**ATTACHMENT C**
**PV SYSTEM SPECIFICATIONS AND REQUIREMENTS**

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## 1. Site Access

Proposer shall conform to all School rules and requirements for accessing sites. The School or the City of San Francisco may regulate road usage, road closures, number of vehicles, access points, etc. Site visits shall be approved and proper check-in requirements must be followed. Proposer shall provide signage and/or electronic notification of possible operational impacts upon School request. Unless otherwise determined by School, Proposer shall be responsible for providing bathroom and storage facilities for all workers on-site, and shall be responsible for procuring, installing, securing, and removing temporary security fencing and scaffolding.

## 2. Project Management

### 2.1 PROJECT MANAGER

Proposer shall assign a Project Manager from their firm upon execution of the Agreement and receipt of Notice to Proceed. The Project Manager shall ensure that all contract, schedule, and reporting requirements of the Project are met and shall be the primary point of contact for the School.

### 2.2 PROJECT SCHEDULE

A Project Schedule is to be prepared and submitted to the School within 10 days of Agreement execution. The School will review and approve the Project Schedule prior to the initiation of work. Updates shall be submitted every other week, though the School may allow less frequent updates at their discretion. The submittal shall be a Critical Path Method (CPM) schedule describing all Project activities including design, equipment procurement, construction, and commissioning.

The following Mandatory Milestones shall be reflected in the schedule and where applicable, represents the dates upon which each milestone is to be achieved for all sites in the Agreement.

### Mandatory Milestones

| Mandatory Milestone | Date |
|---|---|
| 50% Schematic Design submittal | 6/12/15 |
| 90% Design Development submittal | 6/26/15 |
| 100% Construction Documents submittal for permitting | 7/2/15 |
| Approved Construction Documents | 7/12/15 |
| Notice to Proceed | 7/13/15 |
| Mobilization | 7/20/15 |
| Substantial Completion | 8/7/15 |
| Final Completion | 8/14/15 |

### 2.3 SUBMITTALS

Proposer shall provide the following submittals as part of the performance of the Work. The cost of developing and providing submittals shall be included in the Project price.

### Agreement Submittals

| Submittal | Submittal Date | Exhibit D.1 Section |
|---|---|---|
| **I. System Design** | | **TBD** |
| a. System Design Documentation | At each design milestone | TBD |
| b. Warranties | At Construction Documents milestone | TBD |
| c. Testing Plan | At Construction Documents milestone | TBD |
| d. Power production modeling | At Construction Documents milestone | TBD |
| **II. Procurements and Construction** | | **TBD** |
| a. Safety Plan | 30 days before commencement of construction | TBD |
| b. As-built Documentation | After completion of Proving Period | TBD |
| **III. Testing** | | **TBD** |
| a. Acceptance Test Results | After Acceptance Test | TBD |
| b. Startup Test Results | After Startup Test | TBD |
| c. Monitoring Data (Proving Period) | Continually throughout Proving Period | TBD |
| d. Proving Period Report | 30 days after System Startup | TBD |
| **IV. Training** | | **TBD** |
| a. Training Materials | 30 days before Training Session | TBD |
| b. Monitoring Manual | 30 days before Training Session | TBD |
| c. Operations & Maintenance Manual | 30 days before Training Session | TBD |

### 2.4 SOLAR INCENTIVES

Where applicable, Proposer shall submit applications for all available energy incentives (e.g., GoSolarSF, SGIP, SREC, etc.) or, should the School already have submitted such applications, assume responsibility for all future requirements (agreements, submittals, etc.) related to these programs. This includes actions necessary to ensure compliance with the Utility net metering program and all interconnection agreements and related documents for School participation and utilization of the benefits of each applicable program. Proposer shall attend all site verification visits conducted by the applicable public utility or Governmental Authority and shall assist the School in satisfying the requirements of the incentive program. Proposer shall be responsible for providing updated documentation to incentive program administrators throughout the project, as required by rules of the relevant incentive programs. Incentives shall be paid to the Proposer.

