BESS shall be capable of integration with grid control and telemetry systems. If grid service(s) are identified as a requirement for this project, all such systems shall be included as part of the Project.

### **2.04 POWER CONVERSION SYSTEM (PCS) FOR ALTERNATE DESIGN PROPOSALS**

- A. PCS (Inverters) shall meet the following requirements:
  1. Include a warranty for the Term.

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2. Comply with the following:
  - a. UL 1741 listed, inclusive of UL 1741-SA requirements.
  - b. IEEE 1547, including testing to IEEE 1547.1 and IEEE C62.45.
  - c. IEEE C62.41.2 and CSA107.1-01.1.
  - d. California Rule 21, CEC approved and utility line interactive type.
3. Meet the following requirements:
  - a. Nominal AC Voltage (Three-phase,  $\pm 10\%$ ): 208, 240, or 480 VAC (as required per site)
  - b. Nominal AC Frequency ( $\pm 0.5$  Hz): 60 Hz
  - c. Line Power Factor (Above 20% rated power):  $>0.99$
  - d. AC Current Distortion (At rated power):  $<5\%$  THD
  - e. Maximum Open Circuit Voltage DC: 1,000 VDC
  - f. Maximum Ripple Current (% of rated current):  $<5\%$
  - g. Minimum Inverter Efficiency:  $>96\%$
  - h. Temperature Range Ambient:  $-4^{\circ}\text{F}$  to  $122^{\circ}\text{F}$  ( $-20^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ )
  - i. Enclosure Environmental Rating (minimum): NEMA 3R
  - j. Relative Humidity (non-condensing): 0-95%
  - k. Sound level:  $<85$  dBA
  - l. Capable of producing reactive power to operate between a power factor of 0.9 lagging to 0.9 leading (as adjusted on the inverter equipment).
  - m. Protective Functions: Standard wakeup voltage, wakeup time delay, shutdown power, shutdown time delay, AC over / under voltage and time delays, AC over / under frequency and time delays, ground over current, over-temperature, AC and DC over current, DC over voltage
  - n. Isolation Transformer (if applicable): High-efficiency type, supplied by the manufacturer of the Inverter Systems, mounted within same enclosure or directly adjacent, with factory-designated wiring provisions.
  - o. Seismic rating to Project site seismic zone and mounting type
4. The PCS, in conjunction with any microgrid controls (if present), shall be capable of completely automatic unattended operation, including self-protection, and synchronizing and paralleling with the utility. Where a microgrid is part of the project, PCS shall have islanding support functions.
5. The control of the PCS shall be integrated with the overall Project 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.

### **2.05 ENERGY MANAGEMENT SYSTEM (EMS)**

- A. The Project shall include all necessary software applications and supporting hardware required to meet the specified operational/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 defined in the Judicial Council's Project Requirements, Section 1.06 of this document.

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- B. The Project shall include the necessary communication and telemetry hardware, and support communications protocols, to effectively provide the required services.
- C. Provide a UPS for the control and data acquisition module.
- D. Operations and Control Functions. The EMS 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:
  - 1. Protect itself (isolate for any internal fault)
  - 2. Remain within power constraints (transformer and Project ratings)
  - 3. Remain within voltage constraints
  - 4. Remain within operating temperature constraints
  - 5. Isolate in response to system anomalies
  - 6. Charge/discharge Real Power and Reactive Power in response to EMS programs or external commands
  - 7. Communicate status and diagnostic data
- E. The EMS Shall respond to commands issued remotely or locally, including but not limited to:
  - 1. Change Modes (charge, discharge, etc.)
  - 2. Change Status (enable/disable)
  - 3. Reset Alarms
  - 4. System Reset/Restart
- F. Operational States - A command table, with permissible operational states and high-level logic, must be submitted by the Contractor. The command table shall be reviewed and approved by the Judicial Council prior to the acceptance of the BESS and factory acceptance test.
- G. REMOTE OPERATIONS
  - 1. The EMS shall be able to respond to manual commands that are issued remotely by an external supervisory controller using a secure internet-based protocol.
  - 2. The Project shall remain functional in the absence or loss of communication from the remote controller. The Project shall continue its current mode of operation.

