

# **City of Vernon**

## **General Guidelines for the Interconnection of Customer Owned Solar or Wind Generating Facility**

### **1. Introduction**

This document is intended to be a general overview of City of Vernon Department of Public Utilities (“VPU”) current technical requirements for interconnection of Customer Generator (“CG”) solar or wind distributed generation (a “Facility”) to the VPU distribution system (the “VPU System”). It is not intended to be relied on to determine the interconnection requirements for any Facility. City of Vernon does not design, engineer or install generating systems for its customers. VPU is also not able to recommend specific contractors or equipment suppliers.

In order to properly interconnect the proposed distributed generators, certain protective equipment (relays, circuit breakers, etc.) must be installed. These devices ensure that faults or other abnormalities initiate prompt and appropriate disconnection of the Facility from the VPU System. Protective equipment requirements depend on the plan of service. Significant issues that could affect these requirements include:

- The configuration of the Facility.
- The Point of CG Connection to the power system.
- The level of existing service and protection to adjacent facilities (including those of other VPU customers).

In addition, certain modifications and/or additions to the VPU System may be required for Facility interconnection. Each individual request for interconnection must result in a protection system consistent with these technical requirements. VPU makes the final determination as to the protective devices and identifies modifications and/or additions required by the Facility. VPU works with Customer to achieve an installation that meets the CG’s and VPU’s requirements.

VPU cannot assume any responsibility for protection of the Customer Generator’s Facility. Customers are solely responsible for protecting their equipment in such a manner that faults, imbalances, or other disturbances on the VPU System do not cause damage to the Facility facilities.

## **2. Generation Source**

This standard addresses inverter-based interconnection. The end conversion of the connection to the VPU distribution system must be into 60 Hz alternating current. An inverter is approved (certified) equipment for connection to VPU distribution system if it meets the following criteria:

It is UL-1741 certified, and on the California Energy Commission's (CEC) approved inverter list. This list is accessible via a link:

<https://solarequipment.energy.ca.gov/Home/Index>

It is compliant with ANSI/IEEE 1547 Standards for Interconnecting Distributed Resources with Electric Power Systems per <https://standards.ieee.org/standard/1547-2018.html>

In general, Customer Generator Facility consist of photovoltaic or wind-turbine electricity-generating modules, electrical controls, inverter(s), automatic disconnect devices, manual disconnect devices, and wiring to connect all of the above to VPU electric distribution system at VPU meter. Customer represents that the Facility shall be as shown on Exhibit A attached hereto.

## **3. Parallel Operation**

A parallel system is defined as one in which the Customer's generation can be connected to a bus common with the VPU's distribution system. A transfer of power between the two systems is a direct and often desired result. A consequence of such parallel operation is that the parallel generator becomes an electrical part of VPU distribution system that must be considered in the electrical protection of the VPU System.

In systems without parallel generation, the utility controls the only source of power supply to a given line and therefore has the responsibility to install equipment which is adequate, under expected circumstances, to detect faulted equipment and de-energize it. A parallel generator connected to a utility line represents another source of power to energize the line and must also have adequate protective devices installed to sense trouble on the utility system.

## **4. Generation Design Requirements**

- 4.1 Customer's Facility, and all portions of it used to provide or distribute electrical power and parallel interconnection with VPU's distribution equipment, shall be

designed, installed, constructed, operated, and maintained in compliance with these General Guidelines.

- 4.2 The Facility shall conform to all, as applicable, solar or wind electrical generating system safety and performance standards established by the National Electrical Code (NEC), the Institute of Electrical and Electronics Engineers (IEEE), accredited testing laboratories such as Underwriters Laboratories, and applicable building codes.
- 4.3 The installation shall conform to Electrical Utility Service Entrance Requirements Committee (EUSERC) Section 500 requirements. In addition, all metering equipment shall meet VPU accepted EUSERC specifications. For a chart of accepted EUSERC specifications, please refer to VPU Electrical Service Requirements (ESR).
- 4.4 The Facility shall meet the following specific design requirements:
  - (a) It shall automatically detect and isolate from the VPU source without any intentional delay within five cycles under the following conditions:
    1. Overvoltage +5 percent above 240 volts on AC supply
    2. Undervoltage -5 percent below 240 volts on AC supply
    3. Overfrequency - 1% above 60 Hz on AC supply
    4. Underfrequency – 1% below 60 Hz on AC supply
    5. AC overcurrent relay, circuit breaker, or internal fusing that will operate when the AC current is greater than the full load current.
  - (b) Inverter output harmonic distortion shall meet IEEE 519 standards. Any voltage flicker at the Point of Common Coupling caused by the Customer Generator's Facility should not exceed the limits defined by the "Maximum Borderline of Irritation Curve" identified in IEEE 519.
  - (c) In the event of inverter control failure, the DC contactor must return to the normally open condition.
  - (d) A 24 hour a day/365 days a year readily accessible, lockable, visible-break isolation device such as a disconnect switch acceptable to VPU clearly labeled, as appropriate, "Solar Generator Disconnect Switch" or "Wind Generator Disconnect Switch," and conspicuously located shall be provided and maintained by Customer.
  - (e) The inverter must be tested for islanding and the test result confirmed in writing by VPU.
  - (f) The Facility shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Std C62.41.2-2002 or IEEE Std C37.90.1.2002 as applicable.

