3/12/12

SARATOGA LIBRARY SOLAR PHOTOVOLTAIC SYSTEM

OVERVIEW

THIS PROCUREMENT IS FOR A FIXED DOLLAR AMOUNT. THE WINNING QUALIFIED BIDDER WILL BE SELECTED BASED ON THE HIGHEST GUARANTEED *ANNUAL* AC KILOWATT HOUR PRODUCTION OF THE SYSTEM AS CALCULATED BY THE Incentive Calculator - CSI Standard PV available at http://www.csi-epbb.com/default.aspx to calculate the production. All Bidders will use the following specifications to calculate production:

Zip Code: 95070

Utility PG&E

Customer Type: Commercial

Incentive Type: EPBB

Mounting Method: >3”-6”

Shading: Minimal Shading

Array Azimuth: 180 degrees

Results: Annual kWh (a)

SYSTEM PERFORMANCE WILL BE MEASURED BY THE MONITORING SYSTEM, #23, 24, IN THE SPECIFICATIONS.

1. PRODUCTION GUARANTEE

Bidder (“you or your”) will guarantee that the System will produce a range of kilowatt hours of electric energy (“kWh”) in each of the first **5** years of operation.

The Guarantee Year is each successive period of a calendar year from the date you first establish internet communication with the monitoring system to the next anniversary date.

1. Guaranteed Range of Annual Production is your estimate of the range of production for each Guarantee Year based on the **Incentive Calculator - CSI Standard PV**. It will be measured by the monitoring equipment that you install.

2. Actual amount of electricity produced is weather dependent and directly proportional to the amount of solar irradiation and will vary from year to year.

3. Difference in Production. At the end of the third year of system operation the City, at its option, will calculate the difference in production between the actual and 95% of the Bidder's Guaranteed Production. A negative difference in production may result in an invoice from the City for the difference in kilowatt-hours x 80% of the average actual billed utility cost per kilowatt-hour for the previous year.

4. Conditions, Shading, Module cleaning after the Project is accepted by the City. The City will be responsible for removing debris, leaves, and dirt accumulation as well as preventing the construction of any structures that might shade the array. It will insure that power is available to the communications system for the Internet for the minimum number of continuous hours specified by the monitoring and reporting system you install.

5. Exclusions.

    a. If someone other than your company or authorized representative tests, removes, reinstalls or repairs the system.

    b. A power or voltage surge caused by someone other than you.

    c. A grid supply voltage outside of the standard range specified by the local utility or outside of the range of the equipment specifications.

    d. A local power outage or curtailment by the utility or PUC.

    e. Any Force Majeure Event affecting performance of the System or the Monitoring System including:

    Acts of God; war (declared or undeclared); riot; insurrection; civil unrest or disturbance; military or guerilla action; terrorism; economic sanction or embargo; civil strike; work stoppage; slow-down, or lock-out; explosion; fire; earthquake; abnormal weather condition or actions of the elements including abnormal lack of sunshine; hurricane; flood; lightning; wind; drought; the binding order of any governmental agency; changes in any applicable law relating specifically to the design, construction, installation, interconnection or operation of any part of the system which is implemented after beginning of system operation that materially and adversely affects the ability of the Bidder to perform its obligations.

f. A change in usage of the building or adjacent buildings that may affect insolation.

ELECTRICAL SPECIFICATIONS

THE 2010 CALIFORNIA ELECTRICAL CODE (C.E.C.), the 2008 NEC, and THE LATEST EDITION OF CAL.OSHA, AND ALL APPLICABLE LOCAL RULES AND REGULATIONS SHALL BE THE GOVERNING AUTHORITY FOR ALL WORK PERFORMED AND PRODUCTS DELIVERED.

1.1 FURNISH LABOR AND MATERIAL AND INSTALL ELECTRICAL WORK COMPLETE AS SHOWN ON THE DRAWINGS. WORK SHALL INCLUDE ALL MATERIALS ON THE PLANS AND THAT WHICH IS NECESSARY TO MAKE A COMPLETE WORKING INSTALLATION OF THE ELECTRICAL SYSTEMS SHOWN OR DESCRIBED HEREIN.

Prior to construction, the following shall be provided:

1. Detailed system shut down and start up instructions

2. Safety and O&M training manuals

3. Summary of safety training program given in person to City personnel

4. Detailed maintenance plan and schedule

1.2 DO ALL CUTTING, PATCHING, REPAIRING NECESSARY FOR THE PROPER INSTALLATION OF WORK AND REPAIR ANY DAMAGE DONE, COORDINATING THIS WORK WITH THAT OF OTHER CRAFTS.

1.3 CONTRACTOR SHALL BE HELD TO HAVE EXAMINED THE SITE AND COMPARED IT WITH THE SPECIFICATIONS AND PLANS AND TO HAVE SATISFIED HIMSELF AS TO THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED. HE SHALL BE HELD RESPONSIBLE FOR KNOWLEDGE OF ALL EXISTING CONDITIONS WHETHER OR NOT ACCURATELY DESCRIBED, NO SUBSEQUENT ALLOWANCE SHALL BE MADE FOR ANY EXTRA EXPENSE DUE TO FAILURE TO MAKE SUCH EXAMINATION.

