



City of Pasadena
Water and Power Department
Power Division

DISTRIBUTED GENERATION FACILITIES INTERCONNECTION REQUIREMENTS

REGULATION 23

Redlined Pages Only

Adopted by Council Resolution **8304** on October 13, 2003

Revision 1: Amended by Council Resolution **9156** on November 7, 2011

Revision 2: Amended by Council Resolution XXXX on April 30, 2018



I. Mailing List Request Additional Information and Updates

1. Website

Additional information regarding self-generation, customer interconnection and service requirements, and updates to this Regulation 23 may be found on the internet at:

www.PWPweb.com/SelfGeneration

2. Mailing List Request

To be placed on a mailing list to receive update sheets of these regulations, fill out the form below and mail to:

Regulation 23 Mailing List
Pasadena Water and Power
150 S. Los Robles Avenue, Suite 200
Pasadena, CA 91101-2437

Attn: Electric Utility Service Planning

DATE _____

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____



II. TELEPHONE NUMBERS

Utility Service Advisors (626) 744-4495

FOR OTHER INQUIRIES:

Electric Rates..... (626) 744-41834005

Energy Conservation (626) 744-6970

Emergency Service (24 hour number) (626) 744-4673

Inquiries Regarding Electric Bill (626) 744-4005

Inspection by Water and Power of
Underground Conducts and Vaults (24 hour service).. (626) 744-44674495

To obtain quadrant of Utility Pole for Pole Risers (626) 744-4495

Inspection by Electrical Inspector of Community Development Department
For All New Wiring..... (626) 744-4200



SCOPE AND PURPOSE

1. The Distributed Generation Facilities Interconnection Requirements constitute the Rules, Regulations and Policies of the City of Pasadena Water and Power Department (PWP) pertaining to distributed generation units connecting to the electric grid. This book is issued for the guidance and assistance of customers or Producers contemplating the installation of distributed generation, as well as electrical contractors, engineers, architects and manufacturers engaged in the installation and design of distributed generation.

Effective May 1, 2018, PWP will only accept requests to interconnect Generating Facilities that are intended to operate in parallel with PWP's Distribution System if they qualify as Renewable Generating Facilities, as defined herein. This requirement also applies to requests to replace or increase the capacity rating of existing Generation Facilities. This requirement does not apply to Generating Facilities intended as backup power sources and do not operate in parallel with PWP's Distribution System except during Momentary Parallel Operation

2. The provisions of the Distributed Generation Facilities Interconnection Requirements are intended to be in accordance with the latest revision of the following regulation, but are not intended to be a substitute for said regulations:
 - Underwriters Laboratory (UL) 1741
 - Institute of Electric and Electronic Engineers (IEEE) P1547
3. Distributed generation installation must meet the minimum requirements of the above regulations. When the requirements of Regulation 23 are more stringent than the above regulations, Regulation 23 will apply.
4. Any unusual situation or questions that are not covered in these regulations shall be referred to PWP for clarification in advance of commencing construction.



Table of Contents

I. ADDITIONAL INFORMATION AND UPDATES ~~MAILING LIST REQUEST~~ i

II. TELEPHONE NUMBERSii

SCOPE AND PURPOSE..... iii

ELECTRIC REGULATION 23

A. DEFINITIONS..... 1

B. APPLICABILITY 5

C. GENERAL REGULATIONS, RIGHTS AND OBLIGATIONS

 1. Authorization Required to Operate..... 5

 2. Transmission Service Not Provided with Interconnection 5

 3. Compliance with Laws, Regulations, and Tariffs..... 5

 4. Design Reviews and Inspections 5

 5. Right to Access 5

 6. Prudent Operation and Maintenance Required..... 6

 7. Renewable Generating Facility Certification/Attestation 6

 78. Curtailment or Disconnection 6

D. APPLICATION AND INTERCONNECTION PROCESS

 1. Application Process 6

E. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS

 1. General Interconnection and Protection Requirements 9

 2. Prevention of Interference..... 10

 3. Control, Protection and Safety Equipment Requirements..... 13

F. INTERCONNECTION FACILITY OWNERSHIP AND FINANCING

 1. Scope and Ownership of Interconnection Facilities 14

 2. Responsibility for Costs of Interconnecting a Generating Facility 15

G. METERING, MONITORING AND TELEMETRY

 1. General Requirements..... 15

 2. Metering by Third Parties..... 15

 3. Point of Common Coupling Metering 15

 4. Telemetry..... 16

 5. Location 16

H. DISPUTE RESOLUTION PROCESS 16



ELECTRIC REGULATION 23 DISTRIBUTED GENERATION FACILITIES INTERCONNECTION REQUIREMENTS

A. DEFINITIONS

Definitions. Capitalized terms used in this Regulation, and not otherwise defined, shall have the meaning ascribed to such terms in this section. The definitions in this Regulation shall only apply to this Regulation and not to PWP's other regulations.

