
Invitation to Bid
Construction Services for
MCC High Tunnel,
Solar Photovoltaic (PV) System
McHenry, IL



Center for Agrarian Learning
McHenry County College

8900 U.S. Highway 14
Crystal Lake, IL 60012-2761
815-455-8770

Owners Agent:
J. T. Katrakis & Associates, Inc.
Barrington, IL Chicago, IL

July 16, 2020

**McHenry County College Center for Agrarian Learning
High-Tunnel Solar Photovoltaic System**

**INVITATION TO BID
July 13, 2020**

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PROJECT OVERVIEW

Statement of Purpose: McHenry County College (MCC) is inviting bids to select a vendor to build a Solar Photovoltaic (PV) system at McHenry College's Agrarian Learning Center at the main campus: 8900 U.S. Highway 14 Crystal Lake, IL 60012. The Base Design PV system is intended to generate at least 100% of the annual energy required by the north high tunnel, or about 1,045 kWh per year.

Background: McHenry County College (MCC) is fully committed to integrating sustainable principles into college operations. There are multiple issues that influence the College's approach to sustainability. As an educational institution, MCC educates the public and provides training to individuals so they will achieve their academic and career goals. As a community member, MCC positions itself to be a model of sustainability in the McHenry County area for residents, businesses, and other government entities.

This proposed renewable energy project will support the Agrarian Learning Center's efforts to showcase integrating practical renewable energy technologies into High Tunnel systems that extend the growing season of farmland in Northern Illinois. This project aligns with the College's mission of sharing knowledge and resources to support the College community's educational, social, cultural and economic vitality.

Bidding & Contracting Conditions: This Invitation to Bid (ITB) does not obligate McHenry County College (MCC) or its Board of Trustees to award a contract or complete the proposed project, and each reserves the right to cancel this ITB if it is considered to be in its best interest. Proposals must be clear and concise. Bids that are difficult to follow or that do not conform to the ITB format or binding specifications, may be rejected. Responding vendors must include the required information called for in this ITB. MCC reserves the right to reject a proposal if required information is not provided or is not organized as directed. MCC also reserves the right to change the evaluation criteria or any other provision in this ITB by posting notice of the change(s) on MCC's Bid website, www.mchenry.edu/bid. For this ITB, posting on the captioned website above constitutes written notification to each vendor. Vendors should check the site daily and are expected to review information on the site carefully before submitting a final bid.

INSTRUCTIONS FOR BIDDERS

The scope of work for the ITB requires the respondent to provide information for the design, construction, and installation of a Solar PV System.

Qualifications: The Bidders must meet the following requirements and provide the following documentation:

1. Bidder has been in business and offering the proposed equipment/solution for three years or more and is a state-of-Illinois certified installer of distributed generation systems according to Title 83 Public Utilities; Part 468 Distributed Generation Certification Requirements.
2. Provide an abstract on the company, its history, organization and description of any subcontractor relationships for this project. Specify how long the company submitting the proposal has been in the business of providing supplies and services similar to those requested in this RFP and under what company name. Provide a complete description of any relevant past projects, similar in size and scope to this ITB.

3. At least four (4) references that are using or have used supplies and services of the type proposed in this ITB. The references may include state or municipal governments, universities, colleges, or businesses, for which the respondent, preferably within the last three years, has successfully provided the same service solution. The College will contact the client references for validation of the information provided in the Client Reference Form. If the College finds erroneous information, the proposal may be rejected.
4. Proof that Bidder has designed, permitted, installed (currently providing the full/rated solar generation capability) a minimum of five (5) solar PV Projects in this or adjacent counties that are ground mounted and have a minimum generating capacity of 8 kilowatts (kW) or more within the last five (5) years. Provide reference names, addresses and contact information for each of these projects.

Proposed Approach: Review the design described in this ITB and include the following documentation in your bid submittal:

1. A bid reflecting the ITB design
2. Any recommended or proposed alternates/changes to ITB design and their effect on project cost;
3. Any potential problems/risks that need to be addressed;
4. Management plan including identifying the primary contact and their contact information, team members, sub-contractors. Provide resumes with pertinent experiences for the primary members of the team.
5. Submittals for system components including PV modules, Inverter, racking, balance of system components including wiring/cabaling, metering.

Cost Bid: Provide your stipulated price for the complete project per the performance specs and specifications. The Owner is a tax-exempt organization. Use the bid summary sheets on pages 5-6 to record all itemized, add alternate and unit pricing, answers and other pertinent information.

Bid Submittal Deadline: Bids are due electronically no later than 8:00 AM on August 13, 2020. Bids should be sent to biddocuments@mchenry.edu. Bids sent to any other email will be rejected.

Owner _____	Owner's Agent: _____
Jennifer Jones	John Katrakis
jjones@mchenry.edu	john@jtkatrakisassociates.com
McHenry County College	J. T. Katrakis & Associates, Inc.
8900 U.S. Highway 14	418 North Avenue
Crystal Lake, IL 60012-2761	Barrington, IL 60010
815-455-8770	ph:847-382-1877 cell:847-212-5348

Any questions about the Bid Documents are to be submitted in writing to the Owner's Agent, John Katrakis, of J. T. Katrakis & Associates, Inc. Responses will be posted via addendum at www.mchenry.edu/bid.

PROJECT SCHEDULE

In the attached BID SUMMARY SHEETS (pages 5 to 6) please confirm the feasibility and your ability to perform according to the following project schedule:

+

Milestones	Completion Date
1. Bid Invitation Date	7/21/2020
2. Pre-bid Meeting at High Tunnels (Time:8:00 AM) ¹	07/27/2020
3. Deadline for Submitting Questions	07/31/2020 @ 8:00am
4. Responses to Questions posted to www.mchenry.edu/bid	08/03/2020
5. Bid Due Date/Time	08/13/2020
6. Review by MCC Evaluation Team	09/20/2020
7. Approval by Board of Trustees	09/24/2020
8. Contract awarded/Notice-to-Proceed to Contractor	09/25/2020
9. All Submittals and Shop drawings delivered to Owner ²	10/09/2020
10. Permits Obtained	10/23/2020
11. Construction Completed & System Energized-Begin Warranty Period	11/23/2020
12. Commissioning & Training Completed	12/11/2020

1. The North High Tunnel is one of two high tunnels located at the northeast part of the campus as shown in Figure 1 below.
2. Submittals include: Single-line electrical diagram, specifications & O&M materials on the solar PV panels, inverter, balance of system components, metering, racking, identification labels.