2. ALL EQUIPMENT AND MATERIALS SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL MATERIALS SHALL BE NEW AND U.L. LISTED.

3. THE NECESSARY FACILITIES FOR CONSTRUCTION POWER IS AVALABLE ON SITE. ENERGY COSTS SHALL BE PAID BY OWNER.

4. PAY ALL INSPECTION AND OTHER APPLICABLE FEES; PROCURE ALL LICENSES AND PERMITS NECESSARY TO THE PROSECUTION AND COMPLETION OF ELECTRICAL WORK, INCLUDING A NO CHARGE CITY BUILDING DEPARTMENT PERMIT.

5. CONTRACTOR SHALL GUARANTEE ALL WORK AND MATERIALS INSTALLED UNDER THIS CONTRACT FOR A PERIOD OF ONE (1) YEAR FROM DATE OF ACCEPTANCE BY OWNER. IN ADDITION, CONTRACTOR SHALL PROVIDE AND COMPLETE THE MANUFACTURER'S WARRANTY DOCUMENTS PRIOR TO FINAL PAYMENT.

6. VERIFY EXISTING CONDITIONS IN FIELD AND MAKE ADJUSTMENTS AS REQUIRED TO SUIT SUCH CONDITIONS.

7. ALL WORK REQUIRING INTERRUPTION OF EXISTING CIRCUITS, USE OF OWNER'S FACILITIES, OR DISRUPTION OR INTERRUPTION OF ONGOING OWNER ACTIVITIES SHALL BE COORDINATED WITH THE OWNER.

8. **AS-BUILTS**: SUBMIT TO THE OWNER ONE (I) MARKED UP PRINT OF "AS-BUILT" CONDITIONS OF ALL WORK UNDER THIS SECTION.

9. **SAFETY PRECAUTIONS**: PROVIDE AND MAINTAIN THROUGHOUT THE WORK ADEQUATE SAFEGUARDS INCLUDING BARRIERS, WARNING SIGNS, ENCLOSURES AND LIGHTS, TO PREVENT ACCIDENTAL INJURY TO PERSONS OR DAMAGE TO PROPERTY.

10. **PROTECTION:** PROTECT ALL WORK, MATERIALS AND EQUIPMENT FROM DAMAGE FROM ANY CAUSE WHATSOEVER AND PROVIDE ADEQUATE AND PROPER STORAGE FACILITIES DURING THE PROGRESS OF THE WORK. PROVIDE FOR THE SAFETY AND GOOD CONDITION OF ALL WORK UNTIL FINAL ACCEPTANCE OF WORK BY THE OWNER, AND REPLACE ALL DAMAGED OR DEFECTIVE WORK, MATERIALS, AND EQUIPMENT BEFORE REQUESTING FINAL ACCEPTANCE.

11. **DRAWINGS**: THE GENERAL ARRANGEMENT OF MODULES, INVERTERS, AND EQUIPMENT, AS SHOWN ON THE PLANS, IS DIAGRAMMATIC AND APPROXIMATELY CORRECT AS TO THE LOCATIONS, WHERE MINOR CHANGES ARE REQUIRED BECAUSE OF STRUCTURAL CONDITIONS OR FOR THE CONVENIENCE OF THE OWNER, SUCH CHANGES SHALL BE MADE WITHOUT ADDITIONAL EXPENSE TO THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURATE LOCATIONS OF ALL EQUIPMENT, ETC., WITH RESPECT TO THE WORK OF OTHERS, NO EXTRAS WILL BE ALLOWED ON

ACCOUNT OF MOVING WORK UNDER THIS SECTION TO AVOID INTERFERENCE WITH WORK OF OTHER CONTRACTORS.

12. **SUBMITTALS**: CONTRACTOR SHALL SUBMIT A COMPLETE LIST OF ALL PROPOSED MATERIALS AND EQUIPMENT WITHIN 15 DAYS OF AWARD OF CONTRACT. CONTRACTOR SHALL MAKE NO SUBSTITUTIONS OF MATERIALS OR EQUIPMENT WITHOUT WRITTEN APPROVAL OF THE OWNER. ALL DIMENSIONAL OR ELECTRICAL CHANGES, OR CHANGES TO OTHER WORK WHICH ARE REQUIRED BY, OR ARE A RESULT OF, AN ACCEPTABLE ELECTRICAL SUBSTITUTION SHALL BE THE SOLE AND COMPLETE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER.

13. **INSPECTION**: ALL WORK AND MATERIALS COVERED BY THIS SPECIFICATION SHALL BE SUBJECT TO INSPECTION AT ANY AND ALL TIMES BY REPRESENTATIVES OF THE OWNER. WORK SHALL NOT BE CLOSED IN OR COVERED BEFORE INSPECTION AND APPROVAL BY THE OWNER OR HIS REPRESENTATIVE. ANY MATERIAL FOUND NOT CONFORMING WITH THESE SPECIFICATIONS SHALL, WITHIN 3 DAYS AFTER BEING NOTIFIED BY THE OWNER, BE REMOVED FROM PREMISES; IF SAID MATERIAL HAS BEEN INSTALLED, ENTIRE EXPENSE OF REMOVING AND REPLACING SAME, INCLUDING ANY CUTTING AND PATCHING THAT MAY BE NECESSARY, SHALL BE BORNE BY THIS CONTRACTOR.