Certification Test: A test pursuant to this Regulation that verifies conformance of certain equipment with PWP-approved performance standards in order to be classified as Certified Equipment. Certification Tests are performed by NRTLs.

Certification; Certified; Certificate: The documented results of a successful Certification Testing.

Certified Equipment: Equipment that has passed all required Certification Tests.

Commissioning Test: A test performed during the commissioning of all or part of a Generating Facility to achieve one or more of the following:

- Verify specific aspects of its performance;
- Calibrate its instrumentation;
- Establish instrument or Protective Function set-points.

Customer: The entity that receives or is entitled to receive Distribution Service through PWP's Distribution System.

Dedicated Transformer; Dedicated Distribution Transformer: A transformer that provides electricity service to a single Customer. The Customer may or may not have a Generating Facility.

Distribution Service: All services required by, or provided to, a Customer pursuant to the approved rate schedules and Regulations by PWP.

Distribution System: All electrical wires, equipment, and other facilities owned or provided by PWP by which PWP provides Distribution Service to its Customers.

Emergency: An actual or imminent condition or situation, which jeopardizes the Distribution System integrity as determined by PWP.

Field Testing: Testing performed in the field to determine whether equipment meets PWP's requirements for safe and reliable Interconnection

Generating Facility: All Generators that are included in an Interconnection Agreement.

Generator: A device converting mechanical, chemical, or solar energy into electrical energy, including all of its protective and control functions and structural appurtenances. A Generating Facility is comprised of one or more Generators comprise a Generating Facility.

Gross Nameplate Rating: The total gross generating capacity of a Generator or Generating Facility as designated by the manufacturer of the Generator.



Host Load: Electrical power that is consumed by the Customer at the property on which the Generating Facility is located.

Initial Review: The review by PWP, following receipt of an Application, to determine the following: (a) The Generating Facility qualifies for Simplified Interconnection; or (b) the Generating Facility can be made to qualify for Interconnection with Supplemental Review determining any potential additional requirements; or (c) if neither (a) nor (b), provides the cost estimate and schedule for performing an Interconnection Study.

In-rush Current: The current determined by the In-rush Current Test.

Interconnection; (Interconnected): The physical connection of a Generating Facility in accordance with the requirements of this Regulation so that Parallel Operation with the Distribution System can occur or (has occurred).

Interconnection Agreement: An agreement between PWP and the Producer that gives certain rights and obligations to effect or end Interconnection.

Interconnection Facilities: The electrical wires, switches and related equipment that interconnect a Generating Facility to the Distribution System. Interconnection Facilities are part of their related Generating Facilities.

Interconnection Study: A study to establish the requirements for Interconnection of a Generating Facility.

Island, Islanding: A condition on the Distribution System in which one or more Generating Facilities deliver power to Customers using a portion of the Distribution System that is electrically isolated from the remainder of the Distribution System.

Line Section: That portion of the Distribution System connected to a Customer bounded by automatic sectionalizing devices or the end of the distribution line.

Momentary Parallel Operation: The interconnection of a Generating Facility to the Distribution System for one second (60 cycles) or less.

Nationally Recognized Testing Laboratory (NRTL): A laboratory accredited to perform the certification testing requirements under this Regulation.

Net Energy Metering (NEM): Metering for the receipt and delivery of electricity between the Producer and PWP pursuant to NEM service provisions of the PWP Electric Rate Schedule and/or Section 2827 of the Public Utilities Code. Over a given time frame (typically a month) the difference between these two values yields either net consumption or surplus. The meter registers are ratcheted to prevent reverse registration. If available, a single meter may be allowed to spin backward to yield the same effect as a directional, two-meter (or register) arrangement.

