

September 4, 2002

**Advice 2281-E
(Pacific Gas and Electric Company ID U 39 E)**

Public Utilities Commission of the State of California

Subject: Revisions to PG&E's Electric Rule 21 – Generating Facility Interconnections

Pacific Gas and Electric Company (PG&E) submits this advice letter seeking approval of certain changes to Electric Rule 21. PG&E believes the attached changes may constitute modification of Commission Decisions (D.) 00-11-001 and D. 00-12-037 adopting interconnection standards. Accordingly, PG&E requests that the Commission issue a Resolution adopting these changes to the model electric interconnection tariff (Model Tariff) adopted by the Commission in those decisions.¹

I. BACKGROUND

A. Adoption of the “Model Tariff”

In October 1999, the Commission commenced Rulemaking 99-10-025 to address issues associated with interconnection of distributed generation (DG) projects to the electric distribution systems of the three investor-owned electric utilities (UDCs).² One of the objectives of the proceeding was to revise the existing electric rules of the three UDCs to try and simplify and streamline electric interconnections. To accomplish this, the California Energy Commission (Energy Commission or CEC) initiated a workshop process to explore revisions to the UDCs' existing interconnection rules. Workshops were held in December 1999, January and March 2000, and April and May 2000. The Energy Commission staff prepared a report on the workshops in April 2000. The Siting Committee at the Energy Commission adopted and forwarded recommendations to the full Energy Commission in May 2000 and on June 14, 2000 the Energy Commission adopted an order containing “Recommendation Regarding Distributed Generation Interconnection Rule.” This document contained the text of a new electric interconnection rule that the Energy Commission recommended as a

¹ PG&E reserves all legal rights to challenge the decisions or statutes under which it has been required to make this advice filing, and nothing in this advice filing constitutes a waiver of such rights. Also, PG&E reserves any additional legal rights to challenge the requirement to make this advice filing by reason of its status as a debtor under Chapter 11 of the Bankruptcy Code, and nothing in this advice filing constitutes a waiver of such rights.

² PG&E, Southern California Edison Company, and San Diego Gas and Electric Company.

replacement for the UDCs' existing rules. The Energy Commission filed its recommendation with this Commission on June 27, 2000.

On November 2, 2000, the CPUC issued its "Interim Decision Adopting Interconnection Standards," D. 00-01-011, directing the UDCs to file, within 15 days, compliance advice letters to revise their electric interconnection tariffs. Specifically, the Commission adopted a "Model Tariff," based on the CEC's recommendation, which the Commission attached to its order (see Appendix A to D. 00-01-011, "Rule 21 Model Tariff Language.") On November 17, 2000, in compliance with this order PG&E filed Advice 2056-E, which was approved on March 15, 2001.

In its order, the Commission acknowledged that the Energy Commission had under consideration certain supplemental recommendations. On October 25, 2000, the CEC adopted its Supplemental Recommendations for changes to the UDCs' interconnection standards, and conveyed those to the CPUC. On December 21, 2000, the CPUC issued its final "Decision Adopting Interconnection Standards," D. 00-12-037, in which it directed additional language changes to the previously adopted "Model Tariff." These changes were reflected in a revised "Model Tariff" (see Attachment A to D. 00-12-037, "Rule 21 Model Tariff Language."). On January 5, 2001, PG&E filed Advice 2071-E, conforming its Electric Rule 21 to the changes directed by D. 00-12-037.

B. The Continuing Rule 21 Workshop Process

In D. 00-12-037, the Commission also directed that the Rule 21 workshop process at the CEC be continued as a forum to discuss and resolve implementation issues arising from the newly adopted Rule. Decision 00-12-037, Conclusion of Law 9. Since December 2000, the Rule 21 working group has continued to meet and discuss issues related to DG interconnections. One of the efforts of the working group has involved gathering together, and building consensus around, proposed changes to the "Model Tariff". In the spring of 2002, these efforts culminated in the changes proposed in the attached version of PG&E's Electric Rule 21.³

II. THE COMMISSION SHOULD ISSUE A RESOLUTION APPROVING THE PROPOSED CHANGES TO THE MODEL TARIFF

PG&E has participated in the Rule 21 working group process over the past 18 months and supports the changes to the Model Tariff recommended by the working group. These changes are shown in the attached appendix. There are a large number of proposed changes to the Rule. They range from ministerial,

³ Since D. 00-12-037, there have been other CPUC decisions, and statutes, directing changes to Rule 21. In each instance, PG&E followed the decision or statute with a compliance Advice Letter. See Advice Letters 2056-E and 2071-E. The attached revisions to the "Model Tariff" contain those changes to the extent approved by the Energy Division.

where the meaning of the Rule is unchanged, to substantive where the Rule is clarified or changed in a way that may modify the meaning of the Model Tariff.

In the working group the issue was raised as to the proper procedure for changing the Model Tariff. In PG&E's view, since the Model Tariff was adopted by the Commission and made part of its decisions, the Commission should issue a ruling to effectuate any modifications to the Model Tariff.

However, the Commission's Energy Division has expressed a desire that the attached changes be submitted as an advice letter, and not as a petition for modification. In accordance with this desire, PG&E is therefore following the advice letter process. PG&E believes that this is an appropriate process *provided* that the Commission issues a resolution confirming that the proposed changes to the Model Tariff, which may amount to modification of the decisions adopting the Model Tariff, are proper. While flexibility in making beneficial changes to Rule 21 is certainly desirable, a Model Tariff developed after a yearlong deliberative process before both this Commission and the CEC, and adopted in two decisions of this Commission, should not be subject to significant change by a process that simply bypasses further Commission deliberation.

For the foregoing reasons, PG&E asks the Commission to approve PG&E's Advice 2275-E and to issue a Resolution, approving the attached changes to the Model Tariff adopted in D. 00-0-11-001 and D. 00-12-037.

Effective Date

PG&E requests that this advice letter become effective on such date as the Commission shall specify in its Resolution approving Advice 2281-E.

This filing will not increase any rate or charge, cause the withdrawal of service, or conflict with any other rate schedule or rule.

Protest

Anyone wishing to protest this filing should do so by sending a letter via postal mail and facsimile by, **September 24, 2002**, which is 20 days after the date of this filing. The protest must state the grounds upon which it is based, including such items as financial and service impact, and should be submitted expeditiously. Protests should be mailed to:

IMC Branch Chief
Energy Division
California Public Utilities Commission
505 Van Ness Avenue, Room 4002
San Francisco, California 94102
Facsimile: (415) 703-2200
E-mail: jjr@cpuc.ca.gov

Copies should also be mailed to the attention of the Director, Energy Division, Room 4005 and Jerry Royer, Energy Division, at the address shown above. It is also requested that a copy of the protest be sent via postal mail and facsimile to Pacific Gas and Electric Company on the same date it is mailed or delivered to the Commission at the address shown below.

Pacific Gas and Electric Company
Attention: Les Gullasi
Director, Regulatory Relations
77 Beale Street, Mail Code B10C
P.O. Box 770000
San Francisco, California 94177
Facsimile: (415) 973-7226
E-mail: RxDd@pge.com

The protest shall set forth the grounds upon which it is based and shall be submitted expeditiously. There is no restriction on who may file a protest.

Notice

In accordance with General Order 96-A, Section III, Paragraph G, a copy of this advice letter is being sent electronically and via U.S. mail to parties shown on the attached list, and the service list parties for Rulemaking 99-10-025. Address changes should be directed to Rose Abao (415) 973-2218. Advice letter filings can also be accessed electronically at:

http://www.pge.com/customer_services/business/tariffs/

Vice President - Regulatory Relations

Attachments

cc: Service List R. 99-10-025



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

B. GENERAL, RULES, RIGHTS AND OBLIGATIONS (Cont'd.)

- 5. Design Reviews and Inspections. PG&E shall have the right to review the design of a Producer's Generating and Interconnection Facilities and to inspect a Producer's Generating and/or Interconnection Facilities prior to the commencement of Parallel Operation with PG&E's Distribution System. PG&E may require a Producer to make modifications as necessary to comply with the requirements of this Rule. PG&E's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the Producer's design or as warranting the Generating and/or Interconnection Facilities' safety, durability or reliability. PG&E shall not, by reason of such review or lack of review, be responsible for the strength, adequacy or capacity of such equipment. (T)
- 6. Right to Access. A Producer's Generating Facility and Interconnection Facilities shall be reasonably accessible to PG&E personnel as necessary for PG&E to perform its duties and exercise its rights under its tariffs approved by the Commission, and any Interconnection Agreement between PG&E and the Producer. (T)
|
(T)
- 7. Confidentiality of Information. Any information pertaining to Generating and/or Interconnection Facilities provided to PG&E by a Producer shall be treated by PG&E in a confidential manner. PG&E shall not use information contained in the Application to propose discounted tariffs to the customer unless authorized to do so by the Customer or the information is provided to PG&E by the Customer through other means. (T)
- 8. Prudent Operation and Maintenance Required. A Producer shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with this Rule. (T)
(D)
- 9. Curtailment and Disconnection. PG&E may limit the operation or disconnect or require the disconnection of a Producer's Generating Facility from PG&E's Distribution System at any time, with or without notice, in the event of an Emergency, or to correct Unsafe Operating Conditions. PG&E may also limit the operation or disconnect or require the disconnection of a Producer's Generating Facility from PG&E's Distribution System upon the provision of reasonable written notice: 1) to allow for routine maintenance, repairs or modifications to PG&E's Distribution System; 2) upon PG&E's determination that a Producer's Generating Facility is not in compliance with this Rule; or 3) upon termination of the Interconnection Agreement. Upon the Producer's written request, PG&E shall provide a written explanation of the reason for such curtailment or disconnection. (T)
(T)
(T)
(N)
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(N)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

C. APPLICATION AND INTERCONNECTION PROCESS (T)

1. APPLICATION PROCESS (T)

a. Applicant Initiates Contact With PG&E. Upon request, PG&E will provide information and documents (such as agreements, Application, technical information, listing of Certified Equipment, Initial and Supplemental Review fee information, applicable rate schedules and Metering requirements) to a potential Applicant. Unless otherwise agreed upon, all such information shall normally be sent to an Applicant within three (3) business days following the initial request from the Applicant. PG&E will establish an individual representative as the single point of contact for the Applicant, but may allocate responsibilities among its staff to best coordinate the Interconnection of an Applicant's Generating Facility. (T)

b. Applicant Completes an Application. All Applicants shall be required to complete and file an Application and supply any relevant additional information requested by PG&E. The filing must include the completed Application and the Initial Review fee for processing the Application and performing the review to be completed by PG&E pursuant to Section C.1.c. The Initial and Supplemental Review fee shall vary with the type of service that will be provided to the Customer account to which the proposed Generating Facility will be interconnected as indicated in the following table: (T)

Type of Service provided to Customer Account	Initial Review Fee	Supplemental Review Fee
Net Energy Metering (per Public Utilities Code Section 2827)	None	None
Solar Generating facilities of 1 MW or less that do not sell power to the grid (per D.01-07-027)	None	None
All Others	\$800	\$600 (additional)

Notes: Allocation of cost between Applicant and PG&E to be determined by the Commission in Phase 2 of R.99-10-025. The total cost borne by the Applicant should be reduced by the cost allocated to PG&E's distribution function.