**McHenry County Agrarian Learning Center
 High Tunnel Solar Photovoltaic System
 BID SUBMISSION FORM (1 of 2)**

Bid Submitted By:

Company Name: _____ Date: _____

Address: _____

Signature: _____ Title: _____

Print Name: _____ Phone: _____

E-mail: _____ Fax: _____

- Items	Materials & Equipment	Labor & Overhead	Total
1. Solar PV Modules			
2. Module Rack & Foundation			
3. Balance of System			
3.1 Inverter			
3.2 Power Distribution-DC & AC			
3.3 Grounding, Lightning Protection			
4. All Fees (Permit & Interconnection)			
5. Metering & Performance Monitoring			
6. Commissioning & Training			
7. Overhead & Profit Rate (% of Labor)			
STIPULATED TOTAL BID			
Service Contract (\$/yr)			
Labor Rates (Provide Attachment by Trade)			
Standard			
Overtime			

Checklist of Required Bid Attachments (The following items are included in the Bid Response):

1. ____ Qualifications
2. ____ References for Other Solar PV Projects
3. ____ Projected Energy Generation (kWh/yr)
4. ____ Sketches including Electrical Single-line Diagram (Include proposed DC Voltage) with accompanying narrative.
5. ____ Bid Submission Form (2 pages) plus any attachments

BID SUBMISSION FORM-Continued (2 of 2)

Expected Date to Obtain Permit(s): _____

Expected Date to Start Mobilization: _____

Expected Date of Project Completion: _____

Comments on Ability to Meet Project Schedule: _____

Additional Information and Comments: _____

GENERAL CONDITIONS & REQUIREMENTS

The Contractor is responsible to:

1. Document that they are certified by the State of Illinois to be installers of distributed generation systems according to Title 83 Public Utilities; Part 468 Distributed Generation Certification Requirements.
2. Visit the site and verify all existing field conditions prior to submission of his Bid. The Contractor is responsible for determining the actual location, routing and sizing of the components. No extra charges will be accepted for work that has to be performed due to the contractor's failure to adequately verify existing conditions.
2. Select and install components in compliance with all pertinent codes, standards and certifications including but not limited to NEC Article 690, IEC 61215 and 61646. Use Solar PV modules and Utility-Interactive Inverters that are UL-Listed per the pertinent UL safety standards. All materials and equipment shall be UL listed where available.
3. Equipment, materials and construction procedures shall adhere to sustainable principles.
4. Obtain all Permits, Licenses, Approvals, and other Arrangements for the work required at the Contractors expense.
5. Shipping and Handling of all materials & Equipment
6. All details and costs not mentioned and associated with this scope of work. Notify Owner's Agent of non-functioning related systems necessary for the proper completion of the scope of work; for example non-functioning web-based interface needed for remote monitoring of building performance.
7. Provide the following:
 - 7.1 Project Schedule—to be updated weekly.
 - 7.2 Drawings and submittals for obtaining construction permit
 - 7.3 Drawings showing placement of all new equipment, electrical wiring diagram complete metering interface.
 - 7.4 Design calculations and performance projections
 - 7.5 Interface agreement with utility
 - 7.6 Shop drawings on all equipment
 - 7.7 One copy of all completed equipment start-up forms to the Owner's Agent and Engineer.
 - 7.8 Draft training agenda for review by Owner and Owner's Agent, prior to training the Owner's staff

- 7.9 Four (4) copies of Operation & Maintenance manual with all warranty documents, and completed manufacturer's start-up and testing checklists for all systems in pdf format to the Owner and Engineer.
- 7.10 All drawings shall be in pdf format and provided on flash drives (4 copies) to the Owner & Engineer.
8. Commence when permits are issued.
9. Maintain legal and acceptable building temperatures and electrical power during the construction work. The building is to be notified in advance of any system curtailments related to this scope of work.
10. All trenching wall, roof and floor penetrations, coring, cutting, patching, and fire stopping as necessary for the work. Existing equipment pads may be re-used or extended if of appropriate size and location.
11. Temporary protection of interior furnishings and finishes.
12. Obtain approval from Owner for path to transport materials and equipment from the street to the work site.
13. Maintain work site in a safe and clean manner. Daily clean-up of contractor's work is necessary to allow routine maintenance and normal building activities.
14. Final cleanup of work areas after contractor's activities are completed. Restore all landscaping damaged by deliveries and construction.
15. Provide security as necessary to protect contractor's activities and property.
16. Provide on-site storage or lock boxes as necessary for contractor's activities.
17. All demolition, dumpsters, hauling and waste disposal in compliance with local ordinances.
18. Cranes, rigging and lifting for all required equipment including the pre-ordered products.
19. Arrange for storage and safe-keeping of all supplies and equipment for this job.
20. Coordinate necessary field inspections with City Department of Buildings.
21. Comply with the scope of work, specifications and general conditions and requirements in this document.
22. Implement all work in a workmanlike manner according to industry accepted manner.
23. Verify voltages, frequency, number of phases for all equipment prior to ordering. All final power (line voltage) wiring of all equipment will be done by the contractor's electrical sub-contractor.
24. Repair/replace any fireproofing removed in order to install, repair, or remove any items included in the Contractor's scope of work.

25. Arrange for the responsible contractor to conduct all final inspections and tests in the presence of Owner's Agent and Engineer and to provide at least two completed and signed copies of all manufacturer supplied test and start-up forms. All new equipment shall be cleaned and adjusted as required to operate satisfactorily and witnessed by building personnel.
26. Comply with the following McHenry County Colleges Conditions.

MCHENRY COUNTY COLLEGE GENERAL TERMS AND CONDITIONS

1. **Applicability:** These general terms and conditions will be observed in preparing the bid proposal to be submitted.
2. **Purchase:** After notice of the award, purchase will be put into effect by means of purchase orders or suitable contract documents executed by the Director of Business Services.
3. **Right to Cancel:** MCC may cancel contracts resulting from this ITB at any time for a breach of any contractual obligation by providing the contractor with thirty-calendar day's written notice of such cancellation. Should MCC exercise its right to cancel, such cancellation shall become effective on the date as specified in the notice to cancel.
4. **Proprietary Information:** Bidder should be aware that the contents of all submitted bids are subject to public review and will be subject to the Illinois Freedom of Information Act. All information submitted with your bid will be considered public information unless bidder identifies all proprietary information in the proposal by clearly marking on the top of each page so considered, "Proprietary Information." The Illinois Attorney General shall make a final determination of what constitutes proprietary information or trade secrets. While MCC will endeavor to maintain all submitted information deemed proprietary within MCC, MCC will not be liable for the release of such information.
5. **Negotiation:** MCC reserves the right to negotiate all elements, which comprise the bidder's proposal to ensure the best possible consideration, be afforded to all concerned. MCC further reserves the right to waive any and all minor irregularities in the proposal, waive any defect, and/or reject any and all proposals, and to seek new proposals when such an action would be deemed in the best interest of MCC.
6. **Retention of Documentation:** All bid materials and supporting documentation that is submitted in response to this proposal becomes the permanent property of MCC.
7. **Indemnification:** The Contractor shall protect, indemnify and hold MCC harmless against any liability claims and costs for injury to or death of any person or persons and for loss or damage to any property occurring in connection with or in any incident to or arising out of occupancy, use, service, operations or performance of work in connection with the contract, resulting in whole or in part from the negligent acts or omissions of the Contractor.
8. **Substitutes to Specifications:** Consideration will be given to alternatives if they are a standard manufactured item as evidenced by literature and specifications enclosed with this bid document. A demonstration may be requested. Submit complete specifications for any substitute offered. Your bid should be made on the Bid Submission Form (pp 5-7), and any