14. **TESTS:** UPON COMPLETION OF WORK AND ADJUSTMENT OF ALL EQUIPMENT, ALL SYSTEMS SHALL BE TESTED UNDER THE DIRECTION OF THE OWNER TO DEMONSTRATE THAT ALL EQUIPMENT FUNCTIONS ELECTRICALLY AND ELECTRONICALLY IN THE MANNER REQUIRED, ALL SYSTEMS SHALL TEST FREE FROM SHORT CIRCUITS AND GROUNDS AND SHALL BE FREE FROM MECHANICAL AND ELECTRICAL DEFECTS. ALL CIRCUITS SHALL BE TESTED FOR PROPER NEUTRAL CONNECTIONS. CONTRACTOR SHALL REMOVE AND REPLACE ALL DEFECTIVE WORKMANSHIP AND/OR MATERIALS AT NO EXPENSE TO OWNER.

15. **CLEANUP:** AT COMPLETION OF WORK, THIS CONTRACTOR SHALL CLEAN UP AND REMOVE ALL DEBRIS AND MATERIALS NOT INSTALLED IN WORK, LEAVING PREMISES CLEAN.

16. **CONDUCTORS**;

16.1 CONDUCTORS SHALL BE INSULATED COPPER, NO, 10 AWG MINIMUM SIZE, THHN/THWN, SOLID OR STRANDED (EXCEPT FOR LOW VOLTAGE WIRING AND WHERE SPECIFICALLY NOTED OTHERWISE ON THE PLAN)

TO KEEP VOLTAGE DROP LOW AND TO ALLOW FOR FUTURE ADDTIONS TO THE ARRAY, MINIMUM DC FEEDER SIZES:

SHALL BE 250 mcm FOR SINGLE CENTRAL INVERTER SYSTEM DESIGNS FROM A DC RE-COMBINER.

SHALL BE #1/0 FROM EACH COMBINER BOX FOR MULTIPLE INVERTERS.

16.2 ALL CONDUCTORS NO, 8 AND LARGER SHALL BE STRANDED.

16.3 WIRE COLOR CODE SHALL BE AS FOLLOWS:

	120/240 VAC	**277/480 VAC**
A PHASE -	BLACK	BROWN
B PHASE -	RED	ORANGE
C PHASE -	BLUE	YELLOW
NEUTRAL –	WHITE	NEUTRAL GREY
GROUND –	GREEN	GREEN

DC

UNGROUNDED CONDUCTOR	BLACK
GROUNDED CONDUCTOR	WHITE

16.4. FOR CONDUCTORS NO, 6 AND LARGER, INSULATION COLOR MAY BE BLACK WITH TAPE BANDS (COLORED PER ABOVE) LOCATED AT EACH END OF THE CONDUCTOR RUN AND AT ALL OTHER LOCATIONS REQUIRED BY THE C.E.C.

16.5 ALL CONDUCTORS SHALL BE RUN IN APPROVED RACEWAY U.O.N.

17. **CONDUIT AND WIREWAYS**:

17.1. ALL CONDUITS SHALL BE U.L. LISTED AND BEAR THE LABEL OF THE NATIONAL BOARD OF FIRE UNDERWRITERS.

17.2. RIGID NONMETALLIC CONDUIT:SCHEDULE 40 PVC PLASTIC FOR UNDERGROUND OR UNDER SLAB INSTALLATIONS, RATED 90 DEGREES C WITH GLUE-ON PVC COUPLINGS AND FACTORY MADE ELBOWS AND SWEEPS; CARLON "PLUS 40". SCHEDULE 80 PVC FOR EXPOSED CONDUIT OR NIPPLES.

17.3. ELECTRICAL METALLIC TUBING (EMT): GALVANIZED STEEL. FOR DRY INTERIOR WORK PROVIDE STEEL SET-SCREW TYPE FITTINGS, FOR DAMP AND WET INTERIOR LOCATIONS AND FOR EXTERIOR WORK PROVIDE WRENCH TIGHTENED, COMPRESSION TYPE (WATERTIGHT) STEEL FITTINGS U.O.N. DIE CAST ZINC, MALLEABLE IRON OR INDENTING TYPE FITTING ARE NOT PERMITTED. FIELD BENT CONDUIT SHALL BE FREE OF DENTS OR REDUCTION OF CROSS SECTIONAL AREA.

17.4. RIGID STEEL CONDUIT (GRS): HOT-DIPPED GALVANIZED WITH THREADED ONE-PIECE COUPLINGS AND FACTORY MADE ELBOWS. NIPPLES THROUGH 12" IN LENGTH SHALL BE FACTORY MADE. CONNECTORS THREADED TYPE WITH BONDING LOCKNUT, INSULATED THROAT AND NEOPRENE O-RING. PROVIDE GRS FOR INSTALLATIONS SUBJECT TO DAMAGE RESULTING FROM CRUSHING OR BENDING.