Fifty percent of the fees associated with the Initial Review will be returned to the Applicant if the application is rejected by PG&E or the Applicant retracts the Application. The Applicant may propose, and PG&E may negotiate specific costs for processing non-standard Generating Facilities, such as multi-Generators, 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 C.1.c and C.1.d do not apply under these circumstances. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

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| C. | APPLICATION AND INTERCONNECTION PROCESS (Cont'd.) | (T) | |
| 1. | APPLICATION PROCESS (Cont'd.) | (T) | |
| b. | Applicant Completes an Application. (Cont'd.) | | |
| | Within 10 business days of receiving the Application, PG&E shall normally acknowledge its receipt and state whether the Application has been completed adequately. If defects are noted, PG&E and Applicant shall cooperate in a timely manner to establish a satisfactory Application. | (T) | (L) |
| | | | |
| | | | |
| | | (T) | (L) |
| c. | PG&E Performs an Initial and Supplemental Review and Develops Preliminary Cost Estimates and Interconnection Requirements. | (T) | |
| 1) | Upon receipt of a satisfactorily completed Application and any additional information necessary to evaluate the Interconnection of a Generating Facility, PG&E shall perform an Initial Review using the process defined in Section I. The Initial Review determines if: (a) the Generating Facility qualifies for Simplified Interconnection; or (b) the Generating Facility requires a Supplemental Review. | (T) | |
| | | (T) | |
| | | (N) | |
| | | (D) | |
| 2) | PG&E shall complete its Initial Review, absent any extraordinary circumstances, within 10 business days after its determination that the Application is complete. If the Initial Review determines the proposed Generating Facility can be Interconnected by means of a Simplified Interconnection, PG&E will provide the Applicant with a draft Interconnection Agreement pursuant to Section C.1.e. | (T) | |
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| | | (T) | |
| 3) | If the Generating Facility does not qualify for Simplified Interconnection as proposed, PG&E will notify the Applicant and perform a Supplemental Review as described in Section I. The Supplemental Review will result in PG&E providing either: (a) Interconnection requirements beyond those for a Simplified Interconnection, and a draft Interconnection Agreement; or (b) a cost estimate and schedule for an Interconnection Study. The Supplemental Review shall be completed, absent any extraordinary circumstances, within 20 business days of receipt of a completed Application. Payment for the Supplemental Review shall be submitted to PG&E within 10 calendar days after the results of the Supplemental Review are provided to the Applicant. | (T) | |
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RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

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|----|--|--|--------------------------------|
| C. | APPLICATION AND INTERCONNECTION PROCESS (Cont'd.) | (T) | |
| 1. | APPLICATION PROCESS (Cont'd.) | (T) | |
| d. | When Required, Applicant and PG&E Commit to Additional Interconnection Study Steps. When a Supplemental Review reveals that the proposed facility cannot be Interconnected to PG&E's Distribution System by means of a Simplified Interconnection, or that significant PG&E Interconnection Facilities or Distribution System improvements will be needed to accommodate an Applicant's Generating Facility, PG&E and Applicant shall enter into an agreement that provides for PG&E to perform additional studies, facility design, and engineering and to provide detailed cost estimates for fixed price or actual cost billing to the Applicant at the Applicant's expense. The Interconnection Study agreement shall set forth PG&E's estimated schedule and charges for completing such work. Initial and Supplemental Review and Interconnection Study fees for solar generating facilities up to 1 megawatt (MW) that do not sell power to the grid will be waived up to the amount of \$5,000. Generating Facilities eligible for Net Energy Metering under Public Utilities Code Section 2827 are exempt from any costs associated with Interconnection Studies. | (T)

(T)

(T)

(N)

(N)
(D) | |
| e. | Applicant and PG&E Enter Into an Interconnection Agreement and, Where Required, a Financing and Ownership Agreement for Interconnection Facilities or Distribution System Improvements. PG&E shall provide the Applicant with an executable version of the Interconnection Agreement or Net Energy Metering agreement appropriate for the Applicant's Generating Facility and desired mode of operation. Where the Supplemental Review or Interconnection Study performed by PG&E has determined that modifications or additions are required to be made to its Distribution System are required, or that additional Interconnection Facilities will be necessary to accommodate an Applicant's Generating Facility, PG&E may also provide the Applicant with other Interconnection Facilities financing and ownership agreements. These agreements shall set forth PG&E and the Applicant's responsibilities, completion schedules, and estimated or fixed price costs for the required work. | (T)

(T)

(T) | |
| f. | Where Applicable, PG&E or Producer Installs Required Interconnection Facilities or Modifies PG&E's Distribution System. After executing the applicable agreements, PG&E or Producer will commence construction/ installation of the Distribution System improvements or Interconnection Facilities which have been identified in the agreements. The parties will use good faith efforts to meet schedules and fixed costs or estimated costs as appropriate. | (T)

(T)

(D) | (L)

(L) |

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- C. APPLICATION AND INTERCONNECTION PROCESS (Cont'd.) (T)

 - 1. APPLICATION PROCESS (Cont'd.) (T) (L)
 - g. Producer Arranges for and Completes Commissioning Testing of Generating Facility and Producer's Interconnection Facilities. The Producer is responsible for testing new Generating Facilities and associated Interconnection Facilities according to Section J.5 to ensure compliance with the safety and reliability provisions of this Rule prior to being operated in parallel with PG&E's Distribution System. For non-Certified Equipment, the Producer shall develop a written testing plan to be submitted to PG&E for its review and acceptance. Alternatively, the Producer and PG&E may agree to have PG&E conduct the required testing at the Producer's expense. Where applicable, the test plan shall include the installation test procedures published by the manufacturer of the generation or Interconnection equipment. Facility testing shall be conducted at a mutually agreeable time, and depending on who conducts the test, PG&E or Producer shall be given the opportunity to witness the tests. (N)
 - h. PG&E Authorizes Parallel Operation or Momentary Parallel Operation. The Producer's Generating Facility shall be authorized for Parallel Operation or Momentary Parallel Operation, as applicable, with PG&E's Distribution System upon satisfactory compliance with the terms of all applicable agreements and PG&E's express written permission. Compliance may include, but not be limited to, provision of any required documentation and satisfactorily completing any required inspections or tests as described herein or in the agreements formed between the Producer and PG&E. A Producer shall not commence Parallel Operation of its Generating Facility with PG&E's system unless it has received PG&E's express written permission to do so. (N) (T)
 - i. PG&E Reconciles Costs and Payments. If the Producer selected a fixed price billing for the Interconnection Facilities or Distribution System improvements, no reconciliation will be necessary. If the Producer selected actual cost billing, a true-up will be required. Within a reasonable time after the Interconnection of a Producer's Generating Facility, PG&E will reconcile its actual costs related to the Generating Facility against any advance payments made by the Producer. The Producer will receive either a bill for any balance due or a reimbursement for overpayment as determined by PG&E's reconciliation. The Producer shall be entitled to a reasonably detailed and understandable accounting for the payments. (T) (L)

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RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS

(T)
(L)
(N)

1. GENERAL INTERCONNECTION AND PROTECTION FUNCTION REQUIREMENTS

- a. Protective Functions Required. Generating Facilities operating in parallel with PG&E's Distribution System shall be equipped with the following Protective Functions to sense abnormal conditions and cause the Generating Facility to be automatically disconnected from PG&E's Distribution System or to prevent the Generating Facility from being connected to PG&E's Distribution System inappropriately:
 - 1) Over and under voltage trip functions and over and under frequency trip functions;
 - 2) A voltage and frequency sensing and time-delay function to prevent the Generating Facility from energizing a de-energized Distribution System circuit and to prevent the Generating Facility from reconnecting with the Distribution System unless the Distribution System service voltage and frequency is within a range specified by PG&E and is stable for at least 60 seconds; and
 - 3) A function to prevent the Generating Facility from contributing to the formation of an Unintended Island.
- b. Momentary Paralleling Generating Facilities. With PG&E's approval, the transfer switch or system used to transfer the Producer's loads from PG&E's Distribution System to Producer's Generating Facility may be used in lieu of the Protective Functions required for Parallel Operation.
- c. Purpose of Protective Functions. The Protective Functions and requirements of this Rule are designed to protect PG&E's Distribution System and not the Generating Facility. A Producer shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The Producer's protective devices shall not impact the operation of other protective devices utilized on the Distribution System in a manner that would affect PG&E's capability of providing reliable service to its Customers.