- explanation regarding your bid should be attached. A complete disqualification could result without these reference materials attached. Indicate warranty specifications that apply to the items included in your bid.
9. **Disclosure:** Contractors shall note any and all relationships that might be a conflict of interest and include such information with the bid.
 10. **Terms of Payment:** MCC operates under terms of payment for work completed and product delivered within Net 30 days from date of invoice. All payments of invoices need to be approved on a monthly basis. In no case will MCC agree to late fees prior to 60 days before payment is received, this is based on State Statutes for State funded entities.
 11. **Compliance with Law:** Seller will comply with all valid federal, state and local laws and all ordinances and regulations applicable to the manufacture, sale delivery and labeling of the goods ordered and in the performance of any work pursuant hereto. Seller also certifies that the merchandise supplied meets both Illinois Life Safety Code and OSHA regulations.
 12. **Equal Employment Opportunity:** To the extent that Vendor is subject to governmental orders, rules or regulations pertaining to Equal Employment Opportunity and/or to the maintenance or Non-segregated Facilities. Vendor hereby certifies that it is complying therewith, including where applicable, the submission and/or filing of Equal Employment Opportunity Compliance Reports and/or Certificates and/or filing of Certificates on Non-segregated Facilities. Compliance with the rules and regulations of the F.E.P.C., Article III, Section 3.1, Equal Employment Opportunity clause is required.
 13. **Prevailing Wage Law:** The Illinois Prevailing Wage Act, 820 ILCS 130/01 et.seq. shall be mandatory for all contractors and subcontractors who are hired by the College for construction or construction related services. The Act requires contractors and subcontractors to pay laborers, workers, and mechanics performing services on public works projects no less than the prevailing rate of wages in the county where the work is performed. The Illinois Department of Labor periodically determine what rate is in various locales throughout the State, Illinois Prevailing Wage Act, June 26, 1941, as amended, being Section 39A-9 of Chapter 48 of the Illinois Revised Statutes, 1977.
 14. **Insurance Requirements:** If fabrication, construction, installation, service or other work is specified to be conducted on MCC's premises, supplier shall maintain in force during the period of such work the following coverage's: (a) worker's compensation, as required by the laws of the State of Illinois; (b) commercial general liability for bodily injury and/or property damage in an amount of not less than \$1,000,000 single limit, per occurrence; (c) automobile liability for bodily injury and/or property damage in an amount of not less than \$1,000,000 single limit, per occurrence. **The successful bidder shall provide a certificate of insurance naming McHenry County College as additional insured.**
 15. **Performance/Payment & Bid Bond:** For every construction or construction related project greater than Fifty Thousand Dollars (\$50,000), Contractor shall procure a performance and payment bond for the full amount of the contract price(Public Construction Bond Act, 30 ILCS 550/1). Prior to commencement of any work on the Project, Contractor shall submit insurance and bonds. Any provisions contained within the bonds creating a condition precedent for Owner, or abrogating Owner's rights or remedies otherwise available in contract or law, are void. For projects over \$50,000 a 10% bid bond is required to be submitted with bid.

16. **Material Safety Data Sheets:** In compliance with the “Toxic Substance Disclosure to Employees Act” (P.A.83-240) vendor must provide Material Safety Data Sheets (MSDS) within 30 days of shipment of any and all hazardous substance ordered on this purchase order. All MSDS sheets must be sent to the Purchasing Office.
17. **Recycled Materials:** McHenry County College is required to purchase products incorporating recycled materials whenever technically and economically feasible. Contractors are encouraged to offer products with recycled content which meet specifications conforming to Illinois State Statute 20/30.1 pertaining to public community colleges.
18. **Contractor Certification:** The Seller certifies that the Seller is not barred from bidding on governmental contracts as a result of a conviction for either bid-rigging or bid-rotating under Article 33E of the Criminal Code of 1961.
19. **Web Accessibility Law:** As required by Illinois Public Act 095-0307, all information technology, including electronic information, software, systems, and equipment, developed or provided under this contract must comply with the applicable requirements of the Illinois Information Technology Accessibility Act Standards as posted at <http://www.dhs.state.il.us/iitaa>
20. **Department of Employment Security Law:** By entering into this contract, Vendor agrees to either (1) link its employment vacancies with the IllinoisJobsLink.com System or successor system, or (2) provide an online link to its employment vacancies so that this link is accessible through the web page of the IllinoisJobLink.com System or successor system, as required by Illinois Public Act 098-0107 (20 ILCS 1005/1005-47). **NOTE:** Vendors who are parties to a collective bargaining agreement with a bona fide labor organization for the performance of construction or construction-related services are exempt from this requirement.

DESIGN SCOPE & PERFORMANCE STANDARDS

SUMMARY

Acceptable bids will provide complete pricing for a solar PV system generating at least 1,045 kWh/year which corresponds to 100% of the expected annual energy use of the north High Tunnel located on the east side of the MCC main campus on US Hwy 14 in Crystal Lake, Illinois. Also connect the solar PV system to the electric utility grid so any excess solar PV energy is fed to the utility and MCC is credited at the retail rate for this power. Provide calculations, with all assumptions and measurements, of the PV system's projected annual energy output and cost-effectiveness when including all fees, avoided energy costs and SRECs.

1. Scope

Provide all the necessary materials and labor to install, activate and commission the solar PV system by an experienced NAPCEP certified solar installer including; obtaining all necessary permits, utility interconnections, delivering submittals for review, shop drawings, constructing the PV system, preparing and delivering the As-builts, final operating and maintenance procedures and customized training that meet the performance standards and specifications for this project.

2. Solar PV Modules

2.1 Performance Criteria

- a. Solar Power Capacity of the Installed System: minimum 1.2 kW peak DC
- b. Modules characteristics include:
 - i. minimum efficiency of 18.5% at STC, mono-crystalline Silicon, Tier 1 rated
 - ii. Maximum annual degradation in performance: 0.006%
 - iii. Temperature coefficient: -0.30%/oF for voltage or -0.35%/°K for power.
 - iv. 25 year performance warranty & 20 year product warranty on solar modules

2.2 Location & design criteria. Locate the array to the northwest of the north high tunnel per Figure 2 to avoid shading from 9am to 3pm from the High Tunnels (at any location) and minimizes tree shading.