#### **2.06 INFORMATION SECURITY FOR ALTERNATE DESIGN PROPOSALS**

- A. BESS shall include cybersecurity precautions, designed to be hardened against willful attack or human negligence per applicable codes and standards identified in this specification and in common industry practice for BESS.
- B. Contractor shall develop and implement a cybersecurity plan that addresses and mitigates the critical vulnerabilities inherent in both the hardware and software that comprise the control and data acquisition systems.

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### **2.07 MISC. SYSTEM REQUIREMENTS FOR ALTERNATE DESIGN PROPOSALS**

- A. Systems shall meet the controls programming shall comply with Self Generation Incentive Program (SGIP) requirements including performance-based incentives, if the contractor is proposing to fund the system in some part through SGIP.
- B. Systems shall be rated in terms of net delivered power and energy in kilowatts (kW) to the Point(s) of Common Coupling and in kilowatt-hours (kWh) of electrical energy storage capacity. 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 system and ratings are net of these loads and losses as measured (or calculated if not measured) to the Point(s) of Common Coupling.
- C. The system shall be capable of charging from 0% to 100% useable State of Charge (SOC) and discharging from 100% to 0% useable SOC (its rated energy) for a minimum of duration as stated in the drawings and cycling in conformance with incentive and warranty requirements, if applicable.
- D. All exterior equipment shall be designed for an outdoor environment with minimum NEMA 3R rating and to be sunlight and UV resistant.
- E. Fire Mitigation/Safety
  - 1. The Contractor shall design its system to minimize any potential risks of fires, ensure safety of any nearby occupied areas, and meet all local, state and national fire codes.
  - 2. The Contractor shall provide, test and maintain code- and AHJ-compliant fire detection and suppression systems.
  - 3. O&M documentation shall clearly indicate safety precautions and emergency procedures for Judicial Council interaction with the BESS, including fire procedures. Contractor will train Judicial Council staff on emergency response procedures.
- F. Cooling Systems
  - 1. The site temperatures and the effect of temperature on component life shall be considered in developing the thermal design for all components, including batteries and PCS. System shall provide all heat removal systems to accommodate the particular needs of Project components and subsystems (e.g., PCS, transformers, etc.).
  - 2. Air handling systems shall include filters to prevent dust intrusion into the system. Design for energy efficiency using high efficiency motors and variable frequency drives, and variable speed compressors.
- G. No dissimilar metals are allowed to contact each other (use plastic or rubber washers). Best practices shall be used to avoid corrosion. No aluminum in contact with concrete or masonry materials.
- H. Bolted connections shall be non-corrosive and include locking devices designed to prevent twisting over the design life of the BESS.
- I. Environmental impact of system equipment containing hazardous materials shall be disclosed, as well as maintenance and disposal/recycling instructions for equipment at the end of its useful

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life. BESS owned by third-parties shall provide for disposal/recycling at end of life at no-cost to the Judicial Council.