- (g) The circuit feeding the inverter must be clearly identified inside the electrical service panel.
- (h) The Facility paralleling-device shall be capable of withstanding 220% of the VPU System rated voltage.
- (i) The Facility shall have telemetering capabilities, per VPU discretion, to the extent that less intrusive and/or more cost-effective options for providing the necessary data in real time are not available.
- (j) If the performance meter and disconnecting means are installed indoors, a dedicated electrical room with exterior 24/7 access shall be required in line sight or within 10' of the service entrance switchgear. The exterior door shall not be alarmed.

## **5. Specific Requirements**

1. A Customer Generator Facility will meet all applicable safety and performance standards established in the California State Building Code. The standards will be consistent with the applicable standards established by the National Electrical Code, the Institute of Electrical and Electronics Engineers, and Underwriters Laboratories or other similarly accredited laboratory. The Customer Generator Facility must also be in compliance with the applicable provisions of, as applicable, Schedule NM, Schedule NM-Large, or Schedule NM-Small.
2. The Customer Generator is responsible for obtaining all necessary government approvals relating to its Facility.
3. The Customer Generator is responsible for all costs associated with its Facility and is also responsible for all costs related to any modifications to the Facility that may be required by VPU for purposes of safety and reliability.
4. VPU-approved switching equipment capable of isolating the Customer Generator Facility from VPU's distribution system will be provided by the Customer Generator and will be accessible to VPU at all times.
5. VPU maintains the right to approve the facilities for interconnection, and to inspect such facilities at any time and for any reason.

6. VPU maintains the right to disconnect, without liability, the Customer Generator for issues relating to safety and reliability.
7. Customer shall not add generation capacity in excess of the Nameplate rating initially agreed upon, or otherwise modify the Generating Facility without the prior written permission from VPU.
8. Customer shall not commence parallel operation of the generator facility until written approval of the interconnection facilities has been given by VPU. Such approval shall not be unreasonably withheld. VPU shall have the right to have representatives present at the initial testing of Customer's protective apparatus, final inspection made by VPU Building Inspectors, and during the initial Facility start-up.

## **6. Maintenance and Permit**

Customer shall obtain any governmental authorizations and permits required for the construction and operation of the solar-electric generating facility and interconnection facilities and shall maintain all facilities in a safe and prudent manner and in conformance with all applicable laws and regulations including, but not limited to, VPU's Guidelines for Interconnection of Customer Owned Solar or Wind Generating Facility.

Customer shall reimburse VPU for any and all losses, damages, claims, penalties, or liability it incurs as a result of Customer's failure to obtain or maintain any governmental authorizations and permits required for construction and operation of Customer's generating facility.

## **7. Access to Premises**

VPU may enter Customer Generator premises:

- (a) to inspect, at all reasonable hours, Customer's protective devices and read or test meter; and
- (b) to disconnect, without notice the interconnection facilities if, in VPU's opinion, a hazardous condition exists and such immediate action is necessary to protect persons, or VPU's facilities, or property of others from damage or interference caused by Customer's solar-electric facilities, or lack of properly operating protective devices.

## **8. Disconnection, Interruption or Reduction of Deliveries**

- a. VPU shall not be obligated to accept or pay for, and may require Customer to interrupt or reduce, deliveries of as-available energy:
  - (a) When necessary in order to construct, install, maintain, repair, replace, remove, investigate, or inspect any of its equipment or any part of its system; or
  - (b) If VPU determines that curtailment, interruption, or reduction is necessary because of emergencies, forced outages, Force Majeure, or compliance with prudent electrical practices.
- b. Whenever possible, VPU shall give Customer reasonable notice of the possibility that interruption or reduction of deliveries may be required. During electrical emergencies, it may be required to disconnect the Facility from the VPU system. Therefore, the disconnecting device shall be capable of being accessed quickly and conveniently 24 hours a day, 7 days a week by VPU personnel without obstacles or requiring those seeking access to obtain keys, special permission, or security clearances, unless other arrangements for access are mutually agreed upon by both parties.
- c. Notwithstanding any other provisions of these Guidelines, if at any time VPU determines that either:
  - (a) the Facility may endanger VPU personnel, or
  - (b) the continued operation of Customer's Facility may endanger the integrity of VPU's System, VPU shall have the right to disconnect Customer's Facility from VPU's System. Customer's Facility shall remain disconnected until such time as VPU is satisfied that the conditions(s) referenced in (a) or (b) of this Section have been corrected.