(N)
(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)

1. GENERAL INTERCONNECTION AND PROTECTION FUNCTION REQUIREMENTS (Cont'd.)

- d. Suitable Equipment Required. Circuit breakers or other interrupting devices located at the Point of Common Coupling must be Certified or "Listed" (as defined in Article 100, the Definitions Section of the National Electrical Code) as suitable for their intended application. This includes being capable of interrupting the maximum available fault current expected at their location. Producer's Generating Facility and Interconnection Facilities shall be designed so that the failure of any one device shall not potentially compromise the safety and reliability of PG&E's Distribution System. (N) (L)
- e. Visible Disconnect Required. The Producer shall furnish and install a manual disconnect device that has a Visible Disconnect to isolate the Generating Facility from PG&E's Distribution System. The device must be accessible to PG&E personnel and be capable of being locked in the open position. Generating Facilities with Non-Islanding inverters totaling one (1) kilovolt-ampere (kVA) or less are exempt from this requirement.
- f. Single-Phase Generators. For single-phase Generators connected to a shared single-phase secondary system, the maximum Net Nameplate Rating of the Generating Facilities shall be 20 kVA. Generators connected to a center-tapped neutral 240-volt service must be installed such that no more than 6 kVA of imbalanced power is applied to the two "legs" of the 240-volt service. For Dedicated Distribution Transformer services, the maximum Net Nameplate Rating of a single-phase Generating Facility shall be the transformer nameplate rating.
- g. Drawings Required. Prior to Parallel Operation or Momentary Parallel Operation of the Generating Facility, PG&E shall approve the Producer's Protective Function and control diagrams. Generating Facilities equipped with a Protective Function and control scheme previously approved by PG&E for system-wide application or only Certified Equipment may satisfy this requirement by reference to previously approved drawings and diagrams.
- h. Generating Facility Conditions Not Identified. In the event this Rule does not address the Interconnection requirements for a particular Generating Facility, PG&E and Producer may agree upon other requirements. (N)

(D)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)
(D)
2. PREVENTION OF INTERFERENCE

The Producer shall not operate Generating or Interconnection Facilities that superimpose a voltage or current upon PG&E's Distribution System that interferes with PG&E operations, service to PG&E customers, or communication facilities. If such interference occurs, the Producer must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by PG&E. If the Producer does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, PG&E may, without liability, disconnect the Producer's facilities from PG&E's Distribution System, in accordance with Section B.9 of this Rule. To eliminate undesirable interference caused by its operation, each Generating Facility shall meet the following criteria: (T)

- a. Normal Voltage Operating Range. The voltage operating range limits for Generating Facilities shall be used as a Protection Function that responds to abnormal conditions on PG&E's Distribution System and not as a voltage regulation function. (T)

- 1) Generating Facilities (11 kVA or less). Generating Facilities with a Gross Nameplate Rating of 11 kVA or less shall be capable of operating within the voltage range normally experienced on PG&E's Distribution System. The operating range shall be selected in a manner that minimizes nuisance tripping between 106 volts and 132 volts on a 120-volt base. (88%-110% of nominal voltage). Generating Facilities shall cease to energize PG&E's circuits whenever the voltage at the Point of Common Coupling deviates from the allowable voltage operating range. (T)

- 2) Generating Facilities (greater than 11 kVA). PG&E may have specific operating voltage ranges for Generating Facilities with Gross Nameplate Ratings greater than 11 kVA, and may require adjustable operating voltage settings. In the absence of such requirements, the Generating Facility shall operate at a range between 88% and 110% of the applicable interconnection voltage. (T) (L)

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RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)
- 2. PREVENTION OF INTERFERENCE (Cont'd.) (L)
- a. Normal Voltage Operating Range (Cont'd.)

- 3) Voltage Disturbances. Whenever PG&E's Distribution System voltage at the Point of Common Coupling varies from normal (nominally 120 volts) by the predetermined amounts set forth in Table D-1, the Generating Facility's Protective Functions shall cause the Generator(s) to become isolated from PG&E's Distribution System: (N)

Table D.1: Voltage Trip Settings

Voltage at Point of Common Coupling (Assuming 120 V Base)	Maximum Trip Time* (Assuming 60 Cycles per Second)
Less than 60 Volts	10 Cycles
Greater than or equal to 60 Volts but less than 106 Volts	120 Cycles
Greater than or equal to 106 Volts but less than or equal to 132 Volts	Normal Operation
Greater than 132 Volts but less than or equal to 165 Volts	120 Cycles (30 Cycles for facilities greater than 11 Kva)
Greater than 165 Volts	6 Cycles

* "Maximum Trip time" refers to the time between the onset of the abnormal condition and the Generating Facility ceasing to energize PG&E's Distribution System. Protective Function sensing devices and circuits may remain connected to PG&E's Distribution System to allow sensing of electrical conditions for use by the "reconnect" feature. The purpose of the allowed time delay is to allow a Generating Facility to "ride through" short-term disturbances to avoid nuisance tripping. For Generating Facilities with a Gross Nameplate Rating of 11 kVA or less, the set points are to be non-user adjustable. For Generating Facilities with a Gross Nameplate Rating greater than 11 kVA, different voltage set points and trip times from those in Table D.1 may be negotiated with PG&E. (N)

- b. Flicker. Any voltage flicker at the Point of Common Coupling caused by the Generating Facility should not exceed the limits defined by the "Maximum Borderline of Irritation Curve" identified in IEEE 519 (*IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems*, IEEE STD 519, Institute of Electrical and Electronic Engineers, Piscataway, NJ). This requirement is necessary to minimize the adverse voltage affects experienced by other customers on PG&E's Distribution System. Induction Generators may be connected and brought up to synchronous speed (as an induction motor) provided these flicker limits are not exceeded. (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)
- 2. PREVENTION OF INTERFERENCE (Cont'd.) (L)
 - c. Frequency. PG&E controls system frequency, and the Generating Facility shall operate in synchronism with the PG&E Distribution System. Generating Facilities with Gross Nameplate Rating of 11 kVA or less shall have a fixed operating frequency range of 59.3-60.5 Hertz. The Generating Facility must cease to energize PG&E's Distribution System within a maximum of 10 cycles should PG&E's Distribution System remain outside of the frequency limits. The purpose of the time delay is to allow the Generating Facility to ride through short-term disturbances to avoid nuisance tripping. PG&E may require adjustable operating frequency settings for Generating Facilities with a Gross Nameplate Rating greater than 11 kVA. (T) (T) (D)
 - d. Harmonics. Harmonic distortion shall be in compliance with IEEE 519. Exception: The harmonic distortion of a Generating Facility located at a Customer's site shall be evaluated using the same criteria as 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 PG&E's Distribution System. (T) (T)
 - f. Power Factor. Each Generator in a Generating Facility shall be capable of operating at some point within a power factor range from 0.9 leading to 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 the Host Loads or that reactive power is otherwise provided under tariff by PG&E. The Producer shall notify PG&E if it is using the Generating Facility for power factor correction. (T) (T) (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)
- 3. CONTROL, PROTECTIVE FUNCTION AND SAFETY EQUIPMENT REQUIREMENTS (T)
- a. TECHNOLOGY SPECIFIC REQUIREMENTS (D)
- 1) Three-Phase Synchronous Generators. For three-phase Generators, the Generating Facility circuit breakers shall be three-phase devices with electronic or electromechanical control. The Producer shall be responsible for properly synchronizing its Generating Facility with PG&E's Distribution System by means of either a manual or automatic synchronizing device. Automatic synchronizing is required for all synchronous Generators that have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. A Generator whose SCCR exceeds 0.05 shall be equipped with Protective Functions suitable for detecting loss of a synchronism and rapidly disconnecting the Generator from PG&E's Distribution System. Unless otherwise agreed upon by the Producer and PG&E, synchronous Generators shall automatically regulate power factor, not voltage, while operating in parallel with PG&E's Distribution System. Power system stabilization is 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 Hertz, the voltage difference shall be less than 10%, and the phase angle difference shall be less than 10 degrees. (T)
- 2) Induction Generators. Induction Generators do not require a synchronizing function. Starting or rapid load fluctuations on induction generators can adversely impact PG&E's Distribution System's voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferro-resonance. When these counter measures (e.g., additional capacitors) are installed on the Producer's side of the Point of Common Coupling, PG&E must review these measures. Additional equipment may be required as determined in a Supplemental Review or an Interconnection Study. (D)
- 3) Inverter Systems. Utility-interactive inverters do not require separate synchronizing equipment. Non-utility-interactive or "stand-alone" inverters shall not be used for Parallel Operation with PG&E's Distribution System. (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- D. GENERATING FACILITY DESIGN AND OPERATING REQUIREMENTS (Cont'd.) (T)
 - 3. CONTROL, PROTECTIVE FUNCTION AND SAFETY EQUIPMENT REQUIREMENTS (Cont'd.) (T)
 - b. SUPPLEMENTAL GENERATING FACILITY REQUIREMENTS (N) (L)
 - 1) Unintended Islanding for Generating Facilities That Fail the Export Screen (Section I.3.b). Generating Facilities must mitigate their potential contribution to an Unintended Island. This can be accomplished by one of the following options: (1) incorporating Certified Non-Islanding control functions into the Protective Functions; (2) verifying that Host Loads sufficiently exceed the Net Nameplate Rating of the Generating Facility; or (3) incorporating a Transfer Trip or an equivalent Protective Function.
 - 2) Fault Detection. A Generating Facility with an SCCR exceeding 0.1 or one with Protective Functions that do not meet any one of the options for detecting Unintended Islands in D.3.b.1. shall be equipped with Protective Functions designed to detect Distribution System faults, both line-to-line and line-to-ground, and promptly cease to energize PG&E's Distribution System in the event of a fault. For a Generating Facility that cannot detect these faults within two seconds, PG&E may require a Transfer Trip system or an equivalent Protective Function. Reclose-blocking of PG&E's affected recloser(s) may also be required for Generating Facilities that exceed 15% of the peak load on the Line Section. (N) (L)
- E. INTERCONNECTION FACILITY OWNERSHIP AND FINANCING (D)
 - 1. SCOPE AND OWNERSHIP OF INTERCONNECTION FACILITIES (T)
 - a. Scope. Parallel Operation of Generating Facilities may require Interconnection Facilities or improvements to be made to PG&E's Distribution System ("Distribution System improvements"). The type, extent and costs of Interconnection Facilities and Distribution System improvements shall be consistent with this Rule and determined through the Supplemental Review and/or Interconnection Studies described in Section C. (T)
 - b. Ownership. Interconnection Facilities installed on Producer's side of the Point of Common Coupling may be owned, operated and maintained by the Producer or PG&E. Interconnection Facilities installed on PG&E's side of the Point of Common Coupling and Distribution System improvements shall be owned, operated and maintained only by PG&E. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