#### **PART 3 - EXECUTION**

##### **3.01 REQUIRED PLACARDS & LABELING**

- A. All placards and labels shall meet all code requirements, these minimum requirements, and industry best practices.
- B. All placards shall be machine generated phenolic type with red background and white lettering, affixed to equipment with stainless steel screws or with permanent adhesive where set screws are not feasible. Minimum lettering size to be 1/4" unless otherwise noted or required for legibility.
- C. Provide a placard at each Main Switchboard, as noted on drawings and at minimum with the following information in 1/4" High lettering per NEC 690.54: "Caution - Possible Backfeed From BESS – X VAC, XX Amps", where X is the system voltage and XX is the maximum AC amperes of the installed system.
- D. Provide a placard on each BESS component, as noted on drawings and at minimum with the following information in 1/4" high lettering: "BESS Inverter Rating - Operating Current: XX Amps; Operating voltage: XXX VDC; Maximum System Voltage: 1,000 VDC; Short-Circuit Current: XXXX Amps", where XX is the maximum DC amperes of the installed system, XXX is the operating voltage DC, and XXXX is the short circuit current that the Inverter can provide (from all strings in parallel).
- E. For DC Coupled BESS
  - 1. Provide a placard clearly visible at each main service panel to identify both sources of power, with the following wording in 1/4" high lettering per NEC 690.64(B)(4): "Warning - This Service Is Fed by Two Sources Of Power – The Utility Service Main Disconnect And The PV System Main Disconnect – Both Services Must Be Disconnected To Remove Power From The Switchboard".
  - 2. Provide a placard on all disconnects with the following wording in 1/4" high lettering per NEC 690.17: "Warning - Electric Shock Hazard - Do Not Touch Terminals - Terminals On Both The Line and Load Sides May Be Energized In The Open Position".

##### **3.02 UTILITY INTERCONNECTION & PERMITTING**

- A. Contractor shall coordinate with the utility company to provide all grid intertie requirements and process all required paperwork per utility company requirements.
- B. Protection relays for the interconnection shall meet or exceed utility requirements.
- C. Contractor shall manage the utility interconnection process and ensure that the systems achieve Permission to Operate (PTO)
- D. Contractor shall ensure that all permitting is closed out with the AHJ(s).

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### **3.03 INSTALLATION STANDARDS**

- A. System Installation shall conform to the equipment manufacturer's Installation Manual(s) and requirements or guidelines.
- B. All Local, State, and NEC codes shall be observed, including all industry standards related to the installation, operation, and maintenance of photovoltaic power systems.
- C. Installation and components must meet utility equipment and safety requirements.
- D. Installation must meet incentive requirements, where applicable.
- E. CIVIL/STRUCTURAL
  - 1. The Project pads, foundations, fencing and other structures have been designed by or under the supervision, reviewed, approved and signed by a qualified registered professional engineer in the Project state.
  - 2. All design shall be in accordance with seismic design requirements as specified elsewhere in these specifications and drawings.
  - 3. The Contractor shall gain access to the Site as outlined in the Contract. The Contractor shall be responsible for damage to site and roadways resulting from the work performed.
  - 4. Existing structures and utilities that are adjacent to or within the limits of the Project area shall be protected against damage. The Contractor shall be fully responsible for all repairs in the event of removal or damage of any existing structure, equipment or systems that are intended to remain in place.
- F. Excavation. When necessary, the Contractor shall perform all common and deep excavation necessary for installation of all foundations and utilities. All excavation shall be in accordance with Cal-OSHA regulations. Excavation spoils shall be the Contractor's responsibility and may be used for backfill or embankment if suitable for this application. Unsuitable or excess excavated material shall be properly and promptly disposed of. The Contractor shall verify that earth material exposed in excavations is consistent with those assumed for the Contractor's foundation designs. If earth materials are different than assumed for particular foundation design the Contractor shall modify the design and/or treat the earth material (over excavate, replace, etc.) as necessary to provide foundation meeting design requirements.
- G. Construction Surveying. When necessary, the Contractor shall furnish all labor, equipment, material and services to perform all surveying and staking essential for the completion of the Project in conformance with the plans and specifications.
- H. Fills. When necessary, earth fill material adjacent to and below structures shall conform to the Contractor's design requirements for the structure. Contractor prepared specifications and drawings shall indicate the types of soil to use for particular fills and compaction requirements. Fill shall be placed as uniformly as possible on all sides of structural units. Fill placed against green concrete or retaining walls shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly.