Net Generation Output Metering (AKA "Performance Metering"): Metering of the net electrical power output in kW or energy in kWh, from a given Generating Facility. This may also be the measurement of the difference between the total electrical energy produced by a Generator and the electrical energy consumed by the auxiliary equipment necessary to operate the Generator. For a Generator with no Host Load, metering that is located at the Point of Common Coupling. For a Generator with Host Load, metering that is located at the Generator but after the point of auxiliary load(s) and prior to serving Host Load.



Net Nameplate Rating: The Gross Nameplate Rating minus the consumption of electrical power of a Generator or Generating Facility as designated by the manufacturer(s) of the Generator(s).

Non-Export; Non-Exporting: Designed to prevent the transfer of electrical energy from the Producer to PWP.

Non-Islanding: Designed to detect and disconnect from a stable Unintended Island with matched load and generation. Reliance solely on under/over voltage and frequency trip is not considered sufficient to qualify as Non-Islanding.

Parallel Operation: The simultaneous operation of a Generator with power delivered or received by PWP while Interconnected. For the purpose of this Regulation, Parallel Operation includes only those generators that are interconnected with the Distribution System for more than one second (60 cycles).

Periodic Test: A test performed on part or all of a Generating Facility at pre-determined time or operational intervals to achieve one or more of the following:

- Verify specific aspects of its performance;
- Calibrate instrumentation; and/or,
- Verify and re-establish instrument or Protective Function set points.

Point of Common Coupling Metering: Metering located at the Point of Common Coupling. This is the same Metering as Net Generation Output Metering for Generating Facilities with no Host Load.

Point of Common Coupling: The transfer point for electricity between the electrical conductors of PWP and the electrical conductors of the Producer.

Point of Interconnection: The electrical transfer point between a Generator or a Generating Facility and the electrical system. This may or may not be coincident with the Point of Common Coupling.

Producer: The entity that executes an Interconnection Agreement with PWP. The Producer may or may not own or operate the Generating Facility, but is responsible for the rights and obligations related to the Interconnection Agreement.

Production Test: A test performed on each device coming off the production line to verify certain aspects of its performance.

Protective Function(s): The equipment, hardware or software in a Generating Facility (whether discrete or integrated with other functions) whose purpose is to protect against Unsafe Operating Conditions.

Prudent Electrical Practices: Those practices, methods, and equipment, as changed from time to time, that are commonly used in prudent electrical engineering and operations to design and operate electric equipment lawfully and with safety, dependability, efficiency, and economy.

PWP: The City of Pasadena Water and Power Department.

PWP Electric Rate Schedule: Pasadena Municipal Code Section 13.04, the Light and Power Rate Ordinance.



Renewable Generating Facility: A Generating Facility consisting only of Generator(s) that meet the definition of "Renewable electrical generation facility" as defined in Section 25741 of the California Public Resources Code.

Simplified Interconnection: Interconnection conforming to the minimum requirements under these Regulations, as determined by Section I.

Short Circuit Contribution Ratio (SCCR): The ratio of the Generating Facility's short circuit contribution to PWP's short circuit contribution for a three-phase fault at the high voltage side of the distribution transformer connecting the Generating Facility to PWP's system.

Single Line Diagram; Single Line Drawing: A schematic drawing, showing the major electrical switchgear, protection devices, wires, generators, transformers and other devices, providing sufficient detail to communicate to a qualified engineer the essential design and safety of the system being considered.

Stabilization; Stability: The return to normalcy of the PWP Distribution System, following a disturbance. Stabilization is usually measured as a time period during which voltage and frequency are within acceptable ranges.

Starting Voltage Drop: The percentage voltage drop at a specified point resulting from In-rush Current. The Starting Voltage Drop can also be expressed in percentage on a particular base voltage, (e.g. 6 volts on a 120-volt base, yielding a 5% drop).

Supplemental Review: A process wherein PWP further reviews an Application that fails one or more of the Initial Review Process screens. The Supplemental Review may result in one of the following: a) Simplified Interconnection; b) approval of Interconnection with additional requirements; or c) cost and schedule for an Interconnection Study.

System Integrity: The condition under which a Distribution System is deemed safe and can reliably perform its intended functions in accordance with the safety and reliability Regulations of PWP.

Telemetry: The electrical or electronic transmittal of metering data in real-time to PWP.

Transfer Trip: A Protective Function that trips a Generating Facility remotely by means of an automated communications link controlled by PWP.

Type Test: A test performed on a sample of a particular model of a device to verify specific aspects of its design, construction and performance.