### 2.5 INTERCONNECTION

Proposer shall be responsible for preparing, submitting, and procuring interconnection application through appropriate utility and department. Proposer shall accept responsibility for payment for utility interconnection studies and/or project management that are not anticipated but may be required. All anticipated utility work (e.g. transformer installation, meter addition) shall be the responsibility of the Proposer. At project completion, Proposer shall confirm Permission To Operate with the utility, and shall verify most financially-beneficial rate schedule and billing for the School.

Proposer must comply with all interconnection requirements. Systems installed as part of this project will take advantage of Net Energy Metering (NEM), unless specified otherwise by School or its agents. Proposer shall be responsible for ensuring the system design and interconnection qualifies for NEM, as applicable.

## 3. System Design

## 3.1 DESIGN REVIEW PROCESS/ PHASES

The School will review and approve design documentation based on the requirements in this RFI and as detailed in Section 3.3 of this document. The School may request additional documents as needed. Prior to the first design submission, the Proposer and School shall agree upon precise organization and format of the design submittals. The School will review all submittals, provide written comments, and conduct Design Review Meetings for each stage of the process. Proposer shall provide additional detail, as required, at each successive stage of the Design Review. Proposer shall not order equipment and materials until Schematic Design submittals have been approved. Proposer shall not begin construction until Construction Documents have been approved and all required permits have been obtained. The School will formally approve, in writing, each phase of the design and is the sole arbiter of whether each phase of the design has been completed. The Proposer shall not enter a subsequent design phase without the approval of the School.

Proposer is responsible for providing designs approved by the appropriate professional engineers registered in the State of California. Costs for engineering reviews and approvals shall be borne by the Proposer. System designs must take into account School aesthetic issues and not conflict with any current School operations.

## 3.2 PROPOSERS' LICENSE CLASSIFICATION

The School requires that Respondents possess, at the time of submission of a Proposal, at the time of award of the Agreement and at all time during construction activities, a General Contractor License (B), Electrical Contractor License (C-10), or Solar Contractor License (C-46). It shall be acceptable for a Respondent that does not possess a C-10 or C-46 License to list a Subcontractor with a C-10 or C-46 License.

## 3.3 DESIGN SUBMITTALS

### 3.3.1 Plan Set

Proposer shall prepare a comprehensive submittal package for each phase of the Work that will be reviewed and approved by the School. At a minimum, each submittal package shall include the elements required to convey in sufficient detail the following for each phase of the design:

- Site Layout Drawings, with distances from roof edges and existing equipment, as applicable
- Construction Specifications (trenching, mounting, etc.)
- Equipment Layout Drawings
- Electrical Single-Line Diagram
- Module Stringing Diagrams
- Electric Wire and Conduit Schedule
- Electrical Warning Labels & Placards Plans
- Network Connection Diagrams
- Architectural Drawings
- Structural/Mechanical Drawings
- Manufacturer's Cut Sheets with Equipment Specifications
- Data Acquisition System (DAS) Specifications, Cut Sheets, and Data Specifications

Proposer shall include adequate time for School review and approval of submittals, as well as re-submittals and re-reviews. Minimum School review time shall be seven (7) days from the date of receipt of each submittal package during each phase of the Design Review.

### 3.3.2 Production Modeling

Production modeling of the PV systems shall be performed using HelioScope, System Advisor Model (SAM), PVSYST, or equivalent modeling software using TMY3 weather data for the location closest to the site. The simulations shall accurately simulate energy production for proposed system layouts, sizes, and orientation. It is critical that PV production models are accurate with all methodology and assumptions described. The School will independently verify production models are accurate to the designed systems and utilize simulation results for economic evaluations. Proposer shall be responsible for updating the production models each time sufficient changes are made to the proposed system designs that will impact production.

Proposer shall avoid excessive shading on modules to the extent possible. Where shading losses are encountered, Proposer shall perform a shading analysis justifying the basis for their design and explaining why shading does not create an adverse performance and/or economic impact.

