Scope of Work
Solar PV Demonstration Project
Central Florida Zoo
(Rev 7/23/13)

2.0 Photovoltaic System

2.1 Project Specifications

2.1.1 Project Objective

The objective of this Request for Proposal ("RFP") is to identify and select the most qualified photovoltaic (PV) contractor for the design and installation of a PV system at:

Central Florida Zoo and Botanical Gardens
3755 NW Highway 17-92
Sanford, FL

The system will serve as a demonstration of a working photovoltaic installation in a commercial application. The supplier will provide a turnkey, design build installation, and will be responsible for the design and installation of the entire system. The contractor shall comply with all FPL requirements and must commission and certify the system.

2.1.2 Photovoltaic System Description

A photovoltaic system of up to 10 kW using crystalline PV modules of 14% efficiency or above is to be mounted on a canopy-style frame to be built by the contractor. The panels must face south (+/- 30 degrees) inclined to local latitude +/- 5 degrees. The PV array must be located in an area of high traffic and high visibility within the zoo. The rhino or alligator exhibits are two possibilities. Any other location being considered must also be approved by FPL.

The Central Florida Zoo facility will have a net metering Tier 1 (under 10 kW) or tier 2 (between 10 KW and100KW) agreement with FPL; therefore the inverter(s) shall be a Grid Tied no batteries sine wave type with a Maximum Power Point Tracker (MPPT) controller.

A display monitor is to be included which shows the system energy production for the most recent hour, current day hourly production, and historical energy production with environmental offsets. The monitor must be located where it can be clearly seen by the maximum number of visitors to the facility. If the chosen location is exposed to the weather, then the monitor will need to be weatherproof in case of blowing rain. The TV monitor must display various aspects of system performance using rotating screens which change automatically every 15-30 seconds. The winning contractor is to coordinate the exact details of the array design and monitor location with FPL and the authorized decision maker for the property who is designated as:

David Tetzlaff
Vice President, Operations
3755 NW Highway 17/92
Sanford, FL 32771

Email: david@centralfloridazoo.org
Telephone: 407-323-4450 Ext 112
Fax: 407-321-0900

2.1.3 Supplier Qualifications

This bid will be awarded only to responsible bidders, qualified by experience and in a financial position to provide the items specified. In order to facilitate the prompt award of this bid, **the bidder must submit with the proposal the following:**

a. A list showing experience installing at least 50 photovoltaic systems in the past 5 years. Capability of providing signed and sealed plans by a registered in Florida professional engineer (P.E.). Design to include minimum design temperature.
b. Copy of license(s) to do business in the State of Florida as a Solar Contractor (CPV) or electrical contractor.
c. Contractor shall be able to obtain a permit for the subject project.
d. Description of the PV system and major components
e. **Rendering**(s) sufficient to illustrate how the completed PV array(s) will look when installed
f. Methods for monitoring system output, data storage, and internet communication
g. Description of any new structure or reinforcement of existing structure if necessary
h. Draft schedule of work

2.1.4 General Specifications

1. A successful Bidder, hereinafter referred to as Contractor, shall provide up to a 10 kW STC dc grid-tied photovoltaic system. The system will include a data acquisition system provided and installed by Contractor to measure and monitor the PV system performance and operation with data storage of at least one year of hourly energy production retrievable via the internet.
2. The installed system must meet applicable national, state and local standards and codes. Safety signage and labeling should be mounted on the system according to the National Electrical Code and applicable building codes.
3. Conduct startup and commissioning of the PV system. The Contractor will coordinate an acceptance test that must be performed on the System once the installation is complete. The acceptance testing includes measuring the short circuit currents and open-circuit voltages on all source circuits while measuring irradiance and panel temperature, and measuring the instantaneous DC input and AC output of the System to determine its efficiency.
4. The Contractor will conduct a preventive maintenance field visit thirty (30) days after installation completion to ensure the System is operating properly in accordance with System manufacturer specifications. During this visit, the Contractor will conduct tests similar to those made during the original system acceptance test. Such test includes measurements of short-circuit current and open-circuit voltage, and the instantaneous measurement of DC and AC current and voltage while the system is in operation. Irradiance and panel temperature will be taken by the Contractor during all testing procedures.

2.1.5 Mechanical Design Specifications

1. The installed system shall include all hardware required for assembling the photovoltaic array, balance of system components, and structural attachments to the existing structure.
2. Design should account for Exposure Category C, an importance factor of 1.15, and a directionality factor (K_d) of 0.85. Mechanical hardware shall be durable and corrosion resistant. The use of ferrous metals (including but not limited to painted or plated steel), dissimilar metals in contact, or any wood or plastic components will require written approval before commencing construction. Ferrous metals shall be designed to match the lifespan of the PV modules (i.e. stainless steel, hot-dipped galvanizing, aluminum, etc).
3. As this is a high profile, publicly visible system, the aesthetics of the overall installation are extremely important for this facility. To create a uniform appearance of the array, spacing between individual modules shall be kept to a minimum and shall be uniform. Mechanical hardware, conduit, junction boxes and other equipment shall be concealed beneath and/or behind the array.
4. The array layout shall be consistent with the ordering (and labeling) of source circuits in the array combiner box(es).
5. Contractor to provide attachment and engineered fastening pattern in accordance with ASCE 7-02, ASCE-04 and Florida Building Code 2010 edition and Roof Application Standard RAS 117. All PV modules in this project shall have connectors with locking clips, such as the Multi-Contact Type 4 with PV-SSH4 safety lock clips (or equivalent) that require a tool to unlock.
6. Structural wind load calculations for the structure to meet building code requirement such as 180 mph wind in Miami-Dade County.