Unintended Island: The creation of an island, usually following a loss of a portion of the Distribution System, without the approval of PWP.

Unsafe Operating Conditions: Conditions that, if left uncorrected, could result in harm to personnel, damage to equipment, loss of System Integrity or operation outside pre-established parameters required by the Interconnection Agreement.

Visible Disconnect: An electrical switching device that can separate the Generating Facility from the Distribution System and is designed to allow visible verification that separation has been accomplished. This requirement can be met by opening the enclosure to observe the contact separation.



B. APPLICABILITY

Applicability. This Regulation describes the interconnection, operating and metering requirements for Generating Facilities to be connected to the PWP Distribution System pursuant to the PWP Electric Rate Schedule.

Effective May 1, 2018, PWP will only accept requests to interconnect Generating Facilities that are intended to operate in parallel with PWP's Distribution System if they qualify as Renewable Generating Facilities. This requirement also applies to requests to replace or increase the capacity rating of existing Generation Facilities. This requirement does not apply to Generating Facilities intended as backup power sources and do not operate in parallel with PWP's Distribution System except during Momentary Parallel Operation.

C. GENERAL REGULATIONS, RIGHTS AND OBLIGATIONS

- 1. Authorization Required to Operate.** Producer must comply with this Regulation, execute an Interconnection Agreement with PWP, and take electrical energy service pursuant to the PWP Electric Rate Schedule. Other than for momentary testing, Generating Facility shall not be interconnected to PWP's Distribution System prior to receiving permission to operate in writing from PWP.
- 2. Transmission Service Not Provided with Interconnection.** Interconnection with PWP's Distribution System under this Regulation does not provide a Producer any rights to utilize PWP's Distribution System for the transmission or distribution, or wheeling of electric power.
- 3. Compliance with Laws, Regulations, and Tariffs.** Producer shall ascertain and comply with PWP Regulations, rate schedules, and applicable California Public Utilities Commission approved Regulations, tariffs, and regulations; and any local, state or federal law, statute or regulation which applies to the design, siting, construction, installation, operation, or any other aspect of the Producer's Generating Facility and Interconnection Facilities.
- 4. Design Reviews and Inspections.** PWP shall review the design of a Producer's Generating Facility and Interconnection Facilities and to inspect a Producer's Generating and Interconnection Facilities prior to the commencement of Parallel Operation with PWP's Distribution System. PWP may require a Producer to make modifications as necessary to comply with the requirements of this Regulation. PWP's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the Producer's design or as warranting the Generating or Interconnection Facilities' safety, durability or reliability. PWP shall not, by reason of such review or lack of review, be responsible for the strength, adequacy, or capacity of such equipment.
- 5. Right to Access.** Producer's Generating Facility and Interconnection Facilities shall be reasonably accessible to PWP personnel as necessary for PWP to perform its duties and exercise its rights under its rate schedules and



Regulations, and any Interconnection Agreement between PWP and the Producer.

6. **Prudent Operation and Maintenance Required.** Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with this Regulation.

7. **Renewable Generating Facility Biomethane Certification/Attestation:** For any Generating Facility using biomethane to qualify as a Renewable Generating Facility, Producer shall provide an attestation, signed by a duly authorized representative, with sufficient documentation and information for PWP to determine that: (i) any biomethane used meets the Renewable energy resource requirements established by the California Energy Commission ("CEC"); and, (ii) the Generating Facility consumes no other fuel than biomethane. Such attestation shall be provided prior to Interconnection and annually thereafter. At any time, PWP may request documentation providing evidence of CEC certification of biomethane used at the Generation Facility. If PWP determines in its reasonable judgment that Producer either failed to provide evidence or that it provided insufficient evidence that the Generating Facility does not or will not meet the eligibility requirements, then the Generating Facility shall be deemed to be out of compliance with this Regulation until such time as Producer demonstrates to PWP's reasonable satisfaction that the Generating Facility meets the requirements of a Renewable Generating Facility.

- 7.8. **Curtailment or Disconnection.** If Producer or Generating Facility fails to comply with any provision of this Regulation, PWP may lockout or require the disconnection of a Producer's Generating Facility from PWP's Distribution System until such condition is remedied. PWP may limit the operation or disconnect or require the disconnection of a Producer's Generating Facility from PWP's Distribution System at any time, with or without notice, in the event of an Emergency, or to correct Unsafe Operating Conditions. However, PWP must provide written notice as soon as possible following such disconnect. PWP may also limit the operation or disconnect or require the disconnection of Producer's Generating Facility from PWP's Distribution System upon the provision of reasonable written notice: 1) to allow for routine maintenance, repairs or modifications to PWP's Distribution System; 2) upon PWP's determination that Producer's Generating Facility is not in compliance with this Regulation; or, 3) upon termination of the Interconnection Agreement. Upon the Producer's written request PWP shall provide a written explanation of the reason for such curtailment or disconnection.