## 3.4 PERMITS AND APPROVALS

Construction Documents must be reviewed and approved by all authorities having jurisdiction (AHJs) over the work, which may include, but are not limited to: the School, the City or County in which the work is being done, and the utility. Proposer shall be responsible for obtaining all approvals and shall account for permitting and inspection requirements in their system designs, project pricing, and schedule. Proposer shall attend all site verification visits conducted by the applicable public utility or Governmental Authority, including any special inspections for trenching, rebar, concrete, welding, and roof attachment work, according to AHJ requirements. The School will not grant Proposer relief based on Proposer's incomplete or incorrect understanding of permitting and approval requirements.

## 3.5 TECHNICAL REQUIREMENTS

### 3.5.1 General Considerations

All documentation and components furnished by Proposer shall be developed, designed, and/or fabricated using high quality design, materials, and workmanship meeting the requirements of the School and all applicable industry codes and standards. The installations shall comply with at least, but not limited to, the latest approved versions of the International Building Code (IBC), National Electrical Code (NEC), Utility Interconnection Requirements, California Building Standards Commission Codes, and all other federal, state, and local jurisdictions having authority.

### 3.5.2 Electrical Design Standards

The design, products, and installation shall comply with at least, but not limited to, the following electrical industry standards, wherever applicable:

- Illumination Engineering Society of North America (IESNA) Lighting Standards

- Institute of Electrical and Electronics Engineers (IEEE) Standards
- National Electrical Manufacturers Association (NEMA)
- Underwriters Laboratories, Inc. (UL)
- National Fire Protection Association (NFPA)
- California Public Utility Commission (CPUC) and Utility Requirements
- American National Standards Institute (ANSI)
- Occupational Health and Safety Administration (OSHA)
- International Code Council (ICC) Codes
- California Building Standards Commission (BSC) Codes

### 3.5.3 Modules

In addition to the above, the PV modules proposed by Proposer shall comply with at least, but not limited to, the following:

- IEEE 1262 "Recommended Practice for Qualifications of Photovoltaic Modules".
- System modules shall be UL1703 listed and CEC listed.
- Modules shall be new, undamaged, fully warranted without defect.
- If PV modules using hazardous materials are to be provided, then the environmental impact of the hazardous material usage must be disclosed, including any special maintenance requirements and proper disposal/recycling of the modules at the end of their useful life.

### 3.5.4 Inverters

In addition to the above, inverters proposed by Proposer must comply with at least, but not limited to the following:

- Inverters shall be suitable for grid interconnection and shall be compliant with all Utility interconnection requirements.
- IEEE 929-2000 – "Recommended Practice for Utility Interface of Photovoltaic Systems".
- Inverters shall be UL 1741 and IEEE 1547 compliant.
- Inverters shall be CEC-listed with an efficiency of 95.5% or higher.
- Inverters must automatically reset and resume normal operation after a power limiting operation.
- Inverters shall be sized to provide maximum power point tracking for voltage and current range expected from PV array for temperatures and solar insolation conditions expected for Project conditions.
- Enclosures shall be rated NEMA 3R when the inverter is located outdoors. For outdoor installations in corrosive environments, NEMA 4X series 300 stainless steel enclosures must be used.
- Inverter selection shall take into account anticipated noise levels produced and minimize interference with School activities.

### 3.5.5 Electrical Balance of System Components

- Each proposed PV system shall include, at a minimum, one fused DC disconnect and one fused AC disconnect for safety and maintenance concerns.
- String combiner boxes shall be arc-fault-detecting, load-break, disconnecting types, such that opening the combiner boxes shall break the circuit between combiner box feeders and inverters.
- All wiring materials and methods must adhere to industry-standard best practices, and all inter-module connections must require the use of a specialized tool for disconnecting.

### 3.5.6 Mounting Systems

The mounting systems shall be designed and installed such that the PV modules may be fixed or tracking with reliable components proven in similar projects, and shall be designed to resist dead load, live load, corrosion, UV degradation, wind loads, and seismic loads appropriate to the geographic area over the expected 25-year lifetime. Proposer shall conduct an analysis, and submit evidence thereof, including calculations, of each structure affected by the performance of the scope described herein, and all attachments and amendments. The analysis shall demonstrate that existing structures are not compromised or adversely impacted by the installation of PV, equipment, or other activity related to this scope. Mounting systems must also meet the following requirements at a minimum:

- All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 25-year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.
- Thermal loads caused by fluctuations of component and ambient temperatures shall be accounted for in the design and selection of mounting systems such that neither the mounting system nor the surface on which it is mounted shall degrade or be damaged over time.
- Each PV module mounting system must be certified by the module manufacturer as (1) an acceptable mounting system that shall not void the module warranty, and (2) that it conforms to the module manufacturer's mounting parameters.
- For unframed modules, bolted and similar connections shall be non-corrosive and include locking devices designed to prevent twisting over the 25-year design life of the PV system.
- Proposer shall utilize tamper-resistant PV module-to-rack fasteners for all PV module mounting.
- Final coating and paint colors shall be reviewed and approved by the School during Design Review.
- Painting or other coatings must not interfere with the grounding and bonding of the array.

### 3.5.7 Corrosion Control

In addition to the above, Corrosion Control proposed by Proposer must comply with at least, but not limited to the following requirements:

- Fasteners and hardware throughout system shall be stainless steel or material of equivalent corrosion resistance
- Racking components shall be anodized aluminum, hot-dipped galvanized steel, or material of equivalent corrosion resistance
- Unprotected steel not to be used in any components
- Each PV system and associated components must be designed and selected to withstand the environmental conditions of the site (e.g., temperatures, winds, rain, flooding, etc.) to which they will be exposed.

### 3.5.8 Roofing Requirements

The installation of PV modules, inverters and other equipment shall provide adequate room for access and maintenance of existing equipment on the building roofs. A minimum of three feet of clearance will be provided between PV equipment and existing mechanical equipment and other equipment mounted on the roof. Clearance guidelines of the local fire marshal shall be followed. The installation of solar systems will be reviewed for code compliance and adherence to the *State Fire Marshal Solar Photovoltaic Installation Guideline*. The PV equipment shall not be installed in a way that obstructs airflow into or out of building systems or equipment.

Proposed roof top mounted systems may be ballasted or penetrating systems and must meet or exceed the following requirements:

- Systems shall not exceed the ability of the existing structure to support the entire solar system and withstand increased wind uplift and seismic loads. The capability of the existing structure to support proposed solar systems shall be verified by Proposer prior to design approval.
- Roof penetrations, if part of the mounting solution, shall be kept to a minimum.
- Proposer shall perform all work so that existing roof warranties shall not be voided, reduced, or otherwise negatively impacted. As part of the design submittals, Proposer shall include signed certificates from the roofing manufacturer stating:
    - The roofing contractor is certified installer of Complete Roofing System.
    - The manufacturer's Technical Representative is qualified and authorized to approve project.
    - Project Plans and specs meet the requirements of the warranty of the Complete Roofing System for the specified period.
    - Existing warranty incorporates the new roofing work and flashing work.
- No work shall compromise roof drainage, cause damming or standing water or cause excessive soil build-up.
- All materials and/or sealants must be chemically compatible.
- All penetrations shall be waterproofed.
- School shall approve in writing the detail(s) for the sealing of any roof penetrations, as part of system design review and approval. Approval must be made prior to Proposer proceeding with work. The School will also make available the manufacturer for the existing roof in consultation with Proposer as part of the design process.
- Proposer is responsible for remediating any damage to roofing material during installation of solar systems.

### 3.5.9 Shade Structure Requirements

Intentionally left blank.

### 3.5.10 Ancillary Equipment Enclosures

Proposer will be responsible for incorporating the following elements in the design and construction of the System:

- Location: all ancillary equipment shall be located in a manner that minimizes its impact to normal School operations and minimizes the visual impacts to the site.

### 3.5.11 Placards and Signage

- Placards and signs shall correspond with requirements in the National Electric Code and the interconnecting utility in terms of appearance, wording, and placement.
- Permanent labels shall be affixed to all electrical enclosures, with nomenclature matching that found in As-Built Electrical Documents.

### 3.5.12 Infrastructure for Ground Mount Systems

Intentionally left blank.