E. INTERCONNECTION FACILITY OWNERSHIP AND FINANCING (Cont'd.)

2. RESPONSIBILITY OF COSTS OF INTERCONNECTING A GENERATING FACILITY

- a. Study and Review Costs. A Producer shall be responsible for the reasonably incurred costs of the reviews and studies conducted pursuant to Section C.1 of this Rule. Interconnection Study fees for solar Generating Facilities up to 1 MW that do not sell power to the grid will be waived up to the amount of \$5,000. Generating Facilities eligible for Net Energy Metering under California Public Utilities Code 2827 are exempt from any costs associated with interconnection studies. (N)
- b. Facility Costs. A Producer shall be responsible for all costs associated with Interconnection Facilities owned by the Producer. The Producer shall also be responsible for any costs reasonably incurred by PG&E in providing, operating, or maintaining the Interconnection Facilities and Distribution System improvements required solely for the Interconnection of the Producer's Generating Facility with PG&E's Distribution System. Generating Facilities eligible for Net Energy Metering under California Public Utilities Code 2827 are exempt from any costs associated with Distribution System improvements or modifications. (T)
- c. Separation of Costs. Should PG&E combine the installation of Interconnection Facilities or Distribution System improvements required for the Interconnection of a Generating Facility improvements to PG&E's Distribution System to serve other Customers or Producers, PG&E shall not include the costs of such separate or incremental facilities in the amounts billed to the Producer. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

E. INTERCONNECTION FACILITY OWNERSHIP AND FINANCING (Cont'd.)

3. INSTALLATION AND FINANCING OF INTERCONNECTION FACILITIES AND DISTRIBUTION SYSTEM IMPROVEMENTS (Cont'd.) (T)

- c. Third-Party Installations. Subject to the approval of PG&E, a Producer may at its option employ a qualified contractor to provide and install Interconnection Facilities or Producer paid Distribution System improvements, to be owned and operated by PG&E, on PG&E's side of the Point of Common Coupling. Such Interconnection Facilities and Distribution System improvements shall be installed in accordance with PG&E's design and specifications. Upon final inspection and acceptance by PG&E, the Producer shall transfer ownership of such Producer installed Interconnection Facilities or Distribution System improvements to PG&E and such facilities shall thereafter be owned and maintained by PG&E at the Producer's expense. The Producer shall pay PG&E's reasonable cost of design, administration, and monitoring of the installation for such facilities to ensure compliance with PG&E's requirements. The Producer shall also be responsible for all costs, including any income tax liability, associated with the transfer of Producer installed Interconnection Facilities and Distribution System improvements to PG&E. (T)
- d. Reservation of Unused Facilities. When a Producer wishes to reserve PG&E-owned Interconnection Facilities or Distribution System improvements installed and operated as Special Facilities for the Producer at Producer's expense, but idled by a change in the operation of the Producer's Generating Facility or otherwise, Producer may elect to abandon or reserve such facilities consistent with the terms of its agreement with PG&E. If Producer elects to reserve idle Interconnection Facilities or Distribution System improvements, PG&E shall be entitled to continue to charge Producer for the costs related to the ongoing operation and maintenance of the Special Facilities. (T)
- e. Refund of Salvage Value. When a Producer elects to abandon the Special Facilities for which it has either advanced the installed costs or constructed and transferred to PG&E, the Producer shall, at a minimum, receive from PG&E a credit for the net salvage value of the Special Facilities. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

F. METERING, MONITORING AND TELEMETRY

1. GENERAL REQUIREMENTS

All Generating Facilities shall be metered in accordance with this Section F and shall meet all applicable standards of PG&E contained in PG&E's applicable tariffs and published PG&E manuals dealing with Metering specifications. The requirements in this Section F do not apply to Metering of Generating Facilities operating under PG&E's Net Energy Metering tariff pursuant to California Public Utilities Code Section 2827. (T)

2. METERING BY NON-PG&E PARTIES

The ownership, installation, operation, reading and testing of Metering Equipment for Generating Facilities shall be by PG&E except to the extent that the Commission has determined that all these functions, or any of them, may be performed by others as authorized by the Commission. (T)

3. NET GENERATION METERING

For purposes of monitoring Generating Facility operation for determination of standby charges and applicable non-bypassable charges as defined in PG&E's tariff, and for Distribution System planning and operations, consistent with Section B.4 of this Rule, PG&E shall have the right to specify the type, and require the installation of Net Generation Metering equipment. PG&E shall only require Net Generation Metering to the extent that less intrusive and/or more cost effective options for providing the necessary Generating Facility output data are not available. In exercising its discretion to require Net Generation Metering, PG&E shall consider all relevant factors, including but not limited to: (T)

- a. Data requirements in proportion to need for information; (T)
- b. Producer's election to install equipment that adequately addresses PG&E's operational requirements; (T)
- c. Accuracy and type of required Metering consistent with purposes of collecting data; (T)
- d. Cost of Metering relative to the need for and accuracy of the data; (T)
- e. The Generating Facility's size relative to the cost of the Metering/monitoring; (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
 (Continued)

F. METERING, MONITORING AND TELEMETRY (Cont'd.)

3. NET GENERATION METERING (Cont'd.)

- f. Other means of obtaining the data (e.g., Generating Facility logs, proxy data etc.); and (T) | (L)
- g. Requirements under any Interconnection Agreement with the Producer. (T) (L)

PG&E will report to the Commission or designated authority, on a quarterly basis, the rationale for requiring Net Generation Metering equipment in each instance along with the size and location of the facility. (T)

4. POINT OF COMMON COUPLING METERING

For purposes of assessing PG&E charges for retail service, the Producer's Point of Common Coupling Metering shall be a bi-directional meter so that power deliveries to and from the Producer's site can be separately recorded. Alternately, the Producer may, at its sole option and cost, require PG&E to install multi-metering equipment to separately record power deliveries to PG&E's Distribution System and retail purchases from PG&E. Such Point of Common Coupling Metering shall be designed to prevent reverse registration. (T)

5. TELEMETERING

If the nameplate rating of the Generating Facility is 1 MW or greater, Telemetering equipment at the Net Generator Metering location may be required at the Producer's expense. If the Generating Facility is Interconnected to a portion of PG&E's Distribution System operating at a voltage below 10 kV, then Telemetering equipment may be required on Generating Facilities 250 kW or greater. PG&E shall only require Telemetering to the extent that less intrusive and/or more cost effective options for providing the necessary data in real time are not available. PG&E will report to the Commission or designated authority, on a quarterly basis, the rationale for requiring Telemetering equipment in each instance along with the size and location of the facility. (T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

F. METERING, MONITORING AND TELEMETRY (Cont'd.)

6. SUNSET PROVISION

(L)

Sections F.3 and F.5 are interim provisions only. PG&E shall file permanent Metering requirements with the Commission on or by December 31, 2002. At that time, PG&E shall serve its application for approval of permanent Metering requirements on the service list in Order Instituting Rulemaking (OIR) 99-10-025.

(T)
|
(T)

7. LOCATION

Where PG&E-owned Metering is located on the Producer's premises, Producer shall provide, at no expense to PG&E, a suitable location for all such Metering Equipment.

(T)

8. COSTS OF METERING

The Producer will bear all costs of the Metering required by this Rule, including the incremental costs of operating and maintaining the Metering Equipment.

(T) (L)

G. DISPUTE RESOLUTION PROCESS

The following procedures will apply for disputes arising from this Rule:

1. The Commission shall have initial jurisdiction to interpret, add, delete or modify any provision of this Rule or of any agreements entered into between PG&E and the Producer to implement this tariff ("The Implementing Agreements") and to resolve disputes regarding PG&E's performance of its obligations under its tariffs, the applicable agreements, and requirements related to the Interconnection of the Producer's Generating or Interconnection Facilities pursuant to this Rule.

(T)
|
|
|
(T)

2. Any dispute arising between PG&E and the Producer (individually "Party" and collectively "the Parties") regarding PG&E's performance of its obligations under its tariffs, the Implementing Agreements, and requirements related to the Interconnection of Producer's Facilities pursuant to this Rule shall be resolved according to the following procedures.

(T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

G. DISPUTE RESOLUTION PROCESS (Cont'd.)

2. (Cont'd.)

a. The dispute shall be reduced to writing by the aggrieved Party in a letter ("the dispute letter") to the other Party containing the relevant known facts pertaining to the dispute, the specific dispute and the relief sought, and express notice by the aggrieved Party that it is invoking the procedures under Section G.2. Within 45 calendar days of the date of the dispute letter, the Parties' authorized representatives will be required to meet and confer to try to resolve the dispute.

(L)

b. If the Parties do not resolve their dispute within 45 calendar days after the date of the dispute letter, the dispute shall, upon demand of either party, be submitted to resolution before the Commission in accordance with the Commission's Rules of Practice and Procedure Applicable to Customer Complaints.

3. Pending resolution of any dispute under this Section, the Parties shall proceed diligently with the performance of their respective obligations under this Rule and the Implementing Agreements, unless the Implementing Agreements have been terminated. Disputes as to the application and implementation of this Section shall be subject to resolution pursuant to the procedures set forth in this Section.

H. DEFINITIONS

The definitions in this Section H are applicable only to this Rule, the Application and Interconnection Agreements.

(T)

(T)

(D)

(L)

Active Anti-Islanding Scheme: A control scheme installed as part of the Generating or Interconnection Facility that senses and prevents the formation of an Unintended Island.

Applicant: The entity submitting an Application for Interconnection pursuant to this Rule.

(T)

Application: A Commission-approved standard form submitted to PG&E for Interconnection of a Generating Facility.

(N)

(N)

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

(T)

|

(T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

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

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

Commission: The Public Utilities Commission of the State of California.

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; and
- Establish instrument or Protective Function set-points.

Customer: The entity that receives or is entitled to receive Distribution Service through the 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. (L)
(D)

Distribution Service: All services required by, or provided to, a Customer pursuant to the approved tariffs of PG&E other than services directly related to the Interconnection of a Generating Facility under this Rule. (T)
(T)

Distribution System: All electrical wires, equipment, and other facilities owned or provided by PG&E, other than Interconnection Facilities, by which PG&E provides Distribution Service to its Customers. (T)
(D)

Emergency: An actual or imminent condition or situation, which jeopardizes PG&E's Distribution System Integrity.