D. APPLICATION AND INTERCONNECTION PROCESS

1. Application Process

- a. **Applicant Initiates Contact with PWP.** Upon request, PWP will provide information and documents (such as sample agreements, the Application,



technical information, listing of Certified Equipment, application fee information, applicable rate schedules and metering requirements) in response to a potential applicant's inquiry. PWP will establish an individual representative as the single point of contact for an applicant, but may allocate responsibilities among its staff to best coordinate the Interconnection of an applicant's Generating Facility.

- b. Applicant Completes and Files an Application.** All applicants shall be required to complete and file an Application and supply any relevant additional information requested by PWP. The filing must include the completed Application and a fee for processing the application and performing the Initial Review to be completed by PWP pursuant to Section D.1.c. The application fee shall vary with the type of the proposed Generating Facility as follows:

Type of Service	Initial Review	Supplemental Review
Net Energy Metering (per Public Utilities Code Section 2827)	None	None
All others	\$800	\$600 (additional)

Fifty percent of the fees associated with the Initial Review will be returned to the applicant if the Application is rejected by PWP or the applicant retracts the Application.

The applicant may propose and PWP may negotiate specific costs for processing non-standard applications such as multi-units, multi-sites, or otherwise as conditions warrant. The costs for the Initial Review and the Supplemental Review contained in this Section, as well as the language provided in Sections D.1.c and D.1.d, do not apply under these circumstances.

If deficiencies in the application are noted, PWP and applicant shall cooperate in a timely manner to establish a satisfactory Application.

The information submitted in the Application will remain active and valid for a period of twelve months from the date the Application is accepted by PWP as a "completed" Application. If the project has not received authorization to operate per Section D.1.h of this regulation, the Application will expire. The PWP General Manager may authorize a twelve month extension if construction of the Generation Facility is at a substantially advanced stage, in the sole discretion of PWP.



- d. **Harmonics.** Harmonic distortion shall be in compliance with IEEE 519. Exception: The harmonic distortion of a Generating Facility located at a Producer's site shall be evaluated using the same criteria as for the loads at that site.
- e. **Direct Current Injection.** Generating Facilities should not inject Direct Current greater than 0.5% of rated output current into PWP's Distribution System.
- f. **Power Factor.** Each Generator in a Generating Facility shall be capable of operating at some point within a power factor range of 0.9 leading and 0.9 lagging. ~~Operation outside this range is acceptable provided the reactive power of the Generating Facility is used to meet the reactive power needs of on-site loads or that reactive power is otherwise provided under tariff by PWP~~ To the extent technically feasible, a Generating Facility shall be operated in a manner that meets the reactive power needs of on-site loads in order to maintain a power factor at the Point of Common Coupling in the range of 0.9 leading and 0.9 lagging. The Producer shall notify PWP if it is using the Generating Facility for power factor correction.

3. Control, Protection and Safety Equipment Requirements

a. Technology Specific Requirements

- 1) **Three-Phase Synchronous Generators.** For three-phase Generators, the circuit breakers shall be three-phase devices with electronic or electromechanical control. Producer shall be responsible for properly synchronizing its Generating Facility with the Distribution System by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all synchronous generators, which have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. A Generating Facility whose SCCR exceeds 0.05 shall be equipped with Protective Functions suitable for detecting loss of synchronism and rapidly disconnecting the Generating Facility from the Distribution System. Unless otherwise agreed to between the Producer and PWP, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the Distribution System. Power system stabilization functions are specifically not required for Generating Facilities under 10 MW Net Nameplate Rating. Synchronization means that at the time of connection, the frequency difference shall be less than 0.2 Hz, the voltage difference shall be less than 10%, and the phase angle difference shall be less than 10 degrees.
- 2) **Induction Generators.** Induction Generators do not require a synchronizing function. Starting or Rapid fluctuations on induction generators can adversely impact the Distribution System's voltage. Corrective step-switched capacitors or other techniques may be