17.5. NO ELECTRICAL CONDUITS SHALL BE COVERED BEFORE INSPECTION AND APPROVAL BY THE OWNER. CONTRACTOR SHALL NOTIFY OWNER THAT CONDUITS ARE READY FOR INSPECTION PRIOR TO INSTALLATION OF CONDUCTORS.

17.6. CONDUITS SHALL BE INSTALLED IN A RIGID AND SATISFACTORY MANNER WITH SUPPORT SPACED NOT MORE THAN 5 FEET APART U.O.N. CONDUITS SHALL BE INSTALLED TO OUTLET BOXES WITH LOCKNUTS AND BY BUSHING OR OTHER APPROVED DEVICES. CONDUITS SHALL BE JOINED BY APPROVED CONDUIT COUPLINGS AND SHALL HAVE ENDS BUTTED IN ALL CASES WHERE COUPLINGS ARE USED. CONDUITS SHALL BE TIGHTLY CORKED AND OTHERWISE WELL PROTECTED DURING CONSTRUCTION AND BLOWN OUT AND SWABBED BEFORE WIRES ARE PULLED. REAM ALL CONDUITS ENDS AFTER CUTTING. BENDS SHALL BE MADE WITH STANDARD CONDUIT ELBOWS OR CONDUIT BENT TO NOT LESS THAN SAME RADIUS, ALL BENDS SHALL BE FREE FROM DENTS OR FLATTENING.

17.7 PVC CONDUITS: MAKE COUPLINGS AND CONNECTORS WATERTIGHT IN ALL RUNS. UTILIZE SOLVENT CEMENT OF TYPE APPROVED BY CONDUIT MANUFACTURER. PROVIDE ADAPTERS AND LOCKNUTS WHERE CONDUIT IS ATTACHED TO METAL BOXES AND PANELS.

17.8. RACEWAY RUNS SHOWN ON DRAWINGS ARE DIAGRAMMATIC UNLESS SPECIFICALLY DIMENSIONED. DETERMINE EXACT LOCATIONS OF ALL UNDIMENSIONED RACEWAY RUNS IN FIELD.

17.9. LOCATIONS AND ROUTES OF EXPOSED RACEWAYS REQUIRE OWNER APPROVAL PRIOR TO INSTALLATION. PREPARE LAYOUTS OF PROPOSED EXPOSED RACEWAY LOCATIONS/ROUTES AND SUBMIT FOR OWNER'S WRITTEN APPROVAL PRIOR TO ROUGH-IN.

17.10. COORDINATE PLANNED ROUTES WITH WORK OF OTHER TRADES.

18. **GROUNDING**: ALL DEVICES, FIXTURES, RACEWAY, EQUIPMENT ETC. SHALL BE GROUNDED VIA A GROUNDING CONDUCTOR RUN THROUGH THE RACEWAY OR CABLE. WIRING DEVICES SHALL BE GROUNDED THROUGH A COPPER WIRE, SIZED TO COMPLY WITH CODES. A GROUNDING CONDUCTOR SIZED TO COMPLY WITH CODES SHALL BE INSTALLED IN ALL CONDUITS AND CABLES.

18.1. **GROUND RODS**: COPPER OR COPPER-CLAD STEEL, MINIMUM 5/8" DIAMETER. PROVIDE MINIMUM 8 FOOT LONG RODS WHERE DIRECT BURIED (NON-ACCESSIBLE) AND MINIMUM 10 FOOT LONG RODS WHERE INSTALLED IN GROUND WELLS OR OTHER ACCESSIBLE LOCATIONS.

19. **MAIN DISTRIBUTION PANELBOARD IN ELECTRIC ROOM.**

Re: NEC 690.64

THE AC DISCONNECT BREAKER SHALL HAVE INTERNAL COMMON TRIP. BREAKER SHALL HAVE THE SAME INTERRUPTING CAPACITY AS THE OTHER BREAKERS IN THE PANEL. IT SHALL BE RATED FOR 480 VAC. IT SHALL BE INDENTIFIED WITH A PERMANENTLY FIXED NUMBER EITHER ENGRAVED IN BAKE-LITE AND ATTACHED TO PANEL FRONT, STAMPED IN THE STEEL PANEL FRONT OR SNAPPED INTO THE BREAKER BODY. STICK-ON “DYMO” TYPE IS NOT ACCEPTABLE.

20. **IDENTIFICATION OF SWITCHES** AND APPARATUS: ALL PANELBOARDS, COMBINERS, RECOMBINERS, CONTROL DEVICES, INVERTER, AND DISCONNECT SWITCHES SHALL BE IDENTIFIED WITH ENGRAVED NAMEPLATES. NAMEPLATE 1/4" LETTERING (WHITE LETTERS-BLACK FIELD).