3. Module Rack & Foundation

Fixed-pitch array rack approved by the module manufacturer together with the foundation system meet local wind codes or at least minimum sustained wind speeds of 90 mph for the soil conditions at the site. The bottom edge of the PV modules will be a minimum of 36 inches above the ground.

4. Balance of System (BOS)

4.1 Inverter. Use central utility-interactive inverter that are UL listed, are certified for EMI under FCC Part 15, comply with IEEE 519 for harmonics control and have a minimum rated CEC weighted efficiency of 96%. Locate the inverter in a weatherproof enclosure at the solar PV array. The inverter will be compatible with a future battery storage system.

4.2 Power Distribution. Figure 3 is the single-line diagram of the solar PV system and its interconnection with the existing Pole Barn electrical service, Design and install the DC and AC distribution systems with a maximum line voltage drop of 2% on the DC Side and 2% on the AC

Figure 2. Solar PV Array Location

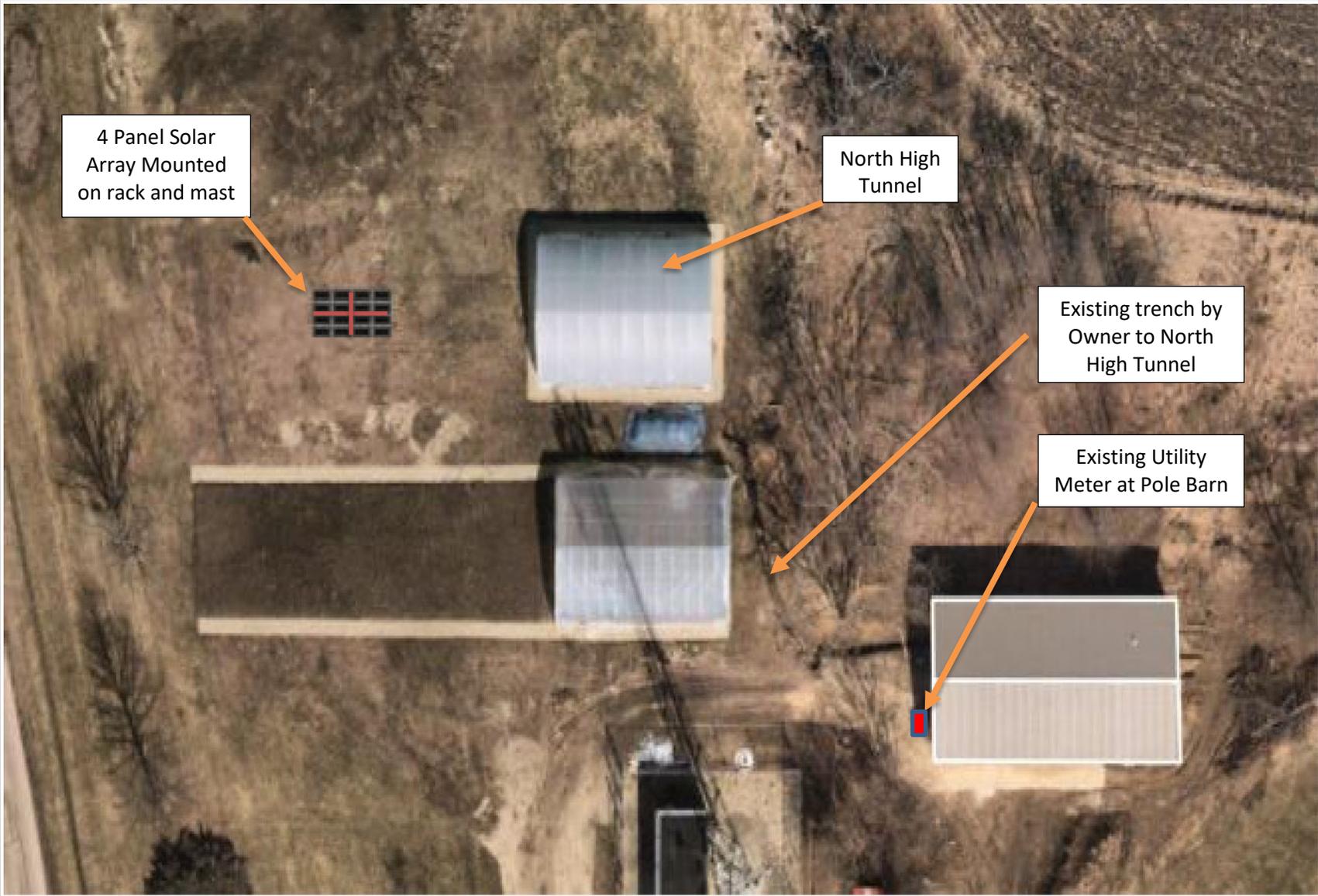
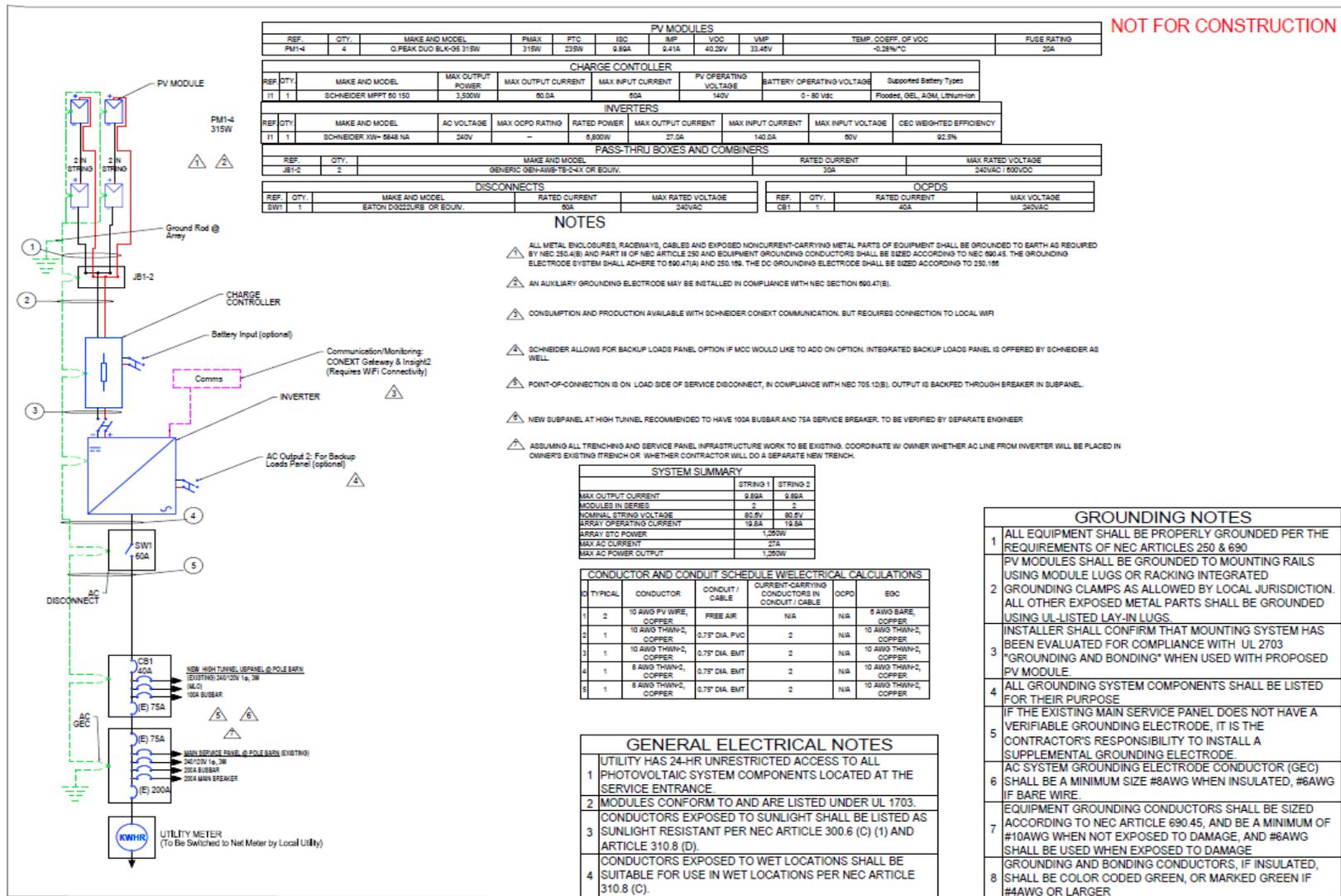


