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Technical Requirements for Interconnection on the CPS Energy Distribution System

A. General

1. This document describes typical technical interconnection requirements for the Solartricity Producers Program. CPS Energy may determine that certain specific interconnection locations and conditions require the installation of more sophisticated protective devices and operating schemes, since the facility is exporting power to CPS Energy.
2. *Point of Interconnection.* If the Point of Interconnection (POI) is defined in the Interconnection Agreement between CPS Energy and the Solar Power Producer (SPP), that definition overrides the following definition:

The Point of Interconnection is defined as the point of termination on the line side of metering equipment.

B. Design Considerations

1. The SPP's equipment shall be designed in accordance with but not limited to UL Standards, Institute of Electrical and Electronics Engineers (IEEE) Standards, the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the ERCOT Operating Guides, CPS Energy Electric Service Standards and any other applicable local, state or federal codes or standards.
2. The SPP's PV shall be equipped with protective hardware and software designed to prevent the PV from being connected to a de-energized CPS Energy circuit.
3. The SPP shall be responsible for protecting its PV equipment in such a manner that CPS Energy system outages, short circuits or other disturbances including zero sequence currents and ferroresonant over-voltages do not damage the SPP's PV equipment. The SPP's protective equipment shall also prevent unnecessary tripping of CPS Energy breakers that would affect CPS Energy's capability of providing reliable service to electric service customers.
4. If CPS Energy determines (based on studies or reviewing test results) that a PV may not trip properly when isolated from CPS Energy's system, CPS Energy shall provide (at the SPP's expense) a communication channel to support



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communication between CPS Energy and the SPP's facility. The channel may be a leased telephone circuit or other mutually agreed upon medium.

7. Circuit breakers or other interrupting devices at the Point of Interconnection must be capable of interrupting maximum available fault current from either direction.
8. The SPP shall furnish and install a manual disconnect device that has a visual break that is appropriate to the voltage level (a disconnect switch, a draw-out breaker, or fuse block), and is accessible to CPS Energy personnel, and capable of being locked in the open position. The SPP shall follow CPS Energy's switching, clearance, tagging, and locking procedures, which CPS Energy shall provide for the SPP.

C. Prevention of interference.

The PV Facility operating requirements are described below and summarized in Table C-1.

1. **Voltage.** The SPP will operate its PV equipment in such a manner that the voltage levels on CPS Energy are in the same range as if the PV equipment were not connected to CPS Energy's system. The SPP shall provide an automatic method of disconnecting the PV equipment from CPS Energy if a sustained voltage deviation in excess of +5.0 % or -10% from nominal voltage persists for more than 2 seconds, or a deviation in excess of +10% or -30% from nominal voltage persists for more than 10 cycles. The SPP may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.
2. **Flicker.** The SPP's equipment shall not cause excessive voltage flicker on CPS Energy's distribution system. This flicker shall not exceed 3.0% voltage dip, in accordance with IEEE 519 as measured at the Point of Interconnection.
3. **Frequency.** The operating frequency of the SPP's PV equipment shall not deviate more than +0.5 Hertz (Hz) or -0.7 Hz from a 60 Hz base. The SPP shall automatically disconnect the PV equipment from CPS Energy within 15 cycles if this frequency tolerance cannot be maintained. The SPP may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.
4. **Harmonics.** In accordance with IEEE 519, the total harmonic distortion (THD) voltage shall not exceed 5.0% of the fundamental 60 Hz frequency nor 3.0% of the fundamental frequency for any individual harmonic when measured at the Point of Interconnection.



5. **Fault and line clearing.** The SPP shall automatically disconnect from CPS Energy within 10 cycles if the voltage on one or more phases falls below -30% of nominal voltage on CPS Energy serving the SPP premises. This disconnect timing also ensures that the PV is disconnected from CPS Energy prior to automatic re-close of breakers. The PV may reconnect when CPS Energy voltage and frequency return to normal range and the system is stabilized.
6. **Direct Current Injection.** The PV Facility should not inject direct current (DC) greater than 0.5% of rated output current into CPS Energy’s distribution system.