21. **DC COMBINER PANELS** SHALL BE Aurora Vision-Power-one SMART COMBINER for grounded arrays, or equal, and MUST BE CAPABLE OF:

MONITORING at the STRING LEVEL;

CURRENT MONITORING;

MODBUS/RS-485 COMMUNICATION INTERFACE;

TOUCH SAFE FUSE HOLDERS

NEMA 4/4X ENCLOSURE;

NEC COMPLIANT AND CSA LISTED TO UL-1741 & IEC 61439

MANUAL OUTPUT DISCONNECT WITH LOCK OUT, TAG OUT;

SURGE PROTECTION FOR TYPE 2 PROTECTION;

22. **RE-COMBINER**, IF USED, SHALL BE SOLAR BOS RCT-04-200-N4 OR EQUAL AND MUST HAVE THESE FEATURES:

LISTED TO UL-1741

NEMA 4 ENCLOSURE

NON-LOAD BREAK DISCONNECTS FOR EACH STRING COMBINER INPUT. [SEE NEC 690.13-17]

INPUT CIRCUIT FUSING

RATED FOR CONTINUOUS DUTY

23. **DATA ACQUISITION SYSTEM** SHALL BE AURORA UNIVERSAL COMMERCIAL, DECK MONITORING, OR EQUAL. IT SHALL BE CAPABLE OF INTEROPERABILITY WITH THE INVERTER, MULTIPLE STRING COMBINERS, METERS, AND ENVIRONMENTAL MONITORS.

SOLAR DATA, MANAGEMENT AND CONTROL SYSTEM: Contractor shall provide a data monitoring system, complete with all hardware and software to allow continuous monitoring of the critical system performance metrics from a remote location set up within the City through the Ethernet connection that you will install. Monitoring system shall include remote computer interactive display of installed system, output performance of each solar string, input/output performance of inverter(s), total system output to utility grid connection. System shall be able to flag and report any equipment malfunctions or should system or components, on an identified component basis, fall below their normal operating range. System shall be able to retain performance history for one year. Contractor shall work with and train City personnel on use of system and provide all programming to allow the system to illustrate monitored data in a user friendly and simple manner acceptable to the City.

All Software and Firmware Operational Documentation required for the SMCS shall be listed in the submission and provided prior to instruction, including, but not limited to:

1. Software operating and upgrade manuals, if any

2. Hardware operating manuals

The SMCS system shall be capable of, and the completed system, shall perform the following:

1. Direct monitor and display the following information (unless otherwise revised):

a. DC-input voltage and ampere to the inverter, instantaneous and cumulative.

b. AC-voltage, frequency and ampere output from the inverter (line-to-line and line-to neutral) three phase, instantaneous.

c. Instantaneous DC-kW input and AC-kW output at the inverter (calculated or direct monitor).

d. Irradiance solar energy incident on the PV solar array (single point monitor for each array).

e. Ambient environment conditions:

1. Outdoor temperature at the surface of the PV solar array (single point monitor for each array).

2. Outdoor general ambient air temperature.

f. DC-kWh input and AC-kWh output at the inverter, summation by day-week-month-year and grand cumulative (calculated or direct monitor).

g. The completed system shall also include the following devices to monitor environmental conditions:

1. Ambient air temperature measuring devices

2. PV panel temperature measuring devices

3. Solar irradiance sensors

2. Perform Solar Photovoltaic System Data Collection, Calculation and Display Requirements (In Total)

a. PV system operating hours, summation by day-week-month-year and grand cumulative total.

b. Carbon Footprint reduction

c. Solar contribution offset to electrical energy usage

d. Monetary savings and renewable energy credits earned, if applicable.

e. Actual versus predicted system performance according to PV Watts

f. Inverter power and energy production

g. Utility net meter power and energy

h. Calculate greenhouse gas offset for the PV system operation. Calculation based on U.S. Department of Energy, Greenhouse Gas Emissions Coefficients for Electrical power Generation, by electric utility companies Statewide for install location:

1. CO2 gas

2. NOX

3. SO2

i. Monitor each DC PV combiner box to detect and report DC circuit faults. The detection method shall be fault by individual string fault condition location.

1. “Blown” DC circuit fuse

j. Each sensor/transducer unit shall be suitable for outdoor and indoor locations, as applicable for the install location. Each unit shall be provided with any necessary protective shielding, power supplies and conductor terminals.

k. System shall have data logger with the following general capability:

1. Collect data from inverters and sensors/transducers. Analyze data and convert data to digital format for display and communications over the LAN and Internet. Multiple parallel input/output channels, self-contained photovoltaic system data logger with power supply.

2. Ports: Provide analog and digital input ports for each sensors/transducers monitor point, RS485 communication port, and Fast Ethernet port for local area network monitoring and Internet remote monitoring.

l. For Public Education and Demonstration:

1. Contractor to provide a visual graphic video display output port for local visual public graphic video display in the building lobby.

2. It will be an optional City responsibility to provide Graphic Visual Display Screen to visually show the PV system information, including photovoltaic system status, alarms, and electrical information. This shall consist of a self contained flat screen panel type display, surface wall mount as follows:

(1). Indoor public graphic video display local photovoltaic system “Public access information kiosk”, nominal 32” display screen size, 16:9 screen aspect ratio, color, and LCD screen type.