### 3.5.13 Wiring and Cabling Runs

- Proposer shall install all AC conductors in conduit.
- Conduit installed on building roofs shall be installed in a manner to reduce visibility. Any conduit penetrations through roof surfaces shall not be made within one (1) foot of the roof edge to reduce visibility. If conduit is installed on the exterior face of any building, it shall be painted to match the existing building color. In all cases, the visible impact of conduit runs shall be minimized and the design and placement of conduit shall be reviewed and approved by the School as part of Design Review.
- All exposed conduit runs over 100-feet in length or passing over building connection points shall have expansion joints to allow for thermal expansion and building shift.
- Design Builder shall install and secure the exposed string cable homeruns along the beams or structure where any combiner box is installed.
- All exposed string wiring must be installed above the lower surface of the racking members. Wire loops under framing members are not acceptable.
- Acceptable wire loss in DC circuits is < 1.5% and acceptable wire loss in AC circuits is < 1.5% as well.
  - All cable terminations, excluding module-to-module and module-to-cable harness connections, shall be permanently labeled.
  - All electrical connections and terminations shall be torqued according to manufacturer specifications and marked/sealed at appropriate torque point.

### 3.5.14 Grounding and Bonding

- Module ground wiring splices shall be made with irreversible crimp connectors.
- All exposed ground wiring must be routed above the lower surface of any structural framing.

### 3.5.15 Monitoring System, DAS, and Reporting

Proposer shall design, build, activate and ensure proper functioning of Data Acquisition Systems (DAS) that enable the School to track the performance of the PV Systems as well as environmental conditions through an online web-enabled graphical user interface and information displays. Proposer shall provide equipment to connect the DAS via existing hardline, Wi-Fi network, or cellular data network at all locations. The means of data connection will be determined during design.

The DAS(s) shall provide access to at least the following data:

- Instantaneous AC system output (kW)
- PV System production (kWh) over pre-defined intervals that may be user configured
- In-plane irradiance
- Ambient and cell temperature
- Inverter status flags and general system status information
- System availability
- Site Load information. Available load data for the meter the system is connected to shall be collected by the solar monitoring solution as part of the DAS.

Environmental data (temperatures and irradiance) shall be collected via an individual weather station installed at the site

Data collected by the DAS shall be presented in an online web interface, accessible from any computer through the Internet with appropriate security (e.g., password controlled access). The user interface shall allow visualization of the data at least in the following increments: 15 minutes, hour, day, week, month, and year. The interface shall access data recorded in a server that may be stored on-site or remotely with unfettered access by the School for the life of the Project. The online interface shall enable users to export all available data in Excel or ASCII comma-separated format for further analysis and data shall be downloadable in at least 15-minute intervals for daily, weekly, monthly and annual production.

The Monitoring system shall enable School staff to diagnose potential problems and perform remediating action. The monitoring system shall provide alerts when the system is not functioning within acceptable operating parameters. These parameters shall be defined during the design phase of the Project and specified in the DAS design document. At a minimum, School shall have the ability to compare irradiance to simultaneous power production measurements through linear regression analysis.

Additionally, Proposer shall make available, at no additional cost, the following reports for a term of 5 years after Final Completion of the project:

- Monthly Production report shall be available online to the School personnel.
- System performance data shall be made available electronically to the School in a format and at a frequency to be determined during the Design Review process.
- Additional reports shall be made available to the School to assist the School in reconciling system output with utility bills and the production guarantee, as determined in the Design Review process.

A Monitoring Manual shall be provided to the School in printed or on-line form that describes how to use the monitoring system, including the export of data and the creation of custom reports.

## 3.6 WARRANTIES

Proposer shall provide at least a twenty (20) year warranty on modules, and ten (10) year warranty on inverters against defects in materials and workmanship under normal application, installation, and use and service conditions.

Additionally, the following minimum warranties are required:

- PV Modules: The PV modules are to be warranted against degradation of power output of greater than 15% of the original minimum rated power in the first ten (10) years and greater than 20% in the first twenty (25) years of operation.
- Inverters: Inverters shall carry a minimum ten (10) year warranty.
- Meters: At minimum, meters shall have a five (5) year warranty. For meters integrated in inverters, the meter warranty period must match the inverter.
- Mounting system: Minimum fifteen (15) year warranty, covering at least structural integrity and corrosion.
- Balance of system components: The remainder of system components shall carry manufacturer warranties conforming to industry standards.