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### **3.04 SAFETY FOR ALTERNATE DESIGN PROPOSALS**

- A. The BESS and Site shall be designed with personnel safety as the top priority and include all code required and industry standard safety components.
- B. Contractor shall design and install a fire protection system that conforms to national and local codes. The fire protection system design and associated alarms shall take into account that the BESS will be unattended at most times. If codes do not exist for the proposed BESS, current industry-accepted best practices shall be employed.
- C. The BESS design shall mitigate against chemical spills that are credible for the types of chemistry used. When BESS employs liquid electrolyte, the design shall include features that contain electrolyte spills (to be emptied by contracted chemical disposal company in the event of a spill) and prevent discharge to surrounding site soils.

### **3.05 TESTING & COMMISSIONING**

- A. Contractor shall develop a commissioning plan and commission the BESS to the requirements of the listed/applicable standards, to industry best practices and to demonstrate the BESS meets the Project functional, operational, and performance requirements as defined in the Judicial Council's Project Requirements in Section 1.06 of this document. All modes of operation shall be tested and validated. The commissioning process shall address the following at a minimum:
  - 1. Verification of sensors, metering and alarms
  - 2. Verification of BESS system performance
    - a. Maximum charge rate
    - b. Maximum discharge rate
    - c. Total usable capacity (kWh)
    - d. Validate reserve charge capacity
    - e. AC-AC roundtrip efficiency
    - f. Parasitic loads
    - g. Four Quadrant operation (P/Q)
    - h. Calibration of State of Charge (SOC) values
    - i. Validate internal safeties
      - i) Maximum SOC
      - ii) Minimum SOC
    - j. Validate Defined Modes of Operation
      - i) Grid Connected
      - ii) Island Mode Operations
  - 3. Verification of Control Functions for the Entire System
    - a. BESS
    - b. PV
    - c. Monitoring and Controls
    - d. Electric Infrastructure.
- B. Factory testing shall be performed and documentation provided as noted in Section 1.07 of this specification.

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- C. Complete testing of the installed system shall be performed by a manufacturer certified representative prior to system start up. All required modifications shall be made, and system signed off prior to making the system operational.
- D. Clear and complete documentation shall be provided demonstrating that the commissioning plan was executed and that the system achieved commissioning requirements.

#### **3.06 DOCUMENTATION**

- A. All commissioning and testing reports shall be provided to the Judicial Council within 15 days of completion of testing.
- B. The Contractor shall submit to the Judicial Council a comprehensive Operations and Maintenance (O&M) Manual with details for BESS. O&M Manuals shall be compiled as a single, bookmarked portable document format (PDF) file. The document shall be a well-organized, comprehensive and custom document created with details for each site. The document shall be provided according to the requirements in Section 01 33 00.
- C. All closeout documentation shall be provided per Sections 01 10 00 and 01 33 00 to achieve the listed project milestones.

#### **3.07 TRAINING**

- A. Judicial Council training shall be provided by the Contractor. The training course shall cover a breakdown of the BESS, procedures related to emergency response (ruptured modules, fire, etc.), and operation and control of the energy storage system.
- B. Training shall be scheduled before commencing Project performance verification tests. An outline for the training and the O&M manual shall be submitted to the Judicial Council 30 days ahead of the actual date of training. Approval of this outline shall be obtained from the Judicial Council.

#### **3.08 OPERATION**

- A. Contractor shall provide operational services for the life of the BESS per the Contract. Services shall include, at a minimum:
  - 1. Preventative maintenance as specified by the manufacturer(s) and industry standards.
  - 2. Software updates. Updates shall be provided remotely and in prompt response to any utility tariff changes or grid service requirements.
  - 3. Ongoing optimization of energy cost savings function of the BESS.
  - 4. Performance reporting, including energy cost savings provided by the BESS.
  - 5. End-of-life disposal of BESS and/or cell replacement. Where system is owned by a third-party, the cost of disposal/replacement shall be the responsibility of the third-party Judicial Council.

END OF SPECIFICATION SECTION 48 17 13