(2). Surface wall mount support bracket to attach to wall and graphic video display screen. The location of the video screen shall be as approved by the City.

3. The graphic video display of PV system information shall update automatically at time intervals not exceeding 15 minutes.

m. The System shall provide a real-time high-definition graphical overview of the system via the Internet that displays the following information at 30 second intervals. This information shall also be capable of being displayed, in whole or in part, on the public education video display:

1. Instantaneous solar PV energy production in kW
2. Instantaneous Building consumption in KW
3. Instantaneous Utility grid import in kW
4. Instantaneous Utility grid export in kW
5. Instantaneous Energy production in kWh
6. Instantaneous kWh Net in and out from facility
7. Instantaneous Solar irradiance
8. Instantaneous Outside air temperature
9. Instantaneous PV panel temperature
10. Instantaneous solar performance metric
12. Avoided Greenhouse Gas Emissions (CO_2, NO_x, SO_2)

SYSTEM COMMISSIONING - Commissioning of the completed system shall be performed by the Contractor. The Commissioning Plan shall include checklists and verifications in the following Project Phases: Design, Installation, Operation (Function and Performance Checks), and Turn-Over. Sample checklists and forms for recording this data shall be provided by the solar firm.

a. System inspection and safety checks: Contractor shall run through a checklist of start up requirements based on manufacturers’ standards and recommendations, and conduct a series of safety tests to ensure proper installation, safe operation and

specified performance. The City and its authorized representatives must be present during the commissioning process. Final acceptance of the commissioning process will be by the City and or designated representative, the Commissioning Agent, the Utility and code enforcement agency.

b. String voltage and current readings: Voltages will be recorded for each string, using calibrated instrumentation. Measurements will be recorded and provided to the local representatives in a clear, tabular format. Each voltage measurement will include the following ancillary data: the date; the time of day that the measurement was taken; the cell temperature at the time; and the solar irradiation at the time. The strings that make up each sub-array will be clearly identified on a drawing by number.

c. After inverter startup: Current shall be recorded for each string. Measurements will be recorded and provided to the local units in a clear, tabular format. Each voltage measurement will include the following ancillary data: the date; the time of day that the measurement was taken; the cell temperature at the time; and the solar irradiation at the time. The strings that make up each sub-array will be clearly identified on a drawing by number.

d. Inverter startup tests: Test shall be as specified by the inverter manufacturer in the inverter operation manual and conducted by a factory-authorized technician. Proof of such authorization must be presented and approved by the local representative prior to commencing work on the Project.

e. Additional commissioning and start up data to be provided include:

1. Actual power vs. predicted power
2. Loss of grid
3. Grid resume
4. Random module shading
5. Data monitoring check out
6. Measure Voc of every source circuit and log it
7. Measure ac power and compare to predicted power
8. Verify tightness of all wiring terminations
9. Verify proper marking and labeling of all wire terminations and enclosures
10. Verify shut-down procedures

11. Verify start-up (“wake-up”) procedures

12. Verify system 5-minute delay upon re-start

13. Verify PV array quick connectors are fully mated and wires neatly secured

14. Verify no debris on the modules, no damaged or broken modules

15. Verify Total Harmonic Distortion and Power Factor

f. A final report shall be provided to the City in five (5) copies and one (1) electronic copy which includes all reports and test data for the commissioning and system start up.

24. ENVIRONMENTAL METEOROLOGICAL MEASUREMENT SYSTEM SHALL BE AURORA ENVIRONMENTAL OR EQUAL WITH THE FOLLOWING CAPABILITIES: CONTINUOUS MEASUREMENT OF: CELL TEMPERATURE; PLANE OF ARRAY IRRADIANCE; AND, AMBIENT TEMPERATURE

MODBUS RS485 COMMUNICATION INTERFACE;

SunSpec Ver 1.1 compliant;

MOUNTING POLE

25. **GRID TIED INVERTER(S)** SHALL:

BE SIZED TO MEET NEC REQUIREMENTS FOR THE PHOTOVOLTAIC ARRAY.

CONNECT TO BUILDING 480/277V 3 PHASE MAIN DISTRIBUTION BOARD.

MAY BE ONE CENTRAL INVERTER OR SEPARATE INVERTERS FOR EACH PHASE.

BE HOUSED IN NEMA ENCLOSURE RATED FOR EXPOSED OUTDOOR MOUNTING;

SHALL HAVE BUILT IN DC DISCONNECT SWITCHES;

HAVE DC INPUT TERMINALS SIZED FOR UP TO 250mcm CONDUCTORS;

HAVE AN OUTPUT TRANSFORMER

BE ENCLOSED ON ALL SIDES EXCEPT THE TOP, TO MATCH THE ADJACENT BUILDING EXTERIOR. HAVE LOCKABLE GATE(S) TO ACCESS ALL SERVICEABLE COMPONENTS, DOORS, PANELS AND HATCHES OF THE INVERTER. ENCLOSURE MUST CONFORM TO NEC 110.26 ‘SPACES ABOUT ELECTRICAL EQUIPMENT’.