## **9. Monitoring and Control**

### **a. Telemetry Requirements**

VPU System requires telemetry data for the integration of new generation resources. This typically consists of the continuous telemetering of kW quantities and hourly transmission of the previous hour's Wh from the Facility to the VPU load dispatching and control center. The net Facility output, which is the Facility generation less the station service load and step-up losses, is normally telemetered.

The following includes specific requirements based on Facility size:

- i. Telemetry is required when the output of the Facility entering the VPU System is 250 KW or greater: For this case, telemetry of real power and energy (kW, kWh), and reactive power (kVAr, kVArh) is normally required.
- ii. For Facilities below 250 KW, VPU determines telemetry needs on a case-by-case basis. Note that should an existing plant expand to over 250 KW, telemetry is required for the entire plant output.

**b. Supervisory Control and Data Acquisition (SCADA) Requirements**

Interconnection may require VPU SCADA control and status indication of the power circuit breakers and associated isolating switches used to connect VPU to the Facility. SCADA indication of real and reactive power flows and voltage levels are also required. SCADA control of breakers and isolating switches that are located at the Generation Site is not normally required; however, status indication may be necessary.

A SCADA Remote Terminal Unit (or PLC) will be installed at the interconnection facility, 250 KW or larger, with the necessary interface to connect it to VPU's communications system. This system will provide telemetering and control.

The minimum information which will be remotely monitored with the telemetering equipment is listed as follows:

- Watts in/out
- Vars in/out
- Amps
- KWhr and kVARhr
- Line voltage at interconnection
- Interconnection breaker status/control
- Phase angle across the interconnection power circuit breaker

**10. Revenue Metering Arrangement**

**a. Revenue and Net Metering Requirements for Billing Data**

Electricity flowing through Customer's interconnection with the City's system shall be measured on a net-metering basis pursuant to, as applicable, Schedule NM, Schedule NM-Large, or Schedule NM-Small. Metering shall be bi-

directional to record reactive flow to or from the Facility as well as Generation out of the Facility and Station Service (if any) from VPU System into the Facility.

Facility meters will be considered, subject to VPU approval, if the metering and net-metering functions are performed by an authorized non-VPU party. Three-element, three-phase, four-wire meters shall be used on grounded power systems. Two-element, three-phase, three-wire meters can be used on ungrounded power systems.

## **b. Meter Accuracy**

Watt-hour meters shall be calibrated to  $\pm 0.1\%$  accuracy at unity power factor for both full load and light load. Watt-hour meters shall also be calibrated to  $\pm 0.3\%$  accuracy for 0.5 power factor at full load. VAR-hour meters shall have  $\pm 0.2\%$  accuracy at unity power factor and  $\pm 0.6\%$  accuracy at 0.5 power factor. Full load is defined as nominal voltage, 100% meter current rating. Light load is normal voltage, 10% meter current rating.

## **11. Solar Equipment Labeling Requirements**

All National Electric Code, VPU and Fire Department required labeling must be made of sunlight and weather-resistant materials. Labeling on disconnects, inverters and service panels must be made of an engraved, plastic materials and be permanently attached to its respective device. All labeling shall be red background with white lettering. Unless otherwise specified, the labeling should be 3/8" high, all capital letters, arial or similar font, non-bold. All labeling shall be attached directly to those pieces of equipment. Labeling for circuit breakers shall be placed directly next to the circuit breaker.

The following labels are required where indicated:

- AC disconnects shall be labeled: "AC PHOTOVOLTAIC DISCONNECT"
- DC disconnects shall be labeled: "DC PHOTOVOLTAIC DISCONNECT"
- On the service entrance, a label stating: "PV SYSTEM WARNING- ELECTRIC SHOCK. THIS EQUIPMENT SUPPLIED FROM MORE THAN ONE SOURCE"

All AC and DC disconnects shall be lockable in the open position. Disconnects must be installed no more than ten (10) feet from the utility's revenue meter, or at the discretion of the VPU.