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

Generating Facility: All Generators, electrical wires, equipment, and other facilities owned or provided by Producer for the purpose of producing electric power. (T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

Generator: A device converting mechanical, chemical or solar energy into electrical energy, including all of its protective and control functions and structural appurtenances. One or more Generators comprise a Generating Facility. (N)
|
(N)

Gross Nameplate Rating; Gross Nameplate Capacity: The total gross generating capacity of a Generator or Generating Facility as designated by the manufacturer(s) of the Generator(s). (T)

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

Initial Review: The review by PG&E, following receipt of an Application, to determine the following: (a) the Generating Facility qualifies for Simplified Interconnection; or (b) if the Generating Facility can be made to qualify for Interconnection with a Supplemental Review determining any additional requirements. (D)
(T)
|
|
(T)

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

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

Interconnection; Interconnected: The physical connection of a Generating Facility in accordance with the requirements of this Rule so that Parallel Operation with PG&E's Distribution System can occur (has occurred).

Interconnection Facilities: The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric Distribution Service to a Customer to allow Interconnection. PG&E Interconnection Facilities may be located on either side of the Point of Common Coupling as appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately. (T)
|
|
(T)

Interconnection Study: A study to establish the requirements for Interconnection of a Generating Facility with PG&E's Distribution System. (T)

Island; Islanding: A condition on PG&E's Distribution System in which one or more Generating Facilities deliver power to Customers using a portion of PG&E's Distribution System that is electrically isolated from the remainder of PG&E's Distribution System. (D)
(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

Line Section: That portion of PG&E's Distribution System connected to a Customer bounded by automatic sectionalizing devices or the end of the distribution line. (L)

Metering: The measurement of electrical power flow in kW and/or energy flow in kWh, and, if necessary, kVAR at a point, and its display to PG&E, as required by this Rule. (T)
(T)

Metering Equipment: All equipment, hardware, software including meter cabinets, conduit, etc., that are necessary for Metering. (L)

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

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

Net Energy Metering: Metering for the receipt and delivery of electricity between the Producer and PG&E pursuant to Section 2827 of the Public Utilities Code and Schedule NEM, Net Energy Metering. (T)
(T)

Net Generation Metering: Metering of the net electrical power of energy output in kW or energy in kWh, respectively 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 and/or Public Utilities Code Section 218 Load (Section 218 Load), Metering that is located at the Point of Common Coupling. For a Generator with Host Load and/or Section 218 Load, Metering that is located at the Generator but after the point of auxiliary load(s) and prior to serving Host Load and/or Section 218 Load. (T)

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). (D)
(T)
(T)

Network Service: More than one electrical feeder providing Distribution Service at a Point of Common Coupling.

Non-Export; Non-Exporting: Designed to prevent the transfer of electrical energy from the Generating Facility to PG&E.

Non-Exporting, Non-Net Metered Solar Distributed Generation: Solar generators up to 1 MW that do not sell power to other users on the grid and engage in only incidental export of power to the grid. These generators may not take service under net-metering tariffs.

(L)
(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

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. (L)
|
(L)

Parallel Operation: The simultaneous operation of a Generator with power delivered or received by PG&E while Interconnected. For the purpose of this Rule, Parallel Operation includes only those Generating Facilities that are so Interconnected with PG&E's Distribution System for more than 60 cycles (one second). (T)

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:
(1) Verify specific aspects of its performance; (2) Calibrate instrumentation; and
(3) Verify and re-establish instrument or Protective Function set-points.

Point of Common Coupling (PCC): The transfer point for electricity between the electrical conductors of PG&E and the electrical conductors of the Producer.

Point of Common Coupling Metering: Metering located at the Point of Common Coupling. This is the same Metering as Net Generation Metering for Generating Facilities with no Host Load and/or Section 218 Load.

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

Producer: The entity that executes an Interconnection Agreement with PG&E. 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. (N)
|
(N)

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 and/or software in a Generating Facility (whether discrete or integrated with other functions) whose purpose is to protect against Unsafe Operating Conditions. (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

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. (L)

Scheduled Operation Date: The date specified in the Interconnection Agreement when the Generating Facility is, by the Producer's estimate, expected to begin operation pursuant to this Rule. (T)

Secondary Network: A network supplied by several primary feeders suitably interlaced through the area in order to achieve acceptable loading of the transformers under emergency conditions and to provide a system of extremely high service reliability. Secondary networks usually operate at 600 V or lower.

Section 218 Load: Electrical power that is supplied in compliance with California Public Utilities Code Section 218. Public Utilities Code Section 218 defines an "Electric Corporation" and provides conditions under which a transaction involving a Generating Facility would not classify a Producer as an Electric Corporation. These conditions relate to "over-the-fence" sale of electricity from a Generating Facility without using PG&E's Distribution System.

Short Circuit (Current) Contribution Ratio (SCCR): The ratio of the Generating Facility's short circuit contribution to the short circuit contribution provided through PG&E's Distribution System for a three-phase fault at the high voltage side of the distribution transformer connecting the Generating Facility to PG&E's system. (T)

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

Single Line Diagram; Single Line Drawing: A schematic drawing, showing the major electric switchgear, Protective Function 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. (N)

Special Facilities: As defined in PG&E's Rules governing Special Facilities. (T)

Stabilization; Stability: The return to normalcy of PG&E's Distribution System, following a disturbance. Stabilization is usually measured as a time period during which voltage and frequency are within acceptable ranges. (D)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

H. DEFINITIONS (Cont'd.)

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 volts on a particular base voltage, (e.g., 6 volts on a 120-volt base, yielding a 5%.

Supplemental Review: A process wherein PG&E 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) approval of Interconnection; (b) approval of Interconnection with additional requirements; or (c) cost and schedule for an Interconnection Study.

(N)
|
|
|
(N)

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 rules of PG&E.

Telemetry: The electrical or electronic transmittal of Metering data in real-time to PG&E.

(T)

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

(N)
(N)

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 PG&E.

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.

(T)

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.

(N)
|
|
(N)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (T)

1. INTRODUCTION

This Review Process allows for rapid approval for the interconnection of those Generating Facilities that do not require an Interconnection Study. The review process includes a screening to determine if a Supplemental Review is required. (T)
(T)

2. PURPOSE

The review determines:

- a. If a Generating Facility qualifies for Simplified Interconnection;
- b. If a Generating Facility can be made to qualify for Interconnection with a Supplemental Review determining any additional requirements; or (T)
- c. If an Interconnection Study is required, the cost estimate and schedule for performing the Interconnection Study.

Note: Failure to pass any screen of the review process means only that further review and/or studies are required before the Generating Facility can be approved for Interconnection with PG&E's Distribution System. It does not mean that the Generating Facility cannot be Interconnected. (T)
(T)
(T)

(Continued)

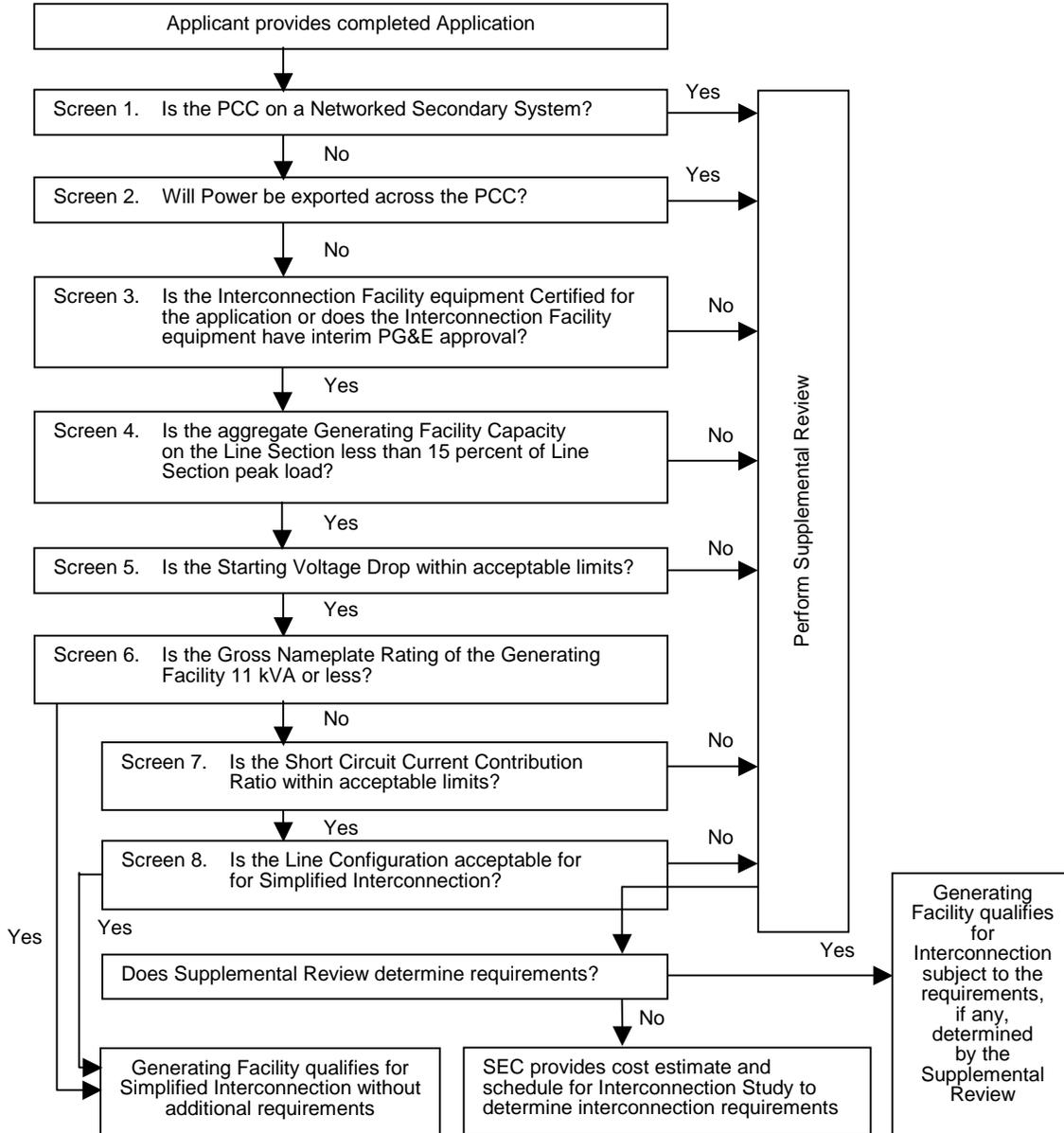


RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)

3. REVIEW PROCESS DETAILS

Review and Supplemental Process Flow Chart



(T) ----- (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)

3. REVIEW PROCESS DETAILS (Cont'd.)

a. Screen 1: Is the PCC on a Networked Secondary System? (N)

- If Yes, the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review.
- If No, continue to next screen.