All warranties must be documented and be fully transferable to the School.

All work performed by Proposer must not render void, violate, or otherwise jeopardize any preexisting School facility or building warranties or the warranties of system components.

## 4. Procurement/Construction

### 4.1 TREE REMOVAL

No trees shall be removed as part of the Project.

### 4.2 LINE LOCATION

Proposer will be responsible for locating, identifying and protecting existing underground utilities conduits, piping, substructures, etc. and ensuring that no damage is inflicted upon existing infrastructure. In addition to USA Dig and utility line-locating, a private line-locator must be used for any project requiring underground work.

### 4.3 QUALITY CONTROL

To ensure safety and quality of the installation, Proposer shall:

- Keep the Site clean and orderly throughout the duration of construction. All trash and rubbish shall be disposed of off-site by licensed waste disposal companies and in accordance with applicable Law.
- Fully comply with all applicable notification, safety and Work rules (including School safety standards) when working on or near School facilities.
- Provide all temporary road and warning signs, flagmen or equipment as required to safely execute the Work. Street sweeping services shall also be provided as required to keep any dirt, soil, mud, etc. off of roads. Comply with all state and local storm water pollution prevention (SWPP) ordinances.

### 4.4 REMOVAL AND REMEDIATION

Proposer shall remove all construction spoils, abandoned footings, utilities, construction equipment and other byproducts of construction. All disturbed areas including landscaping, asphalt, and concrete shall be remediated to be in equal or better condition than found. Parking lots shall be re-striped if affected by construction operations.

The site shall be left clean and free of debris or dirt that has accumulated as a result of construction operations.

## 5. Testing and Commissioning

Following completion of construction, Proposer shall provide the following services related to startup and performance testing of the PV systems:

- Acceptance Testing
- System Startup
- Proving Period

A detailed Testing Plan covering each of the phases above shall be submitted and approved by the School prior to substantial completion of construction. A detailed description of each phase is provided below.

### 5.1 ACCEPTANCE TESTING

Proposer shall perform a complete acceptance test for each PV System. The acceptance test procedures include component tests as well as other standard tests, inspections, safety and quality checks. All testing and commissioning shall be conducted in accordance with the manufacturer's specifications.

The section of the Testing Plan that covers Acceptance Testing shall be equivalent or superior to the CEC (California Energy Commission) "Guide to Photovoltaic (PV) System Design and Installation", Section 4 and shall cover at least the following:

- Detailed list of all items to be inspected and tests to be conducted.
- Acceptance Criteria: For each test phase, specifically indicate what is considered an acceptable test result.

The Acceptance Testing section of the Testing Plan shall include (but not be limited to) the following tests:

- String-level voltage (open circuit) and amperage (under load) testing for all PV strings. Amperage testing shall be performed concurrently with irradiance testing.
- Inverter testing for all inverters. The inverters shall be commissioned on-site by a qualified technician and shall confirm that the inverter can be operated locally per specification and that automatic operations such as wake-up and sleep routines, power tracking and fault detection responses occur as specified. Performance testing shall be performed concurrently with irradiance testing.
- Testing of all sensors of the DAS.
- Testing of the Data Presentation interface of the DAS.

After Proposer conducts all Acceptance Testing based on the Testing Plan approved by the School prior to substantial completion, Proposer shall submit a detailed Acceptance Test Report to the School for review.

The Acceptance Test Report shall document the results of the tests conducted following the Testing Plan, and include additional information such as the date and time each test was performed. It shall also make reference to any problem and deficiencies found during testing. If there was troubleshooting done, the Report shall describe the troubleshooting methods and strategy. Proposer shall be responsible for providing the labor and equipment necessary to troubleshoot the System.