Table C-1. Summary of PV Facility Operating Requirements

CPS Energy PV Operating Variable	Trigger Point for Disconnect	Maximum Time to Disconnect (seconds)
1. Voltage @ Point of Interconnection (POI)		
Over Voltage Set point #1	+5% of nominal voltage	2 sec
Under Voltage Set point #1	-10% of nominal voltage	2 sec
Over Voltage Set point #2	+10 % of nominal voltage	0.167 sec
Under Voltage Set point #2	-30% of nominal voltage	0.167 sec
2. Flicker	Voltage at the POI must be less than 3% voltage dip as defined by the “Maximum Borderline of Irritation Curve” in IEEE 519.	
3. Frequency		
Over Frequency Set point	+0.5 Hz from base frequency	0.25 sec
Under Frequency Set point	-0.7 Hz from base frequency	0.25 sec
4. Harmonics		IEEE 519 requirement
Total Harmonic Distortion	<5.0% of fundamental frequency	
Individual Harmonics	<3.0% of fundamental frequency	
5. Fault and Line Clearing for Loss of Voltage on any phase of CPS circuit	-30% of nominal voltage	0.167 sec
6. Direct Current Injection	< 0.5% of PV Facility rated output current.	

Note: The above limits apply at the Point of Interconnection. Disconnect set points are based on nominal frequency of 60 Hz.



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D. Control, protection and safety equipment requirements specific to single phase PV systems connected to CPS Energy's system.

Exporting to CPS Energy may require additional operational or protection devices and will require coordination of operations with CPS Energy. The necessary control, protection, and safety equipment specific to single-phase PV systems include an interconnect disconnect device, a PV disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, and a synchronizing check for synchronous and other types of generators with stand-alone capability.

E. Control, protection and safety equipment requirements specific to 3-phase PV systems connected to CPS Energy's system.

Exporting to CPS Energy may require additional operational or protection devices and will require coordination of operations with CPS Energy. Three-phase facilities rated 25-500 kW must have an interconnect disconnect device, a PV disconnect device, an over-voltage trip, an under-voltage trip, an over/under frequency trip, a manual or automatic synchronizing check (for facilities with stand alone capability), and either a ground over-voltage trip or a ground over-current trip depending on the grounding system if required by CPS Energy.

F. System Acceptance and Commissioning

- 1. Inspection and start-up testing.** The SPP shall provide CPS Energy with notice at least two weeks before the initial energizing and start-up testing of the SPP's PV equipment and CPS Energy may witness the testing of any equipment and protective systems associated with the interconnection. The SPP may be required to retest the system protection elements upon any reasonable request by CPS Energy, thereafter.
- 2. Site testing and commissioning.** Testing of protection systems shall include procedures to functionally test all protective elements of the system up to and including tripping of the PV and interconnection point. Testing will verify all protective set points and relay/breaker trip timing. CPS Energy may witness the testing of installed protection systems and PV. The SPP is responsible for routine maintenance of the PV and control and protective equipment. The SPP will maintain records of such maintenance activities, which CPS Energy may review at reasonable times.

G. Metering.

CPS Energy shall supply, own, and maintain all necessary meters and associated equipment to record energy purchases by the SPP and energy exports to CPS Energy.



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The SPP shall supply at no cost to CPS Energy a suitable location on its premises for the installation of CPS Energy's meters and other equipment.

H. SCADA.

CPS Energy shall supply, own, and maintain all RTU (remote terminal unit) and associated equipment to remotely control and/or monitor status and analog data deemed necessary by CPS Energy. All serial connected devices providing these reads to the RTU must be capable of communicating DNP 3.0 or Modbus protocol or provide a 4-20ma input to the RTU. This analog and status data may also be provided by the CPS Energy Metering Department at the site if the SPP's equipment cannot provide it. The SPP shall supply at no cost to CPS Energy a mutually agreed upon location on its premises for the installation of CPS Energy's SCADA equipment.