

**SPECIFICATION SECTION 48 19 00:
MICROGRID CONTROL SYSTEM**

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 17 13: Battery Energy Storage 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)
 - 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
 - g. IEEE P2030.8/D9, Testing of Microgrid Controllers
 - 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
- 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
- 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

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- F. DAS – Data Acquisition System
- G. DER – Distributed Energy Resources (PV Solar, Gen Set, BESS, Wind turbine, etc)
- 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 Microgrid Control System. 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 Microgrid Control System shall be grid connected and “behind-the-meter”.
- D. The Microgrid Control System shall meet all applicable codes, utility interconnection requirements and the specified requirements including anti islanding, high and low voltage and/or frequency ride-through, and power quality as well as operational requirements regarding real and reactive power import and export. The microgrid as an entity and the microgrid control system shall satisfy these requirements.
- E. The Microgrid Control System shall be capable of managing non-dispatchable generation such as solar PV as well as dispatchable generation such as BESS, generators, and other DER at necessary setpoints to supply power to the microgrid.
- F. The Microgrid Control System shall manage the transition from grid connected to islanded state for both planned and unplanned islanding. Transition time from grid to island mode must be less than 15 seconds.

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- G. If the BESS is fully depleted after running in island mode and the Site has a backup generator for critical loads, the backup generator must then come online to service critical loads.
- H. Microgrid islanding capability shall be offered and maintained for the life of the system, including an open protocol integration capability so that it can later be integrated with Building Energy Management Systems or similar load shedding enabled controllers and software.

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 Microgrid Control System 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 Microgrid Control System.
- C. Provide and maintain a Schedule for all fabrication, procurement, installation and testing activities for the project.
- D. Microgrid Control System equipment shall include all associated control and communication interface systems equipment necessary to support the intended operation of the Microgrid and to allow for interconnection with the utility. Microgrid Control 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 Microgrid Control System shall be designed to provide automatic, unattended operation of the Microgrid.
- F. The Microgrid 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 Microgrid with the utility company grid, including bi-directional utility meters at each location.
- G. 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.
- H. 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 Microgrid Control System and BESS shall support the following Grid Connected functions:
 - 1. 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),

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weather forecasts looking at high wind speeds, and encroaching major storms such as a 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 Microgrid Control System and BESS shall support the following islanded functions:
1. Grid-Forming – Grid-forming is the ability to operate when electricity from the grid is not available. Upon loss of the grid, the BESS needs to transition from grid-following (current-source) to grid-forming (voltage-source). When in grid-forming operation, the BESS provides a voltage and frequency reference for the other generating devices (e.g., PV solar system) and electrical loads.
 2. Resiliency – When electricity from the grid is not available, the Microgrid Control System communicates to the relays to open the main breaker to the facility or PV & BESS point of common coupling and transition the BESS to grid-forming mode. Once the internal grid is established and stable, the primary functions are related to maintaining stability of the islanded electrical network, managing the balance between generation supply (both solar PV and BESS) and load demand, and to maintain electrical safety and protection of loads. When the solar PV system is generating energy, it shall serve all loads that have not been manually shed or shed by the Building Energy Management System and charge the BESS with any energy not required by those loads. If there is solar PV energy not required by the those loads and the BESS is approaching 100% State of Charge (SOC), the BESS/Microgrid controller shall begin to curtail or shut down the PV system. The BESS/Microgrid controller shall restore the PV system to an operational mode if the BESS can be charged and the solar PV system can operate. Once the grid is back in service, the controls synchronize the inverters to the grid, communicate to the relays to close the main breaker to the facility or PV & BESS point of common coupling, and transition the BESS back to grid-following mode.
- C. Load Shedding. Facility loads will be shed manually or utilizing the Building Energy Management System by Judicial Council staff. On the occurrence of an outage start and end (and other major status changes) the Judicial Council will be notified through automated email to csc@jud.ca.gov with the subject line specifying the outage appropriately: **“Status” AND Building ID “XX-XX” AND “Site Name”** . Microgrid controllers must be able to accommodate future installation of relays to control load shedding.
- D. The Battery Management System shall always reserve a minimum capacity above the manufacturer’s minimum charge, as listed in Attachment C1, for use in the event of a grid outage.
- E. The BESS shall prioritize the order of the below listed functions with the first functions as higher priority:
1. Off Grid Preparation
 2. Resiliency
- F. The Grid Connected to Island transition shall occur with less than 15 seconds of power outage to the Site.

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- G. The Island to Grid Connected transition shall occur in less than 10 Minutes. During this transition there shall be no loss of power.