Figure 3. Electrical Single-Line Diagram



THIS DOCUMENT HAS BEEN CREATED FOR THE PURPOSE OF DESCRIBING THE DESIGN OF A PROPOSED PHOTOVOLTAIC POWER SYSTEM WITH ENOUGH DETAIL TO DEMONSTRATE COMPLIANCE WITH ALL APPLICABLE CODES AND REGULATIONS. THE DOCUMENT SHOULD NOT BE RELIED UPON AS A SUBSTITUTE FOR FOLLOWING MANUFACTURER INSTALLATION MANUALS. INSTALLER SHALL INSTALL ALL EQUIPMENT IN ACCORDANCE WITH MANUFACTURER INSTALLATION MANUALS. NOTHING IN THIS DOCUMENT SHOULD BE INTERPRETED IN A WAY THAT OVERRIDES THE INSTRUCTIONS IN MANUFACTURER INSTALLATION MANUALS.

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 HIGH TUNNEL PV ARRAY
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 CRYSTAL LAKE, ILLINOIS

side with all copper conductors. The maximum combined line voltage drop of the entire system (from PV module output to interconnection point at existing switchgear) will be 3%.

The AC cable connecting the inverter output to the High Tunnel load center at the Pole Barn will be buried underground. If the cable is encased by appropriate conduit, it must be buried at least 6-inches below grade. If the cable is buried not encased in appropriate conduit, it must be buried at least 2-feet underground. Winning contractor will submit proposed approach and trench path to Owner and Owner's Agent prior to commencing trenchwork.

4.3 Grounding, Lightning and Surge Protection. Ground the DC and AC distribution systems per NEC Articles 250 and 690. Provide for maintaining ground continuity when panels are temporarily removed. Document for the Owner and Owner's Agent whether the solar PV system requires lightning/surge protection due to the utility service or other on-site systems. If so ensure the lightning protection system ground is bonded to the electrical service grounding electrode.

5. Interconnection & Metering

Provide and arrange for utility-approved interconnection based on the present net-metering arrangement offered by ComEd and MCC's electricity commodity provider.

6. Performance Monitoring

6.1 **System performance.** Program the inverter to provide for continuous monitoring of measured performance of the combined inverter AC output.

6.2 **Monitored Energy Use.** Program the inverter to monitor and display the total energy use of the north High Tunnel. Coordinate with MCC faculty and ensure the PV monitoring systems data and new utility meter are interfaced with MCC IT networks or through stand-alone Apps provided by the inverter manufacturer.

7. **Identification & Labels.** Install durable labels on all key solar PV system equipment (exterior and interior). Provide shop drawings of proposed labeling for approval prior to ordering.

8. Commissioning, Training & Warranty

8.1 O&M Documents & Training. Provide bound O&M manuals and any required customized O&M procedures for MCC staff. In addition, a maintenance plan for the PV array must be included. Prepare a training agenda for review by Owner and Owner's Agent and facilitate a one-day training for MCC Facilities staff.

8.2 Warranty Period. Provide warranty documents covering repair or replacement of any defective PV system parts; minimum 20 year warranty on the solar panels, 15 year warranty on the inverter, 2-year warranty on the installation. The warranty commences on the date of start-up of the assembly. Provide all necessary servicing for the solar PV system during the two year Warranty on Labor & Workmanship required by MCC.

9. Fees

Contractor covers all project fees including for all permits, net-metering interconnection, SRECs.

9. SRECS

Prepare and submit for the Owner the necessary application and documentation to ensure SRECs are received by the Owner for this project.

11. Annual Service Contract

Contractor to develop and present to MCC staff a proposal for on-going servicing of the solar PV system after completion of the two-year warranty period.

SPECIFICATIONS SECTION 263100
PHOTOVOLTAIC POWER SUPPLY SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Prime Electrical Contractor

B. Section Includes: Requirements for the design, furnishing and installation of a complete photovoltaic power supply systems as follows:

Provide and install specified photovoltaic modules, PV racking at a minimum 25 degree tilt angle, inverter, meter/monitoring system, fused combiner boxes, conduit, wire and cable near the Pole Barn at the east side of the McHenry County College Campus at 8900 US HWY 14, Crystal Lake, Illinois 60012. Connect the AC output of the inverter to the new High Tunnel load center at the Pole Barn installed by MCC.

C. Related work described in the Performance Standards including, but is not limited to:

- 1. Solar PV Module Performance & Certifications**
- 2. Balance of System**
- 3. Rack and Foundation**
- 4. Metering and Monitoring**
- 5. Commissioning & Training**

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

- | | |
|-----------------------------------------|-------------------------|
| 1. National Electrical Code | 8. IEEE 1547 |
| 2. County of McHenry Codes | 10. ISO 9001 |
| 3. City of McHenry Building Code | 10. UL Inc. 1703 |
| 4. IEC-61215 | 11. UL 1743 |
| 5. ANSI 62.41 | 12. UL 1741 10 |
| 6. IEEE 519 | 13. UL-508A |
| 7. IEEE 929 | |

1.3 DEFINITIONS

- A. PVSI: Photovoltaic System Integrator.** The PVSI has full responsibility for the, design, submittals, construction, installation, testing, commissioning and implementation of the Photovoltaic System including all control, monitoring and Internet reporting of system operation.
- B. PTC: PV USA Test Conditions.** A set of reference photovoltaic device measurement conditions consisting of solar irradiance of 1 kW/m², air mass of 1.5, 20°C ambient temperature at 10 meters above ground level and wind speed of 1 meter per second.
- C. NOCT: Normal Operating Cell Temperature.** The temperature at which the cells in a photovoltaic module operate under standard operating conditions (SOC). These conditions are: irradiance of 0.8 kW/m², 20°C ambient temperature, and average wind speed of 1 m/s, with the cell or module in an electrically open circuit state, the

wind oriented parallel to the plane of the array, and all sides of the array fully exposed to the wind.