Significance: Special considerations must be given to Generating Facilities proposed to be installed on networked secondary Distribution Systems because of the design and operational aspects of network protectors. There are no such considerations for radial distribution systems.

b. Screen 2: Will power be exported across the PCC?

- If Yes, the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review.
- If No, the Generating Facility must incorporate one of the following four options:

Option 1 ("Reverse Power Protection"): To insure power is never exported, a reverse power Protective Function may be implemented at the PCC. The default setting for this Protective Function, when used, shall be 0.1% (export) of the service transformer's rating, with a maximum 2.0 second time delay.

Option 2 ("Minimum Power Protection"): To insure at least a minimum amount of power is imported at all times (and, therefore, that power is not exported), an under-power Protective Function may be implemented at the PCC. The default setting for this Protective Function, when used, shall be 5% (import) of the Generating Facility's total Gross Nameplate Rating, with a maximum 2.0 second time delay.

(N)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)

3. REVIEW PROCESS DETAILS (Cont'd.)

b. Screen 2: Will power be exported across the PCC? (Cont'd.) (N)

Option 3 (“Certified Non-Islanding Protection”): To insure the incidental export of power is limited to acceptable levels, this option, when used, requires that all of the following conditions be met: (a) the total Gross Nameplate Capacity of the Generating Facility must be no more than 25% of the nominal ampere rating of the Producer’s service equipment; (b) the total Gross Nameplate Capacity of the Generating Facility must be no more than 50% of the Producer’s service transformer capacity rating (this capacity requirement does not apply to customers taking primary service without an intervening transformer); and (c) the Generating Facility must be certified as Non-Islanding.

Option 4 (“Relative Unit Size”): This option, when used, requires Net Nameplate Capacity of the Generating Facility to be so small in comparison to its host facility’s minimum load, that the use of additional Protective Functions is not required to insure that power will not be exported to PG&E’s Distribution System. This option requires the Generating Facility capacity to be no greater than 50% of the Producer’s verifiable minimum Host Load over the past 12 months.

Significance:

- 1) If it can be assured that the Generating Facility will not export power, PG&E’s Distribution System does not need to be studied for load-carrying capability or Generating Facility power flow effects on PG&E voltage regulators as the Generating Facility will be reducing load on PG&E’s Distribution System.
- 2) This Screen permits the use of reverse-power or minimum-power relaying at the PCC as a positive Anti-Islanding Protective Function.

c. Screen 3: Is the Interconnection Facility equipment Certified for the application or does the Interconnection Facility equipment have interim PG&E approval?

- If Yes, continue to next screen.
- If No, the Generating and/or Interconnection Facility does not qualify for Simplified Interconnection. Perform Supplemental Review.

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)
3. REVIEW PROCESS DETAILS (Cont'd.)
- c. Screen 3: Is the Interconnection Facility equipment Certified for the application or does the Interconnection Facility equipment have interim PG&E approval? (Cont'd.) (T)
|
(T)
- Significance: If the Generating and/or Interconnection Facility has been Certified or previously approved by PG&E, PG&E does not need to repeat its full review and/or test of the Generating and/or Interconnection Facility's Protective Functions. Site Commissioning Testing may still be required to insure that the Protective Functions are working properly. (N) (L)
| |
| |
(N) (L)
- Certification or PG&E approval indicates the following criteria have been tested and verified:
- Basic Protective Function requirements met.
 - Harmonic distortion limits met.
 - Synchronizing requirements met.
 - Power factor regulation requirements met.
 - Non-Islanding requirements met.
 - If used, reverse power function requirement met.
 - If used, under-power function requirement met.
- d. Screen 4: Is the aggregate Generating Facility capacity on the Line Section less than 15% of Line Section peak load? (T)
(T)
- If Yes, continue to next screen.
 - If No, the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review to determine cumulative impact on Line Section.
- Significance:
- 1) Low penetration of Generating Facility installations will have a minimal impact on the operation and load restoration efforts of PG&E's Distribution System. (T)
- 2) The operating requirements for a high penetration of Generating Facilities may be different since the impact on PG&E's Distribution System will no longer be minimal, therefore requiring additional study or controls. (T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- | | | | |
|----|--|-----|-----|
| I. | REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) | (T) | |
| | 3. REVIEW PROCESS DETAILS (Cont'd.) | | |
| | e. Screen 5: Is the Starting Voltage Drop within acceptable limits? | (T) | (L) |
| | • If Yes, continue to next screen. | (N) | |
| | • If No, the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review. | | |
| | Note: This Screen only applies to Generating Facilities that start by motoring the Generator(s). | (N) | (L) |
| | PG&E has two options in determining whether Starting Voltage Drop could be a problem. The option to be used is at PG&E's discretion: | | |
| | Option 1: PG&E may determine that the Generating Facility's starting In-rush Current is equal to or less than the continuous ampere rating of the customer's service equipment. | (T) | |
| | Option 2: PG&E may determine the impedances of the service distribution transformer (if present) and the secondary conductors to Customer's service equipment and perform a voltage drop calculation. Alternatively, PG&E may use tables or nomographs to determine the voltage drop. Voltage drops caused by starting a Generator as a motor must be less than 2.5% for primary interconnections and 5% for secondary interconnections. | (T) | |
| | | | (T) |
| | Significance: | | |
| | 1) This Screen addresses potential voltage fluctuation problems for Generators that start by motoring. | (T) | (T) |
| | 2) When starting, Generating Facilities should have minimal impact on the service voltage to other PG&E Customers. | | |
| | 3) Passing this screen does not relieve the Producer from ensuring that its Generating Facility complies with the flicker requirements of this Rule, Section D.2.b. | (T) | (T) |
| | | | (L) |

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)
3. REVIEW PROCESS DETAILS (Cont'd.)
- f. Screen 6: Is the Gross Nameplate Rating of the Generating Facility 11 kVA or less? (T) (L)
- If Yes, the Generating Facility qualifies for Simplified Interconnection. Skip remaining screens.
 - If No, continue to next screen.
- Significance: The Generating Facility will have a minimal impact on fault current levels and any potential line overvoltages from loss of Distribution System neutral grounding. (T) (L)
- g. Screen 7: Is the Short Circuit Current Contribution Ratio within acceptable limits? (T)
- If Yes, continue to next screen.
 - If No, the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review. (T)
- The Short Circuit Current Contribution Ratio Screen consists of two criteria; both of which must be met when applicable: (T)
- 1) When measured at primary side (high side) of a Dedicated Distribution Transformer serving a Generating Facility, the sum of the Short Circuit Contribution Ratios of all generating facilities connected to the particular Distribution System circuit that serves the Generating Facility must be less than or equal to 0.1, and (T)
 - 2) When measured at the secondary side (low side) of a shared distribution transformer, the short circuit contribution of the proposed Generating Facility must be less than or equal to 2.5% of the interrupting rating of the Producer's Service Equipment. (T)
- Significance: If the Generating Facility passes this screen it can be expected that it will have no significant impact on PG&E's Distribution System's short circuit duty, fault detection sensitivity, relay coordination or fuse-saving schemes. (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

I. REVIEW PROCESS FOR APPLICATIONS TO INTERCONNECT GENERATING FACILITIES (Cont'd.) (T)

3. REVIEW PROCESS DETAILS (Cont'd.)

h. Screen 8: Is the Line Configuration acceptable for Simplified Interconnection? (L)

- If Yes, the Generating Facility qualifies for Simplified Interconnection. Skip remaining screens.
- If No, then the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review. (T)

Line Configuration Screen: Identify primary distribution line configuration that will serve the proposed Generating Facility. Based on the type of Interconnection to be used for the Generating Facility, determine from the following table if the proposed Generating Facility passes the screen. (T) (L)

<u>Primary Distribution Line Type Configuration</u>	<u>Type of Interconnection to be Made to Primary Distribution Line</u>	<u>Results/Criteria</u>	(T)	(L)
Three-phase, three wire	Any type	Pass Screen	(T)	
Three-phase, four wire	Single-phase, line-to-neutral	Pass Screen	(T)	(L)
Three-phase, four wire (For any line that has such a section OR mixed three wire and four wire)	All others	To pass, aggregate Generating Facility capacity must be less than or equal to 10% of Line Section peak load		(L)

Significance: If the primary distribution line serving the Generating Facility is of a "three-wire" configuration, or if the Generating Facility's distribution transformer is single-phase and connected in a line-to-neutral configuration, then there is no concern about overvoltages to PG&E's, or other Customer's equipment caused by loss of system neutral grounding during the operating time of the Anti-Islanding Protective Function. (T) (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (T)

1. INTRODUCTION

This Section describes the test procedures and requirements for equipment used for the Interconnection of Generating Facilities to PG&E's Distribution System. Included are Type Testing, Production Testing, Commissioning Testing and Periodic Testing. The procedures listed rely heavily on those described in appropriate Underwriters Laboratory (UL), Institute of Electrical and Electronic Engineers (IEEE), and International Electrotechnical Commission (IEC) documents—most notably UL 1741 and IEEE 929, as well as the testing described in *May 1999 New York State Public Services Commission Standardized Interconnection Requirements*. These procedures and requirements were developed prior to the completion of IEEE P1547 *Standard for Distributed Resources Interconnected with Electric Power Systems*, and should be revisited once that standard is published. (L)