## 5.2 PROVING PERIOD (30 DAYS)

Upon completion of Acceptance Testing and System Startup, and approval by the School, Proposer shall monitor the system during a thirty (30) day Proving Period and submit a report for School review and approval prior to final acceptance by the School. This includes monitoring system output and ensuring the correct functioning of system components over this time. The values for the following data shall be acquired every fifteen (15) minutes over thirty (30) days:

- AC system output (kW)
- PV system production (kWh)
- In-plane irradiance
- Ambient and cell temperature
- Inverter status flags and general system status information
- System availability

Proposer shall utilize calibrated test instruments and the DAS and monitoring system to collect the test data described above, which shall be made available to the School for access throughout the Proving Period. Proposer shall determine through analysis of data from the Proving Period whether the PV system delivers the expected production as determined by the final approved design (i.e., Construction Documents). Actual production shall be compared against expected production using actual weather data and other system inputs (such as module cell temperature factor, module mismatch, inverter efficiency, and wiring losses) for calculating expected production. The production figures for all meters, whether existing or installed by or on behalf of the IOU or by or on behalf of the Respondent, shall be correlated during this test to verify their accuracy in measuring system production.

All data and reports required in Section 3.5.15 shall be fully functional and available to the School at the commencement of the Proving Period. Data and reporting requirements are included in the testing scope of the Proving Period and deficiencies in these areas (including missing data, inaccurate reports, and other issues that make validation of system performance inconclusive) shall be grounds for denying approval of the Proving Period Report.

If the PV system does not perform to design specifications, Proposer shall perform diagnostic testing. Deficiencies shall be identified with proposed corrective actions submitted to the School, and the Proving Period test repeated. Proposer shall be responsible for providing the labor and equipment necessary to troubleshoot the system. The Proving Period Report shall be submitted after the successful completion of this phase and submitted to the School for review and approval. The report shall contain, but not be limited to, the following information; calculations shall be provided in Excel format with formulas visible to allow for peer review:

- System description
- Test period
- Test results
- Anomalies identified during test
- Corrective action performed
- Actual measured performance
- Calculations detailing expected performance under TMY conditions

## 5.3 CLOSE-OUT DOCUMENTATION REQUIREMENTS

Close-Out documents prepared by Proposer must include at minimum, but not limited to, the following items:

- Final As-Built Drawing Set with accurate string diagram, provided in (2) hard copy sets and an electronic copy in both DWG and PDF format (or as desired by School).
- Megger test Results
- Module flash-test results with serial numbers
- Component warranties
- Signed inspections cards from AHJ and required Special Inspections
- Interconnection agreements and Permission To Operate
- Owner's Manual

### 5.4 TRAINING

The Proposer shall provide two (2) hours of on-site training for School personnel in all aspects of operation, routine maintenance, and safety of the PV systems, DAS, and monitoring solution. At a minimum, training topics shall include the following:

- PV system safety, including shut-down procedures
- PV module maintenance and troubleshooting
- Inverter overview and maintenance procedures
- Calibration and adjustment procedures for the inverters and tracking systems (if any)
- DAS and monitoring solution, including standard and custom reporting

Proposer shall submit a proposed Training Plan during the design process for approval and provide all training materials and manuals to support on-site training in advance of scheduled training sessions (see schedule of submittals in Section 2.3, "Submittals"). The on-site portion of the training program shall be scheduled to take place at the jobsite at a time agreeable to both the School and Proposer.

## 6. Operations and Maintenance

Proposer shall offer Operations and Maintenance services for ten (10) years with their Proposal, with an option to extend the Contract for up to an additional ten (10) years. The School reserves the right to not execute the Operations and Maintenance services agreement. In offering such services, Proposer shall perform all necessary preventive and corrective maintenance, which includes routine maintenance adjustments, replacements, and electrical panel/transformer/ inverter cleaning (interior and exterior) with supporting documentation delivered to the School after the Work has been performed. Maintenance by Proposer shall ensure that all warranties, particularly inverter warranties, are preserved. Proposer shall determine the frequency and timing of panel wash-downs based on system monitoring data, as described below. Environmental sensors such as pyranometers shall be tested and recalibrated at least once every three (3) years.

For any maintenance visits, Proposer shall give 3-day advance notification to School, and no on-site visits shall be performed without approval of the School, except in case of emergency.