- D. STC: Standard Test Conditions. A set of reference photovoltaic device measurement conditions consisting of solar irradiance of 1 kW/m², air mass of 1.5, and 25°C cell temperature.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:

The photovoltaic (PV) system will provide a minimum nameplate of 1.2 kW DC. Provide the corresponding necessary inverters. Utilize identical, individual minimum >300W PV modules on a ground-mounted rack system, connected in series to form the PV array. Provide required mounting rack and accessories, circuit combiners, inverter, wiring systems, grounding, testing, control and monitoring systems. PV system monitoring will include secure on-line metering/monitoring from a public access web site.

B. Performance Requirements

1. Each photovoltaic module is to have a Minimum Peak Power rating of 300 watts minimum at Standard Test Conditions (STC).
2. Each photovoltaic module is to provide a minimum of 83 percent of the specified Minimum Peak Power for a period of 25 years

C. Electrical Requirements:

1. All equipment to be UL Inc. Listed
2. Provide individual photovoltaic modules with a maximum open circuit voltage (Voc) of 42 volts dc.
3. Connect individual modules in series to form a string and limit the dc voltage to under 1000-volts using corrections for temperature as required by the NEC. Combine strings in parallel to form arrays. Utilize fused circuit combiners for all parallel connections.
4. Provide up to 1000-volt dc rated non-fused disconnect switches at the combiner outputs or at the inverter as shown on the drawings.
5. Provide inverters with continuous power ratings as shown on the drawings and as specified and each with a circuit input combiner and each with an isolation transformer. The output of each inverter is to be a regulated voltage that is coordinated to the design voltage of the modules and strings on the dc side of the system, three-phase four-wire.
6. Provide the appropriate transformer to step down the voltage to match service switchboard.
7. All wiring for the photovoltaic system, from the individual combiner boxes to the inverters may be up to 1000-volt insulated, copper wiring installed in conduit.
8. Wiring for the series connections from individual modules to adjacent modules on the same mounting rack and may be installed without conduit. Utilizing color-coded black, white and green type rated cable. Utilize black UV rated plastic wire ties at not more than twelve inch spacing to support this wiring from mounting racks. All module series connection wiring that is not to an adjacent module but is to a module or connection on the same mounting rack is to be run within recessed channels in the mounting racks and secured at a spacing of not more than twelve inches with black UV rated plastic wire ties. Install all wiring in conduit for cables that extend beyond a mounting rack.

9. Provide conduit for all wiring from combiners to the disconnect switches and to inverters.
10. In every conduit provide an insulated "system"-grounding cable sized in accordance with the Article 690.41 of the CEC.
11. Provide equipment-grounding conductors sized in accordance with the Article 690.43 of the CEC.
12. Limit total voltage drop of the wiring systems (total of DC and AC wiring from field combiner box to interconnection point in building switchgear) to less than 4%. Limit the voltage drop of each of the DC or AC wiring systems to less than 2%.
13. Ensure that at the highest expected ambient and cell temperatures the string voltage—after DC voltage drop to the inverter is considered—is above the bottom end of the MPPT window of the corresponding inverter. Provide the calculations, based on 20 years of depreciated module performance at the maximum rate of degradation specified herein.
14. Ensure that the inverter AC output circuit does not have excessive voltage drop that would cause the inverters to reach the high voltage limit, cause a high-voltage trip and the inverter to go offline with a "high grid voltage" error.

1.5 SUBMITTALS

A. General:

1. Provide all submittals, including the following, as specified in the Scope of Services

B. Design:

1. Submit for review and approval the detailed design of the photovoltaic system with sufficient information to determine conformance with these specifications. Include the following:
 - a. Provide calculations demonstrating voltage and amperage of each series and parallel connection of modules, panels and arrays.
 - b. Provide calculations of solar availability at the proposed site along with proposed location and dimensions of the solar array
 - c. Perform projected annual energy production calculations using a program such as the NREL PV Watts for total peak wattage and peak and annual kilowatt-hour output of the system based on PTC, measured solar availability, installation location, angle of installation, number and efficiency of proposed modules and number and efficiency of proposed inverters and transformer, voltage drop, estimated module performance degradation and effect of dirt accumulation after one year.
 - d. Provide calculations for all wire and conduit sizing including voltage drop calculations for the DC and AC wiring.
 - e. Provide a detailed block diagram of proposed system showing; modules, panels, arrays, disconnect switches, inverters, circuit combiners, inverters and connections.
 - f. Provide Manufacturers Calculations based on module weight and wind loading for mounting rack sizes, connections and loading.
 - g. Provide Attachment and anchoring details for rack connections to roof structure for anchored PV systems and module connections to rack.
 - h. Provide Electrical one-line diagram of proposed system. Showing system and equipment grounding system diagrams.
 - i. Provide Calculations to verify sizing of all electrical protective devices such

- as fuses and breakers.
 - j. Provide information control, monitoring and Internet reporting system architecture, I/O naming convention and lists, display screens, reports and security methods.
- C. Provide Product Data and Information: Provide standard manufacturer's specification data on photovoltaic modules, circuit combiners, disconnect switches, inverters, meters, racks, wiring, wire ways, grounding elements and individual components. Data to include materials of manufacturer, finishes, standard dimensions and weights, mounting requirements including mounting bolt spacing and wire way locations, physical properties, rating data and Listings and Certifications.
- D. Shop Drawings:
 1. Photovoltaic Modules: Provide drawings detailing electrical terminations, connection diagrams, mounting details and cleaning and maintenance requirements. Also provide specific data on individual solar module materials, connections, efficiency, electrical performance including warranties.
 2. Support Racks and Foundations: Provide drawings stamped by licensed professional engineers detailing component dimensions, module mounting arrangements and mounting hardware, method of securing racks to the ground, grounding and calculations for loading including wind loading.
 3. Array Location: Provide drawing showing exact location of the array that will produce the calculated annual energy use required in Section 1b above. Identify any trees that will need removal and or trimming to maintain the solar availability over the life of the solar PV system.
 4. Circuit Combiners: Provide drawings detailing internal and external views, identification of all components, component dimensions, rating data of enclosures and of all components and nameplate data.
 5. Disconnect Switches: Provide drawings detailing internal and external views, rating data of enclosures and of all components and nameplate data.
 6. Inverters: Provide detailed drawings showing internal and external views with dimensions and identification of all components, wiring diagrams of all internal and external connections, rating data of all components, efficiency of inverters and isolation transformers, impedance of transformers and safety and electrical protection devices and nameplate data.
 7. Wiring: Provide detailed physical drawings showing location and dimensions of all wiring, mounting of wiring and wire ways, termination details and labeling system for all wiring.
 8. Internet monitoring systems: Provide detailed drawings showing internal and external views with dimensions and identification of all components, wiring diagrams of all internal and external connections, rating data of all components, including methods for securing all data and systems.
- E. Samples: Submit samples of mounting rack, wire labels and wire conduit for below-grade and above grade wiring.
- F. Quality Control & Commissioning: Provide all required and specified test reports, certificates, and evidence of manufacturer's experience. Provide all proposed test and commissioning procedures for review and approval prior to beginning any tests.
- G. Operation and Maintenance Manuals: Provide operation and maintenance manuals, as specified in part d shop drawings. Provide specific information on photovoltaic module