A SINGLE CENTRAL INVERTER, OR THE SUPPORT FRAME FOR MULTIPLE INVERTERS, SHALL BE MOUNTED ON A 12" THICK REINFORCED CONCRETE PAD PER THE MANUFACTURER'S SPECIFICATIONS. TOP OF PAD TO BE 6" ABOVE GRADE.

MULTIPLE INVERTERS SHALL BE MOUNTED ON A STRUT FRAME. SEE SKETCH, BELOW. ALL CONNECTIONS TO BE FASTENED WITH MINIMUM 3/8 BOLTS, NUTS, WASHERS, LOCK WASHERS. FRAME SHALL BE BRACED TO WITHSTAND SEISMIC FORCES IN 2 LATERAL PLANES. IT SHALL BE FASTENED AT THE UPPERMOST PART OF THE FRAME TO A HORIZONTAL STRUT WHICH IS FASTENED TO THE BUILDING FRAMING AT 3 POINTS WITH MINIMUM 5/6 X 4" LAG SCREWS.

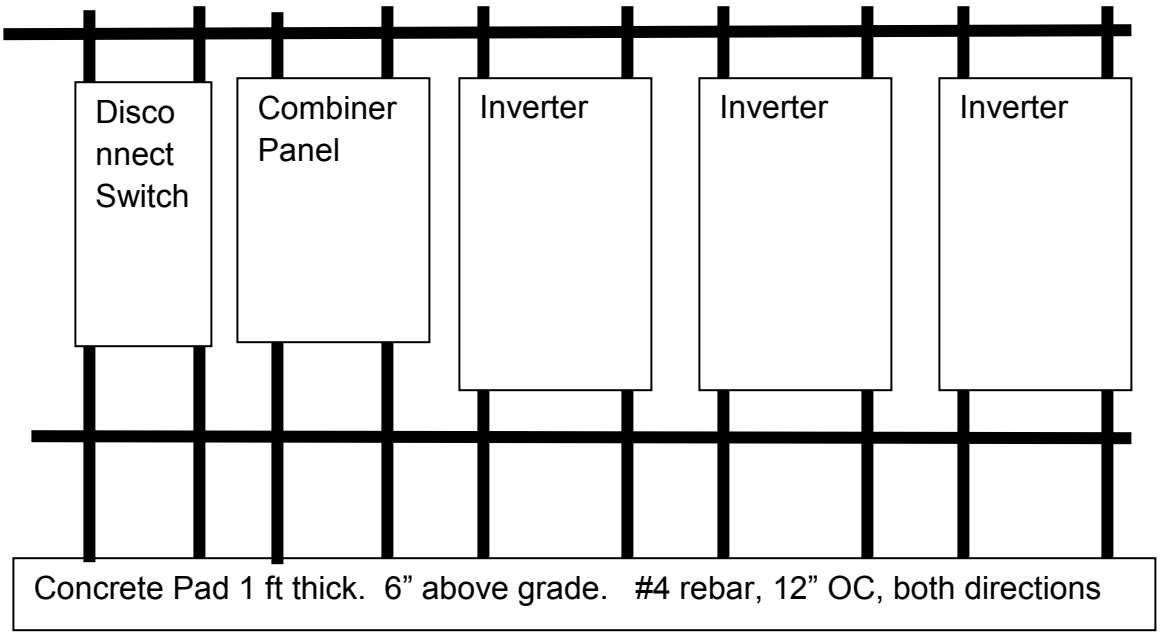
SUGGESTED INVERTER MOUNTING FRAMING:

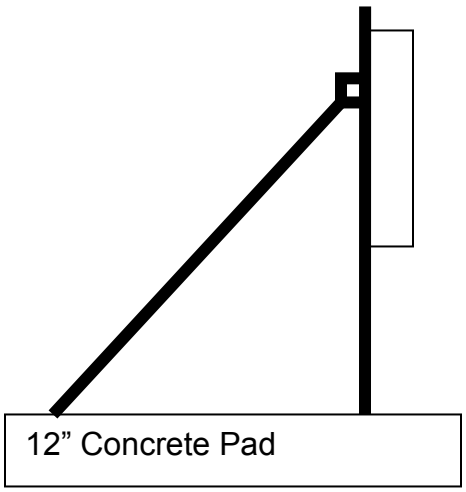
Use B-Line or equal for: Vertical and diagonal struts: B22SH 1-5/8" galv. Strut. with 3/8" attachment hardware.

Attach B22SH vertical struts to concrete pad use B280SQ. Anchor with 1/2" X 5" concrete anchors, Red Head, Hilti, or similar, with approved epoxy system.

Provide 2 diagonal braces from the ends of the top bar to rear of pad.

Attach with B248 45 deg. Angle brackets





26. **PHOTOVOLTAIC MODULES** SHALL BE ON THE LIST OF ELIGIBLE SB1 GUIDELINES COMPLIANT PHOTOVOLTAIC MODULES FOR INCENTIVES IN CALIFORNIA.