Proposer shall perform the following maintenance services, at a minimum, as described in the following sections:

### 6.1 PREVENTIVE MAINTENANCE

Preventive Maintenance shall be performed at least annually and include:

- System testing (voltage/amperage) at inverter and string levels
- System visual inspection to include but not be limited to the list below. All discovered issues should be resolved as needed.
  - Inspect for stolen, broken or damaged PV modules, record damage and location. Report to the School and wait for the School to authorize a course of action.
  - Inspect PV wiring for loose connections and wire condition.
  - Inspect for wires in contact with the structure or hanging loose from racking.
  - Check mechanical attachment of the PV modules to the racking.
  - Check attachment of racking components to each other and the structure.
  - Verify proper system grounding is in place from panels to the inverter.
  - Check conduits and raceways for proper anchorage to structures.
  - Inspect all metallic parts for corrosion.
  - Check combiner boxes for proper fuse sizes and continuity.
  - Inspect all wiring connections for signs of poor contact at terminals (burning, discoloration).
  - Inspect disconnects for proper operation.
  - Survey entire jobsite for debris or obstructions.
  - Inspect fasteners for proper torque and corrosion.
  - Inspect inverter pad for cracking or settling.
  - Inspect electrical hardware for proper warning and rating labeling.
  - Inspect alignment of arrays and racking to identify settling foundations or loose attachments.
  - Inspect operation of tracking hinges, pivots, motors and actuators if present.
  - Check for proper operation and reporting of monitoring hardware.
  - Inspect sealed electrical components for condensation buildup.
  - Inspect wiring and hardware for signs of damage from vandalism or animal damage.
- Routine system maintenance to include correction of loose electrical connections, ground connections, replacement of defective modules found during testing, other minor maintenance repair work.
- Module cleaning, at a frequency to be determined by the ongoing monitoring of the system such that effect on production is no more than 5%, but not less often than twice a year.
- Routine DAS maintenance to include sensor calibration and data integrity check.

## 6.2 TROUBLESHOOTING, INSPECTION AND ADDITIONAL REPAIRS

- Dispatch of field service resources within two business days of notification (via automated or manual means) for repairs as necessary to maintain system performance.
- Any corrective action required to restore the system to fully operational status shall be completed within 24 hours of the service resources arriving on-site.
- Major system repairs, not to include mid-voltage switchgear or transformers.

## 6.3 CUSTOMER SERVICE SUPPORT

- Support telephone line made available to School staff to answer questions or report issues.

- Support line shall be staffed during operational hours from 8 am – 6 pm California Standard Time. During times outside of this operational period, an urgent call shall be able to be routed to a supervisor for immediate action.

## 6.4 MAJOR COMPONENT MAINTENANCE AND REPAIR

- Inverter repair and component replacement and refurbishment as required in the event of inverter failure.
- Inverter inspection and regular servicing as required under inverter manufacturer's warranty specifications. Those include but are not limited to the following annually:
  - Check appearance/cleanliness of the cabinet, ventilation system and all exposed surfaces.
  - Inspect, clean/replace air filter elements
  - Check for corrosion on all terminals, cables and enclosure.
  - Check all fuses.
  - Perform a complete visual inspection of all internally mounted equipment including subassemblies, wiring harnesses, contactors, power supplies and all major components.
  - Check condition of all the AC and DC surge suppressors.
  - Torque terminals and all fasteners in electrical power connections.
  - Check the operation of all safety devices (E-stop, door switches).
  - Record all operating voltages and current readings via the front display panel.
  - Record all inspections completed.
  - Inform inverter manufacturer of all deficiencies identified.
  - Oversee inverter manufacturer performance of In-Warranty replacement of failed inverter components.
- Customer advocacy with vendors.

## 6.5 OTHER SYSTEM SERVICES

- O&M Manuals – Proposer shall provide three (3) copies of O&M Manuals. Updated editions of O&M Manuals shall be sent electronically to the School as they become available.
- Management of long-term service and warranty agreements, ongoing.
- Proposer shall log all maintenance calls and document all maintenance activities. These activities shall be presented in a report, which is to be submitted to the School upon request.

O&M services shall be priced separately from the design and construction of the PV system. Proposer shall submit a detailed description of their O&M services, detailing the activities and the intervals at which they will be performed, with their Proposal.