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 Microgrid Control System. 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. Tests shall demonstrate that when the utility grid goes down, the microgrid system is capable of automatically islanding from the utility connection using a protection relay paired with a motor operated circuit breaker. Tests shall also demonstrate that when the utility grid comes back up, the microgrid system is capable of automatically synchronizing and reconnecting with and operating in parallel with the utility connection.
 - 3. Certified reports of all tests shall be furnished to the Judicial Council for review and shall indicate that there are no exceptions noted and that the tests meet the bridging document and design requirements.
- 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 Contractor shall work cooperatively with Judicial Council/Judicial Council's representative to develop a formal commissioning plan to demonstrate the Microgrid performs to the project requirements.
 - 2. Overall System Tests - The Contractor shall demonstrate that the Microgrid Control System 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, BESS, overall site controls, Gen Set, and DER interact as intended in grid connected, islanded mode and transitions between grid connected and islanded mode. The contractor shall support any testing required by the utility.
- 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 the Microgrid Control System furnished for the Project. These books shall contain all illustrations, assembly drawings, outline drawings, wiring diagrams, replacement parts list that includes part number

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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 installation 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 Microgrid 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.

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.
- 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.

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2.02 EQUIPMENT AND MATERIALS FOR ALTERNATE DESIGN PROPOSALS

- A. Microgrid Control Systems Shall Meet the Following Minimum Requirements:
1. At least three of the same systems proposed for this Project (including overall design and software systems), have been installed in a behind-the-meter arrangement with a utility in the United States and are fully operational.
 2. The Microgrid Control System 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.
- B. The Contractor shall have overall responsibility for the safety of the electrical design and installation of the Microgrid Control System.
- C. The Microgrid Control System 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.
- D. All racks and metallic conductive members shall be solidly grounded.
- E. Incorporate disconnect switches for AC and DC power disconnect in compliance with applicable codes and utility requirements.
- F. 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.
- G. Microgrid Control System shall meet the following requirements:
1. All monitoring equipment associated with the Microgrid control system shall record and report data at the same time interval.
 2. 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.
 3. Monthly timescale on the monitoring platform to be aligned with utility billing cycle where possible.
 4. Monitoring at a minimum shall provide the following real-time and logged parameters on a 15-min interval or less and be accessible in a web-based portal for the life of the project
 - a. BESS (Charging/Idle/Discharging, Grid Connected/Island, Normal/Fault)
 - b. DER Status
 - c. Instantaneous power and accumulated energy output (kW and kWh) for both BESS and Site Load, and other DER
 - d. BESS State of Charge (usable kWh and % of total capacity available for discharge)
 - e. System Warning and alarms

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- f. System Logs of operations and alarms
- 5. Microgrid Control System 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.
- 6. The Microgrid Control System shall provide all reporting required to obtain incentives.
- 7. The Microgrid Control System must meet the following requirements.
 - a. Determine if the Microgrid System is in imminent danger of failing to meet specified performance levels or potential safety hazards exist.
 - b. Determine if the Microgrid System components 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. The 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.
- 8. This Project may participate in grid service markets as identified in the bridging documents, Contract or during design. The Microgrid Control Systems 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.

2.03 POWER CONVERSION SYSTEM (PCS) FOR ALTERNATE DESIGN PROPOSALS

- A. PCS (Inverters) shall meet the following requirements:
 - 1. 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.

2.04 INFORMATION SECURITY FOR ALTERNATE DESIGN PROPOSALS

- A. 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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2.05 MISC. SYSTEM REQUIREMENTS FOR ALTERNATE DESIGN PROPOSALS

- A. Systems shall meet and 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. All exterior equipment shall be designed for an outdoor environment with a minimum NEMA 3R rating and to be sunlight and UV resistant.
- C. 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. 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.
- D. 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.
- E. 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.
- F. Bolted connections shall be non-corrosive and include locking devices designed to prevent twisting over the design life of the Microgrid Control System.
- G. 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 life.

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.

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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).

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.

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- 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.

3.04 SAFETY FOR ALTERNATE DESIGN PROPOSALS

- A. The 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.

3.05 TESTING & COMMISSIONING

- A. Contractor shall develop a commissioning plan and commission the Microgrid to the requirements of the listed/applicable standards, to industry best practices and to demonstrate the Microgrid 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 Microgrid 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

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d. Electric Infrastructure.

- B. Factory testing shall be performed and documentation provided as noted in Section 1.07 of this specification.
- 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 Microgrid.
- 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 Microgrid 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 Microgrid Control System.
 - 4. Performance reporting, including energy cost savings provided by the Microgrid Control System.
 - 5. End-of-life disposal of Microgrid components and/or BESS 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.

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