The tests described here, together with the technical requirements in Section D of this Rule, are intended to provide assurance that the Generating Facility's equipment will not adversely affect PG&E's Distribution System and that a Generating Facility will cease providing power to PG&E's Distribution System under abnormal conditions. The tests were developed assuming a low level of Generating Facility penetration or number of connections to PG&E's Distribution System. At high levels of Generating Facility penetration, additional requirements and corresponding test procedures may need to be defined. (T)

This Section also provides criteria for "Certifying" Generators or inverters. Once a Generator or inverter has been Certified per this Certification process, it may be considered suitable for use as part of a Generating Facility Interconnected with PG&E's Distribution System. Subject to the exceptions described in this Appendix, PG&E will not require a Producer to repeat the design review or test the Protective Functions of equipment that has been Certified. It should be noted that the Certification process is intended to facilitate Generating Facility Interconnections. Certification is not a prerequisite to interconnect a Generating Facility. The use of non-Certified Equipment may be acceptable subject to testing and approval by PG&E as discussed below. (T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

2. CERTIFICATION CRITERIA

Equipment tested and approved (e.g., "Listed") by an accredited, Nationally Recognized Testing Laboratory ("NRTL") as having met both the Type Testing and Production Testing requirements described in this document is considered to be Certified Equipment for purposes of Interconnection with PG&E's Distribution System. Certification may apply to either a pre-packaged system or an assembly of components that address the necessary functions. Type Testing may be done in the manufactures' factory or test laboratory, or in the field. At the discretion of the testing laboratory, field-Certification may apply only to the particular installation tested. In such cases, some or all of the tests may need to be repeated at other installations. (T) (L)

For non-Certified Equipment, some or all of the tests described in this document may be required by PG&E for each Generating Facility installation. The manufacturer or a laboratory acceptable to PG&E may perform these tests. Test results for Non-Certified Equipment must be submitted to PG&E as part of the application process for PG&E's review and approval under the Supplemental Review. Approval by PG&E for equipment used in a particular application does not guarantee PG&E's approval for use in other applications or by other California Electric Corporations. (T) (L)

When equipment is Certified by a NRTL, the NRTL shall provide to the manufacturer, at a minimum, a Certificate with the following information for each device:

a. Administrative:

- 1) The effective date of Certification or applicable serial number (range or first in series), and/or other proof that Certification is current; (T)
- 2) Equipment model number(s) of the Certified Equipment;
- 3) The software version utilized in the equipment, if applicable;
- 4) Test procedures specified (including date or revision number); and
- 5) Laboratory accreditation (by whom and to what standard). (T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)
- 2. CERTIFICATION CRITERIA (Cont'd.) (L)
 - b. Technical (as appropriate):
 - 1) Device ratings (kW, kVA, Volts, Amps, etc.); (T)
 - 2) Maximum available fault current in Amps;
 - 3) In-rush Current in Amps;
 - 4) Trip points, if factory set (trip value and timing);
 - 5) Trip point and timing ranges for adjustable settings;
 - 6) Nominal power factor or range if adjustable;
 - 7) If the device/system is Certified for Non-Exporting and the method used (reverse power or under power); and
 - 8) If the device/system is Certified Non-Islanding.
 - It is the responsibility of the equipment manufacturer to ensure that Certification information is made publicly available by the manufacturer, the testing laboratory or by a third party. (T) (L)
- 3. TYPE TESTING
 - a. Type Tests and Requirements for Interconnection Equipment Certification. (N)

Type Testing provides a basis for determining that equipment is designed appropriately and meets the specifications for being designated as Certified Equipment under this Rule. The requirements described in this Section cover only issues related to Interconnection and are not intended to address device safety or other issues outside the needs of the relationship between PG&E and the Producer operating a Generating Facility. (N)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.)

3. TYPE TESTING (Cont'd.)

(T)

a. Type Tests and Requirements for Interconnection Equipment Certification
(Cont'd.)

(N)

The following table defines the test requirements by Generator or inverter technology. While UL 1741¹ was written specifically for inverters, the requirements are readily adaptable to synchronous Generators, induction Generators, as well as single/multi-function controllers and protection relays. Until a universal test standard is developed, PG&E or NRTL shall adapt the procedures referenced in the following table as appropriate and necessary for a Generating and/or Interconnection Facility or associated equipment performance and its control and protection system functions.

Type Tests and Requirements for Interconnection Equipment Certification

Type Test	Reference (1)	Inverter	Synchronous Machine	Induction Machine
Utility Interaction	UL 1741 – 39	X	X	X
DC Isolation	UL 1741 – 40.1	X	—	—
Simulated PV Array (Input) Requirements	UL 1741 – 41.2	X	—	—
Dielectric Voltage Withstand	UL 1741 – 44	X	X	X
Power Factor	UL 1741 – 45.2.2	X	X	X
Harmonic Distortion	UL 1741 – 45.4	X	X	X
DC Injection	UL 1741 – 45.5	X	—	—
Utility Voltage and Frequency Variation	UL 1741 – 46.2	X	X	X
Reset Delay	UL 1741 – 46.2.3	X	X	X
Loss of Control Circuit	UL 1741 – 46.4	X	X	X
Short Circuit	UL 1741 – 47.3	X	X	X
Load Transfer	UL 1741 – 47.7	X	X	X
Surge Withstand Capability	J.3.e	X	X	X
Anti-Islanding	J.3.b	(2)	(2)	(2)
Non-Export	J.3.c	(3)	(3)	(3)
In-Rush Current	J.3.d	—	—	(4)
Synchronization	J.3.f	(5)	X	—

Note: X = Required
— = Not Required

- Table Notes: (1) References are to section numbers in either UL 1741 (Inverters, Converters and Charge Controllers for use in Independent Power Systems) or this Rule. References in UL 1741 to "photovoltaics" or "inverter" may have to be adapted to the other technologies by the testing laboratory to appropriately apply in the tests to other technologies.
- (2) Required only if Non-Islanding designation.
- (3) Required only if Non-Export designation is desired.
- (4) Required for Generators that use PG&E power to motor to speed.
- (5) Required for all synchronous Generators as well as Inverters that operate as voltage sources when connected to PG&E.

(N)

(D)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

3. TYPE TESTING (Cont'd.)

b. Anti-Islanding Test (T)

Devices that pass the Anti-Islanding test procedure described in UL 1741 Section 46.3 will be considered Non-Islanding for the purposes of these interconnection requirements. The test is required only for devices for which a Certified Non-Islanding designation is desired.

c. Non-Export Test

Devices that pass the Non-Export test procedure described in Section J.7.a. will be considered Non-Exporting for the purposes of these Interconnection requirements. This test is required only for devices for which a Certified Non-Export designation is desired.

d. In-Rush Current Test

Generation equipment that utilizes PG&E power to motor up to speed will be tested using the procedure defined in Section J.7.b. to determine the maximum current drawn during this startup process. The resulting In-rush Current is used to estimate the Starting Voltage Drop.

e. Surge Withstand Capability Test

Interconnection equipment shall be tested for surge withstand capability (SWC), both oscillatory and fast transient, in accordance with the test procedure defined in IEEE/ANSI C62.45 using the peak values defined in IEEE/ANSI C62.41 Tables 1 and 2 for location category B3. An acceptable result occurs even if the device is damaged by the surge, but is unable to operate or energize PG&E's Distribution System. If the device remains operable after being subject to the surge conditions, previous type tests related to PG&E's protection and power quality will need to be repeated to ensure the unit will still pass those tests following the surge test.

(T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

3. TYPE TESTING (Cont'd.)

f. Synchronization Test (T)

This test verifies that the unit synchronizes within the specified voltage/frequency/phase angle requirements. It is applied to synchronous generators and inverters capable of operating as voltage-source while connected to the PG&E. This test is not necessary for induction Generators or current-source inverters. The test will start with only one of the three parameters: (1) voltage difference between Generating Facility and PG&E's Distribution System; (2) frequency difference; or (3) phase angle outside of the synchronization specification. Initiate the synchronization routine and verify that the Generating Facility is brought within specification prior to synchronization. Repeat the test five times for each of the three parameters. For manual synchronization with synch check or manual control with auto synchronization, the test must verify that paralleling does not occur until the parameters are brought within specifications.

4. PRODUCTION TESTING

As a minimum, the Utility Voltage and Frequency Variation Test procedure described in UL1741 under Manufacturing and Production Tests, Section 68 shall be performed as part of routine production (100 percent) on all equipment used to interconnect Generating Facilities to PG&E's Distribution System. This testing may be performed in the factory or as part of a Commissioning Test (Section J.5.).

(T)

(L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

- J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)
5. COMMISSIONING TESTING (L)
- a. Commissioning Testing, where required, will be performed on-site to verify protective settings and functionality. Upon initial Parallel Operation of a Generating Facility, or any time interface hardware or software is changed that may affect the functions listed below, a Commissioning Test must be performed. An individual qualified in testing protective equipment (professional engineer, factory-Certified technician, or licensed electrician with experience in testing protective equipment) must perform Commissioning Testing in accordance with the manufacturer's recommended test procedure to prove the settings and requirements of this Rule. (T)
- PG&E has the right to witness Commissioning Tests as described below, or to require written certification by the installer describing which tests were performed and their results. Protective Functions to be tested during commissioning, particularly with respect to non-Certified Equipment, may consist of the following: (T)
- Over and under voltage (T)
 - Over and under frequency
 - Anti-Islanding function (if applicable)
 - Non-Export function (if applicable)
 - Inability to energize dead line
 - Time delay on restart after utility source is stable
 - Utility system fault detection (if used)
 - Synchronizing controls (if applicable)
 - Other Interconnection Protective Functions that may be required as part of the Interconnection Agreement (T)
- b. Other checks and tests that may need to be performed include: (T)
- Verifying final Protective Function settings (T)
 - Trip test (T)
 - In-service test (L)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

5. COMMISSIONING TESTING (Cont'd.) (T)

c. Certified Equipment

Generating Facilities qualifying for Simplified Interconnection incorporate Certified Equipment that have, at a minimum, passed the Type Tests and Production Tests described in this document and are judged to have little or no potential impact on PG&E's Distribution System. For such Generating Facilities, it is necessary to perform only the following tests: (T)