cleaning, maintenance and testing procedures and inverter troubleshooting, calibration, testing and maintenance procedures.

1.6 QUALITY ASSURANCE

- A. Codes: Provide each of the photovoltaic power supply systems in accordance with the McHenry County and City Electrical Code.
- B. Regulatory Requirements: All components are to be UL Inc. Listed and modules and inverters are to be certifiable under the applicable McHenry County and McHenry City Electric Code
- C. Experience Requirements - Photovoltaic System Integrator (PVSI): The PVSI must have demonstrated experience in the integration of at least three photovoltaic systems of 3 KW or larger in size and arrangement similar to that specified. Provide verification and certification of required experience. Electrical license and NABCEP certification and State of Illinois certification required as of January 1, 2020.
- D. Experience Requirements - Equipment: Provide photovoltaic modules from a manufacturer that has manufactured modules of the type specified for at least three (3) years. Provide inverters from a manufacturer that has manufactured inverters of the type specified for at least three (3) years. Provide verification and certification of required experience.

1.7 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified by the manufacturer
- B. Provide any special instructions for storage of spare photovoltaic modules
- C. If recommended by the photovoltaic module supplier, provide storage racks for spare modules.

1.8 PROJECT CONDITIONS

- A. Existing Conditions:
 - 1. The array is to be located on the existing grass lawn north of the existing building.
 - 2. The electrical Interconnection is to occur at the existing switchgear in the basement of the building.
 - 3. All work and the installation of all equipment must not disturb, damage or otherwise compromise the existing trees and other vegetation that the Owner intends to preserve and maintain.
 - 4. All work and the installation of all equipment must not disturb, damage or otherwise inhibit the existing building systems from their designed operation, or void their warranty.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate all work with the requirements of other trades work under this contract.

1.10 WARRANTY

- A. Warrant that each PV module shall be free from defects in materials and workmanship for a period of ten (10) years from date of installation.
- B. Warrant that each PV module shall provide a minimum of 83 percent of the

specified Minimum Peak Power for a period of twenty-five (25) years from the date of installation.

- C. Warrant each inverter and isolation transformer for ten (10) years from the date of installation.
 - D. Warrant the Labor and Workmanship of the entire photovoltaic power supply system for a period of two (2) years.
 - E. Warrant all other equipment and components for 25 years as required.
- 1.11 SPARE PARTS (1.2+pkW DC SYSTEM)
- A. General: Furnish the following spare parts, packaged for long-term storage with easily identifiable labels on each package.
 - 1. 1% photovoltaic modules
 - 2. 1% photovoltaic module and string connectors (male and female)
 - 3. 5% of each type of circuit combiner fuses.
 - 4. Two (2) complete replacement sets of fuses for each inverter

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Tier 1 manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review and approval.
 - 1. Photovoltaic Modules
 - a. Hanwah Q Peak Duo BLK G-5 315W
 - b. Grape Solar
 - c. Sunpower
 - d. ET Solar
 - e. Wangxiang New Energy
 - 2. Inverters:
 - a. Schneider XW+6848NA
 - b. SMA
 - c. Genesis
 - d. Eaton Corporation
 - e. AE- PV Powered
 - 3. Circuit Combiners:
 - a. SMA
 - b. SolarBOS
 - c. DECK
 - d. Xantrex
 - e. Amtec
 - f. Eaton
 - 4. Module Mounting Racks (at a minimum 25 degree module tilt).
 - a. Unirac

- b. SolaRac2
- c. DP & W
- d. Patriot Solar Group
- e. Iron Ridge

2.2 PHOTOVOLTAIC MODULES

- A. General: Provide photovoltaic modules designed to meet the specified requirements.
- B. Provide Modules with the following characteristics:
 - 1. Mono crystalline cells Tier 1 rated
 - 2. Minimum conversion efficiency of 18.5 percent
 - 3. Output power rating must be positive tolerance only
 - 4. Minimum peak power ratings of 300 watts at STC
 - 5. Modules have all factory-installed MC4 connectors
- C. Provide modules specifically designed for outdoor, rack mounted installations.
- D. Each module is to have weatherproof insulated cable and connectors
- E. Provide each module with an anodized aluminum frame, predrilled for mounting.
- F. PHOTOVOLTAIC MODULE MOUNTING RACKS
 - 1. Provide mounting racks specifically designed for mounting photovoltaic modules in an inclined position.
 - 2. Rack system to be stainless steel, galvanized steel or aluminum.
 - 3. For anchored systems, provide fixed mounted rack. For ballasted systems, install in accordance with manufacture's recommendations for applications and design loads indicated.
 - 4. All fasteners and mounting hardware are to be from the same manufacturer as the rack system and of material recommended by the rack system manufacturer.
 - 5. Provide a continuous equipment grounding system for all racks with screw type connections to each rack and to each photovoltaic module. (WEEB style ground washers may be accepted upon review) Connect equipment ground systems directly to the building main ground system bus.

2.3 INVERTER

- A. Provide grid connected inverters specifically designed for photovoltaic systems.
- B. Inverter to meet IEEE 519 for total harmonic distortion
- C. Design of inverters rated for the dc voltage from the photovoltaic array with the following features and components:
 - 1. Internal, input parallel combiner
 - 2. No-load break input dc disconnect switch.
 - 3. DC rated input contactor for back feed protection
 - 4. DC surge and fault protection
 - 5. harmonic isolation can be done by a separate field-installed transformer.
 - 6. AC-volt rated output contactor
 - 7. Pre-charge circuit to minimize in-rush current and nuisance trips

8. AC surge protection
 9. AC-volt rated output circuit breaker
 10. Integrated control system with RS 485 Modbus communications
 11. Provide metering integral to the inverter, or with the monitoring system.
- D. Interior Inverters to be furnished in a minimum NEMA 1 enclosure
- E. Inverter to comply with UL 1741, IEEE 929, IEEE 1547, IEEE 519 and ANSI 62.41
- F. Inverter to have efficiency rating of at least 98 percent and average operating efficiency of at least 96%
- G. Inverter to have a maximum heat rise of 50 degrees C at an ambient temperature of 50 degrees C
- H. Provide weatherproofing provisions for enable mounting inverter outside secured to the solar PV rack.