26.1 **MODULE FRAME AND MOUNTING RACK GROUND** SHALL BE #6 CU.

27. **WALKWAYS**, MINIMUM 24 INCHES WIDE, SHALL BE MOUNTED ON THE ROOF SLOPE, APPROXIMATELY EVERY 20 FT, TO FACILITATE ARRAY CLEANING AND REPLACEMENT OF DEFECTIVE MODULES. MATERIAL SHALL BE OPEN GRATING TO PROVIDE A SAFE FOOTHOLD IN ICING AND WET CONDITIONS. McNICHOLS HEAVY DUTY GRIP STRUT WALKWAY H-55010-W OR EQUAL. MOUNTING HARDWARE PER MANUFACTURER’S SPECIFICATIONS. WEIGHT OF WALKWAYS INCLUDING SUPPORT SYSTEM AND MOUNTING HARDWARE SHALL BE INCLUDED IN THE TOTAL ALLOWABLE ROOF LOAD PER STRUCTURAL DRAWINGS.

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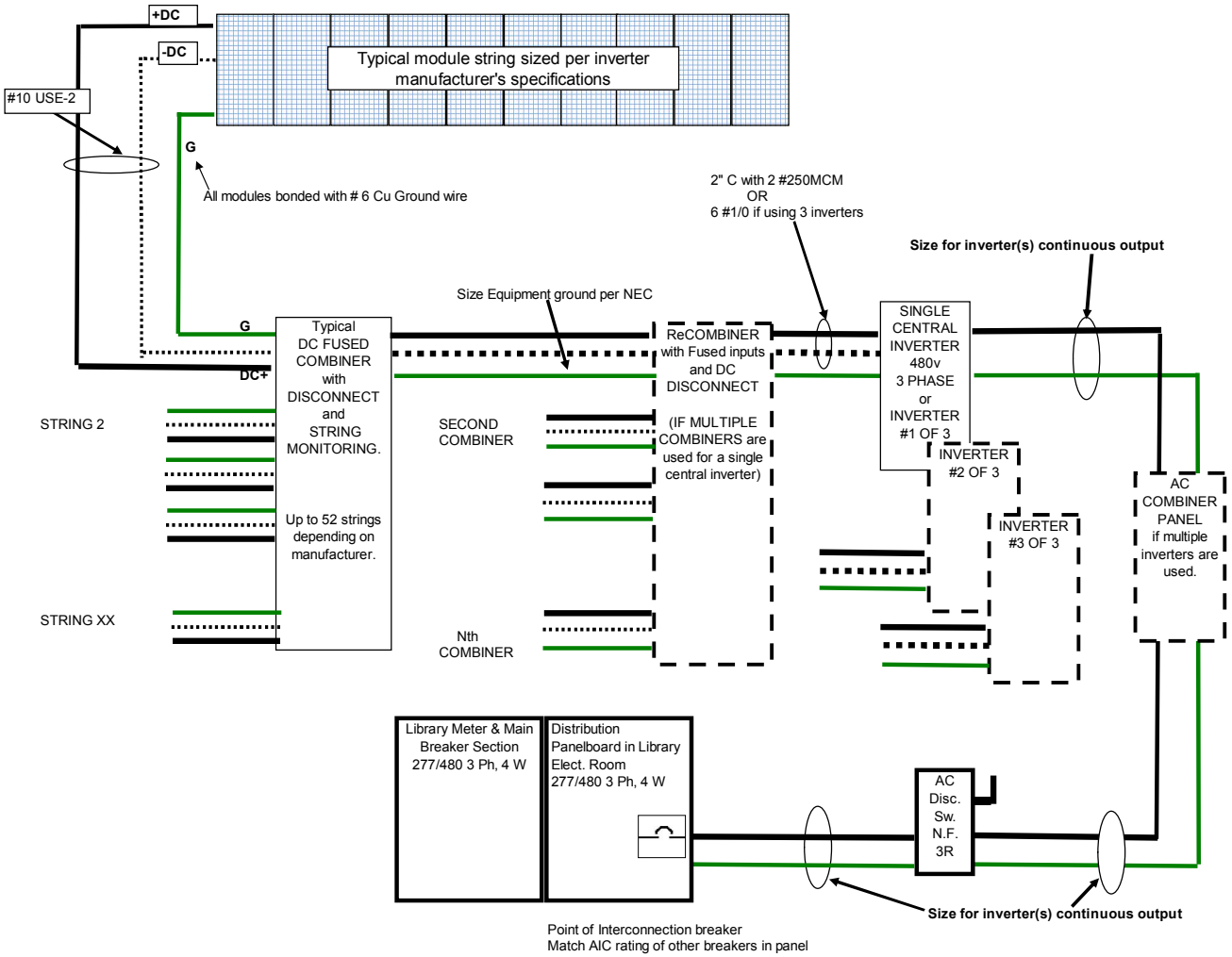
SINGLE LINE WIRING DIAGRAM.
M. Mora 3/9/12