2.1.6 Electrical Design Specifications

1. All work shall be done in accordance with the National Electrical Code 2008 and the latest edition of the 2010 Florida Building Code with latest supplements.
2. PV system must be capable of parallel operation with the utility supplied electrical service to the facility through a UL 1741 listed inverter(s).
3. Space permitting, the PV array nameplate capacity (at Standard Test Conditions, STC) shall be up to 10 kWdc, accounting for the lower end of a module's power tolerance. For a 10 kW example, if a module manufacturer guarantees a -0% tolerance, a 10.00 kWdc array would meet the requirements of this ITB. A module with a -3% guarantee will need to provide an array of 10.000/(1.00-0.03) = 25.75 kWdc. PV modules shall have a minimum conversion efficiency of 14% to keep array layouts compact. This nameplate capacity shall not exceed 115% of the power rating of its connected inverter(s).
4. All PV modules shall be commercially-available models presently under active manufacture, and shall be listed to UL1703.
5. A grounding electrode (or multiple electrodes if required per NEC) shall be installed at the arrays per NEC 690.47(D).
6. All inverters shall be currently-available SMA SunyBoy models, or and FPL approved equivalent, to ensure data format compatibility with FPL's renewable data storage site. The

inverters shall be listed to UL1741-2005. Installed system shall include ground-fault detection and interruption systems with a visible indicator.

7. All outdoor wiring must be listed to a temperature rating of 90°C in wet locations, and it shall be listed as sunlight resistant where run outdoors and outside of conduit.
8. Voltage drop shall not exceed 2% for AC and DC for each circuit. Voltage drop calculation should be measured at full load, defined as I_{MP} on the DC circuits. For the DC operating voltage, please use PV manufacturer coefficients to account for temperature correction on a hot summer day and annual voltage degradation.
9. **Contractor shall coordinate interconnection details with FPL and shall be responsible for the required interconnection paperwork with input from the Owner. A licensed master electrician must make the final connection**.
10. Placards showing mapped locations of the interconnection point, PV system, and inverter(s).
11. Interconnection shall be accomplished in accordance with NEC, Florida Building Code, and all other applicable codes and standards.
12. PV modules shall have linear warranties as follow:
    1. 80 % of minimum rated power after 20 years.
    2. 90% of minimum rated power after 10 years.
    3. Product defect/ workmanship of 10 years.
13. The inverter(s) shall be guaranteed for 10 years by the manufacturer.
14. If possible, communication box should be located in the electrical room.
15. Provide and install CAT5 communications cable with surge protector at each side of the inverter(s) for data monitoring system to communication room or different location designated by owner. Leave 15 feet of additional cable coiled in communications room. If the distance from inverter to communication room is more than 328 Feet contractor shall consider fiber optic as an alternative to avoid performance issues in the communication. Contractor shall provide and install all necessary equipment and software so that FPL may log data and make it available for display and performance review. The data communication method along with the indoor data display monitor and screen content shall be included in the proposal. Screen content must automatically rotate among all the pages about every 15 seconds. FPL revisions to the monitor type and displayed screen content may be negotiated with the contractor before the contract is awarded.

If requested by FPL, the contractor shall install indoor and outdoor signs 2'x3' or less provided by FPL.

16. Contractor shall purchase, install, and connect an indoor TV monitor of at least 37" (measured diagonally) to display system performance. Mounting location will be coordinated with owner and FPL prior to installation.