2.4 CIRCUIT COMBINERS

- A. Provide fused circuit combiners with the following features and ratings at each location two or more photovoltaic panels are to be connected together:
1. UL Inc. Listed to UL-508A
 2. Up to 1000-volt dc rated with integral lightning protection.
 3. Single, dual and triple outputs as required
 4. Continuous duty rated
 5. Provide each exterior circuit combiner in a NEMA 3R or NEMA 4 enclosure
 6. Provide labels for each interior component
 7. Provide descriptive label on exterior door
 8. All internal and external wiring to be landed on labeled terminal blocks
 9. Provide individual fusing for each input
 10. Provide brackets for outdoor mounting on the photovoltaic module racks.

2.5 WIRING AND WIREWAYS

- A. Provide all interconnecting wiring and wire ways as specified below
- B. All wiring for the photovoltaic system is to be insulated per NEC. Conductors are to be sized to limit voltage drop from the circuit combiners to the inverter input to less than 2 percent. Conductor sizing is to also consider CEC requirements for temperature and number of current carrying conductors in a raceway.
- C. Conduits within the building and from circuit combiners to the inverters are to be installed in, RGS, IMC or EMT where not subject to Physical Damage. Utilize GRS conduit where subject to physical damage.
- D. Provide labeling for each conduit, each wire and each wire way.

2.6 OPERATION, MONITORING AND CONTROL

- A. Solar Electric Monitoring System may include the following (See Add Alternate #5—scope to be determined by MCC staff):
1. 24x7 monitoring service
 2. Automatic email alerts to your system installer or maintenance service provider
 3. Communications via locations Internet broadband link
 4. Online storage of data and system information, hosted at a data center
 5. Metering and reporting for Load energy use and total generated renewable

energy suitable for quantifying Performance-Based Incentives such as Renewable Energy Credits (REC)

- B. Basic Weather Station for measuring sunlight strength, air temperature and solar module temperature
- C. Electrical demand measurement
- D. Internet-based communications

2.7 SOURCE QUALITY CONTROL

- A. Tests: Factory test equipment and provide certified factory test reports as follows:
 - 1. Photovoltaic modules: Provide copies of test reports for tests done on similar modules at PTC Rating and factory test at least 1 % of actual modules to be provided demonstrating
 - a. Peak power output (Pmax)
 - b. Maximum power voltage (Vmp)
 - c. Maximum power current (Imp)
 - d. Open circuit voltage (Voc)
 - e. Short circuit current (Isc)
 - f. Short circuit temperature coefficient
 - g. Open circuit voltage coefficient
 - 2. Factory tested inverter to be provided demonstrating the following:
 - a. Inverter Efficiency in percent
 - b. Total harmonic distortion
 - c. Noise level
 - d. Temperature rise
 - 3. Monitoring and Control System: Factory test the complete Monitoring and Control System and submit test reports certifying each aspect of the system has functioned properly.
- B. Inspections: The Owner and its representatives reserve the right to visit any facility manufacturing components or assembling components and systems for the photovoltaic power supply systems during the manufacture of equipment for this Contract. This includes witnessing any tests specified herein.

PART 3 - PART 3 EXECUTION

3.1 PREPARATION

- A. The Installation of the photovoltaic power supply systems must be coordinated with other work done under this Contract. Provide a detailed schedule of all activities as required,
- B. Review activities and work schedules of other work on the site.
- C. Coordinate site specific information

3.2 INSTALLATION

- A. Install the photovoltaic power supply systems in accordance with the manufacturer's recommendations and approved shop drawings and as specified
- B. Coordinate all work with all other work on the site.

- C. Ground Mounting
 - 1. Move material, modules and racking using access paths approved by the Owner.
 - 2. As part of Base Scope of Work, restore any damaged vegetation due to movement of materials and equipment, on-site storage and installation of the PV system.
 - D. Wiring and wire ways
 - 1. Utilize integral wiring and connectors provided with photovoltaic modules for series connection wiring from individual photovoltaic modules to adjacent modules. Secure this wiring to modules and mounting rack system with black UV rated plastic wire ties at distances not greater than every twelve inches.
 - 2. Provide up to 1000-volt insulated, copper conductors in conduit for all parallel connections from series connected panel groups to circuit combiners. Size conductors for 156 percent of peak current calculated for the circuit.
 - 3. Provide Aluminum, IMC or galvanized steel conduit for all interior exposed conduit. Secure exposed conduit to mounting racks with approved conduit clamps at distances not greater than every three feet. Provide up to 1,000-volt insulated, copper conductors in conduit for all connections between circuit combiners. Provide rigid aluminum, rigid galvanized steel conduit for all exterior exposed conduit subject to damage. Secure exposed conduit to mounting racks with appropriate straps or clamps at distances not greater than every three feet.
 - 4. Size conductors for 156 percent of peak current calculated for the circuit.
 - 5. Provide labels for all conductors, conduits, modules, combiners, boxes and inverters as required by Specifications.
 - E. Provide complete grounding systems as per Articles 250 and 690 of the CEC
 - F. Inverter and isolation transformers:
 - 1. Provide all mounting hardware.
 - 2. Install in the locations provided as coordinated with Architect.
 - 3. Furnish, install and terminate all wiring and wire ways for all connections.
 - 4. Provide complete grounding system per Articles 250 and 690 of the CEC.
- 3.3 FIELD QUALITY CONTROL
- A. Tests: After installation of the complete system and before connection to the unit substation, provide a test of the system to demonstrate:
 - 1. Proper connection of all components
 - 2. kW output of system is as required by these specifications
 - 3. All controls and monitoring function correctly
 - 4. All protective devices function correctly
 - B. Submit for approval the test procedure prior to beginning these tests.
 - C. Provide all equipment necessary to conduct all tests.
 - D. If necessary for the proper operation of the system during testing, provide for temporary connections to the buildings electrical system.
 - E. Provide for connections to the Internet to demonstrate the on-line monitoring features of the control and monitoring system.

3.4 COMMISSIONING AND OPERATION DEMONSTRATION

- A. Perform a complete system commissioning record of all measured data, findings and recommendations.
- B. Furnish the services of a qualified representative of the PVS I to demonstrate the proper operation and instruct the owner's staff on the equipment's operation and maintenance, as specified herein.

3.5 TRAINING

- A. Following complete installation and field-testing; provide training in the operation, troubleshooting and maintenance of the equipment as specified in this Section.

END OF SECTION