2.1.7 Documentation to be Supplied by Contractor

1. The contractor shall provide signed and sealed design documents suitable for permitting. Design to include at a minimum, field investigation, timeline/project schedule, selection of key equipment, system description, layout of installation, local site plan showing location of all new equipment and existing service equipment, riser diagram including integration of solar PV system with other power sources, electrical grid interconnection requirements, trenching, conduits, electrical conductors, communications cable and wind pressure calculation including connection to existing structure.
2. One copy of all equipment manufacturers' specifications and operations manuals, including those for PV panels, inverter(s), over current devices, disconnects and optional equipment.
3. Overview of major system components and principles of operation.
4. Complete parts lists, including all electrical components, mechanical hardware and other equipment required for installing the system (Must include description, make, model/part number and source for all the equipment provided).
5. Diagram indicating overall layout of entire system, including PV array, and location of balance of system (BOS-equipment such as wiring, fuses, disconnects, and fittings) with respect to the array.
6. Electrical schematics and diagrams showing all major components and devices, including conductor types and sizes, connections of individual panels and array source circuits, terminations at junction boxes, connection to surge suppression devices and the inverter(s), and interface with the utility grid.
7. Electrical calculations showing ampacity, temperature de-ratings, conduit fill de-ratings, voltage drop calculations for all DC and AC conductors, and ambient temperature effects on PV array output voltage. Sizes of disconnects and overcurrent protection should also be included, as well as input and output current, voltage and power specifications for all major pieces of equipment.
8. Structural wind load calculations for the structure to meet building code requirements.
9. Structural drawings showing means of attachment of PV array to existing structure or code compliant building or ground mounting.
10. Certification of components listings (include manufacturers' data sheet for PV modules, inverter and array amount.
11. System description including:
    a) Inverter rating and UL 1741 compliance statement
    b) DC array rating
    c) AC Gross Power rating (0.85 x DC array rating)
    d) Type of system
    e) Block diagram showing power flows
    f) Brief description of system operation
12. Procedures for operating, disconnecting, servicing and maintaining complete system and individual components.

13. As-built diagrams indicating overall layout of entire system, including PV array, location of BOS hardware and server with respect to the array, data collection, communication, and display equipment.
14. All documentation must be provided to FPL and owner for review prior to permit application.

2.1.8 Performance Monitoring

1. Contractor shall supply and install an automated data acquisition system (DAS) to measure and monitor the PV system performance and operation. The DAS may be internally integrated into the inverter(s) and system or externally interfaced with the PV system to collect required data. Contractor is responsible for providing and installing the DAS, for its initial operation and to provide FPL with detailed documentation both on the use and maintenance of the DAS and the data streams.
2. The DAS and an on-site weather station will be required to measure and log the following information:

    - *Inverter(s) DC input voltage, current, and power*
    - *Inverter(s) AC output voltage, current, and power(W or kW)*
      *Last hour, **last 24 hours**, daily, monthly and lifetime totals for ac kWh*
    - *Solar irradiance on a horizontal plane*
    - *Ambient temperature*
    - *Module temperature*
    - *Environmental savings*
    - *Display inverter(s) faults and warnings*
    - *Send email alerts if deviations are detected. Owner's contact information will be provided during construction phase.*

3. Monitoring systems should be able to display data with no more than a 15 minute delay. Data must be made available to FPL in XML format and transmitted to FPL server in no less than 15 minute and no longer than 60 minute increments. Contractor shall confirm format to be used to transmit data to FPL during design phase. Contractor to coordinate with owner to allow data monitoring system to penetrate firewall and transmit data. Generally data is transmitted via port for file transfer protocol (FTP), ports 20 or 21 but additional ports may need to be opened to allow other functionality such as time synchronization and remote diagnostics. The ports to be used shall be closely coordinated with FPL during the construction phase.

4. Before an FPL acceptance test can be scheduled or performed, the DAS shall be transmitting data to FPL. The data that is transmitted must be viewable by FPL staff and include sensor readings, which indicate that the photovoltaic system as well as the DAS is fully functional and operating within expected norms. All information needed to remotely view the data such as The internet link, site identification number, password, etc. will be provided to the FPL project manager by email within 24 hours after the data communication is operational and displaying accurately.

2.1.9 Other Requirements

1. Provide a system fully guaranteed against defects in parts, workmanship and labor for a minimum of 2 years beginning on the in-service date. **During this time, the contractor will be responsible to repair the system if malfunctions occur.**
2. Contractor shall list and supply additional manufacturer's standard guarantees for the solar collectors and inverters. (Please attach copies of manufacturer's standard guarantees).
3. Notice of commencement filing with City and fees paid before starting the project.
4. Install the complete system as per approved design.
5. All underground cable and conflicts shall be located prior to any excavation.
6. The contractor will follow manufacturer's instructions and recommendations for delivery storage and handling requirements.
7. Contractor and contractor's subcontractor expected to work in a safe manner complying with OSHA regulations.
8. Attend preconstruction meeting with owner as required.
9. Restoring all disturbed existing improvements as a result of construction and start-up activities.
10. Provide two sets of operation & maintenance manuals. The manual shall include a certified as-build drawing. Provide one copy of approved/inspected permit to FPL for net metering requirements.
11. Provide system training to owner. O&M manuals to be provided at or prior to the training to owner representative
12. Contractor to submit documents for permit within 30 days of notice to proceed. This includes 5 days for FPL to complete a design review. Installation shall be completed by supplier within 60 days of permit approval.

3.0 Commercial Requirements:

1. Proposed Payment Schedule:

- Upon obtaining a permit 10%
- Upon delivery of all the equipment and materials to the job site 30%
- Upon final inspection approval 50%
- Upon successful operation of all data feeds communication and performance display screens, and completion of customer training 10%