1) Protective Function settings that have been changed after factory testing will require field verification. Tests will be performed using injected secondary frequencies, voltages and currents, applied waveforms, a test connection using a Generator to simulate abnormal utility voltage or frequency, or varying the set points to show that the device trips at the measured (actual) utility voltage or frequency. (T)

2) The Non-Islanding function will be checked by operating a load break disconnect switch to verify the Interconnection equipment ceases to energize the line and does not re-energize for the required time delay after the switch is closed. (T)

3) The Non-Exporting function will be checked using secondary injection techniques. This function may also be tested by adjusting the Generating Facility output and local loads to verify that the applicable Non-Exporting criteria (i.e., reverse power or under power) are met. (T)

The Supplemental Review or an Interconnection Study may impose additional components or additional testing.

d. Non-Certified Equipment (T)

Non-Certified Equipment shall be subjected to the appropriate tests described in Type Testing (Section J.3.) as well as those described in Certified Equipment Commissioning Tests (Section J.5.c.). With PG&E's approval, these tests may be performed in the factory, in the field as part of commissioning, or a combination of both. PG&E, at its discretion, may also approve a reduced set of tests for a particular application or, for example, if it determines it has sufficient experience with the equipment. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

5. COMMISSIONING TESTING (Cont'd.)

e. Verification of Settings (T)

If the testing is part of the commissioning process, then, at the completion of such testing, the Producer shall confirm all devices are set to PG&E-approved settings. This step shall be documented in the Commissioning Test Certification. (T)

f. Trip Tests (T)

Interconnection Protective Functions and devices (e.g., reverse power relays) that have not previously been tested as part of the Interconnection Facility with their associated interrupting devices (e.g., contactor or circuit breaker) shall be trip tested during commissioning. The trip test shall be adequate to prove that the associated interrupting devices open when the protective devices operate. Interlocking circuits between Protective Function devices or between interrupting devices shall be similarly tested unless they are part of a system that has been tested and approved during manufacture. (T)

g. In-Service Tests (T)

Interconnection Protective Functions and devices that have not previously been tested as part of the Interconnection Facility with their associated instrument transformers or that are wired in the field shall be given an in-service test during commissioning. This test will verify proper wiring, polarity, CT/PT ratios, and proper operation of the measuring circuits. The in-service test shall be made with the power system energized and carrying a known level of current. A measurement shall be made of the magnitude and phase angle of each Alternating Current (AC) voltage and current connected to the protective device and the results compared to expected values. For protective devices with built-in Metering functions that report current and voltage magnitudes and phase angles, or magnitudes of current, voltage, and real and reactive power, the metered values may be used for in-service testing. Otherwise, portable ammeters, voltmeters, and phase-angle meters shall be used. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

6. PERIODIC TESTING

Periodic Testing of Interconnection-related Protective Functions shall be performed as specified by the manufacturer, or at least every four years. All periodic tests prescribed by the manufacturer shall be performed. The Producer shall maintain periodic test reports or a log for inspection by PG&E. Periodic Testing conforming to PG&E test intervals for the particular line section may be specified by PG&E under special circumstances, such as high fire hazard areas. A system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage. Once every four years, the battery must be either replaced or a discharge test performed.

7. SUPPLEMENTAL TESTING PROCEDURES

This section describes the additional Type Tests necessary to qualify a device as Certified for use on PG&E's Distribution Systems. These Type Tests are not contained in Underwriters Laboratories UL 1741 Standard *Inverters, Converters and Controllers for Use in Independent Power Systems*, or other referenced standards, but are considered necessary for Certification by PG&E. (T)

a. Non-Exporting Test Procedures

The Non-Exporting test is intended to verify the operation of relays, controllers and inverters designed to limit the export of power and certify the equipment as meeting the requirements of Screen 2, Options 1 and 2, of the review process. Tests are provided for discrete relay packages and for controllers and inverters that include the intended function. (T)

1) Discrete Reverse Power Relay Test (T)

This version of the Non-Exporting test procedure is intended for discrete reverse power and under power relay packages provided to meet the requirements of options 1 and 2 of the Non-Exporting Screen. It should be understood that in the reverse power application, the relay will provide a trip output with power flowing in the export (toward the PG&E Distribution System) direction. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

a. Non-Exporting Test Procedures (Cont'd.)

1) Discrete Reverse Power Relay Test (Cont'd.) (T)

Step 1: Power Flow Test at Minimum, Midpoint and Maximum Pickup Level Settings

Determine the corresponding secondary pickup current for the desired export power flow of 0.5 secondary watts (the minimum pickup setting, assumes 5 Amps and 120V CT/PT secondary). Apply nominal voltage with minimum current setting at zero (0) degrees phase angle in the trip direction. Increase the current to pickup level. Observe the relay's (LCD or computer display) indication of power values. Note the indicated power level at which the relay trips. The power indication should be within 2% of the expected power. For relays with adjustable settings, repeat this test at the midpoint, and maximum settings. Repeat at phase angles of 90, 180 and 270 degrees and verify that the relay does not operate (measured watts will be zero or negative).

Step 2: Leading Power Factor Test

Apply rated voltage with a minimum pickup current setting (calculated value for system application) and apply a leading power factor load current in the non-trip direction (current lagging voltage by 135 degrees). Increase the current to relay rated current and verify that the relay does not operate. For relay's with adjustable settings, this test should be repeated at the minimum, midpoint and maximum settings.

Step 3: Minimum Power Factor Test

At nominal voltage and with the minimum pickup (or ranges) determined in Step 1, adjust the current phase angle to 84 or 276 degrees. Increase the current level to pickup (about 10 times higher than at 0 degrees) and verify that the relay operates. Repeat for phase angles of 90, 180 and 270 degrees and verify that the relay does not operate.

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

a. Non-Exporting Test Procedures (Cont'd.)

1) Discrete Reverse Power Relay Test (Cont'd.) (T)

Step 4: Negative Sequence Voltage Test

Using the pickup settings determined in Step 1, apply rated relay voltage and current at 180 degrees from tripping direction, to simulate normal load conditions (for three-phase relays, use I_a at 180, I_b at 60 and I_c at 300 degrees). Remove Phase-1 voltage and observe that the relay does not operate. Repeat for Phases-2 and 3.

Step 5: Load Current Test

Using the pickup settings determined in Step 1, apply rated voltage and current at 180 degrees from the tripping direction, to simulate normal load conditions (use I_a at 180, I_b at 300 and I_c at 60 degrees). Observe that the relay does not operate.

Step 6: Unbalanced Fault Test

Using the pickup settings determined in Step 1, apply rated voltage and two times rated current, to simulate an unbalanced fault in the non-trip direction (use V_a at 0 degrees, V_b and V_c at 180 degrees, I_a at 180 degrees, I_b at 0 degrees, and I_c at 180 degrees). Observe that the relay, especially single phase, does operate properly.

Step 7: Time Delay Settings Test

Apply Step 1 settings and set time delay to minimum setting. Adjust the current source to the appropriate level to determine operating time, and compare against calculated values. Verify that the timer stops when the relay trips. Repeat at midpoint and maximum delay settings.

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

a. Non-Exporting Test Procedures (Cont'd.)

1) Discrete Reverse Power Relay Test (Cont'd.)

Step 8: Dielectric Test

(L)

Perform the test described in IEC 414 using 2 kV RMS for one minute.

(L)

Step 9: Surge Withstand

Perform the surge withstand test described in IEEE C37.90.1.1989 or the surge withstand test described in Section J.3.g.

2) Under-Power Relay Test

This version of the non-exporting test procedure is intended for discrete relay packages and meets the requirements of Option 2 of Screen 2. A trip output will be provided when import power (toward the Producer's Load) drops below the specified level.

(N)
|
|
(N)

Note: For an under-power relay, pickup is defined as the highest power level at which the relay indicates that the power is less than the set setting.

(T)

Step 1: Power Flow Test at Minimum, Midpoint and Maximum Pickup Level Settings

Determine the corresponding secondary pickup current for the desired power flow pickup level of 5% of peak load minimum pickup setting). Apply rated voltage and current degrees phase angle in the direction of normal load current.

(T)
|
(T)

Decrease the current to pickup level. Observe the relay's (LCD or computer display) indication of power values. Note the indicated power level at which the relay trips. The power indication should be within 2% of the expected power. For relays with adjustable settings, repeat the test at the midpoint and maximum settings. Repeat at phase angles of 90, 180 and 270 degrees and verify that the relay operates (measured watts will be zero or negative).

(T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

a. Non-Exporting Test Procedures (Cont'd.)

2) Under-Power Relay Test (Cont'd.)

Step 2: Leading Power Factor Test

Using the pickup current setting determined in Step 1, apply rated voltage and rated leading power factor load current in the normal load direction (current leading voltage by 45 degrees). Decrease the current to 145 percent of the pickup level determined in Step 1 and verify that the relay does not operate. For relays with adjustable settings, repeat the test at the minimum, midpoint and maximum settings.

Step 3: Minimum Power Factor Test

At nominal voltage and with the minimum pickup (or ranges) determined in Step 1, adjust the current phase angle to 84 or 276 degrees. Decrease the current level to pickup (about 10 percent of the value at 0 degrees) and verify that the relay operates. Repeat for phase angles 90, 180 and 270 degrees and verify that the relay operates for any current less than rated current.

Step 4: Negative Sequence Voltage Test

Using the pickup settings determined in Step 1, apply rated relay voltage and 25 percent of rated current in the normal load direction, to simulate light load conditions. Remove Phase-1 voltage and observe that the relay does not operate. Repeat for Phases-2 and 3.

Step 5: Unbalanced Fault Test

Using the pickup settings determined in Step 1, apply rated voltage and two times rated current, to simulate an unbalanced fault in the normal load direction (use V_a at 0 degrees, V_b and V_c at 180 degrees, I_a at 0 degrees, I_b at 180 degrees, and I_c at 0 degrees). Observe that the relay, especially single phase, operates properly.

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

a. Non-Exporting Test Procedures (Cont'd.)

2) Under-Power Relay Test (Cont'd.)

Step 6: Time Delay Settings Test

Apply Step 1 settings and set time delay to minimum setting. Adjust the current source to the appropriate level to determine operating time and compare against calculated values. Verify that the timer stops when the relay trips. Repeat at midpoint and maximum delay settings.

Step 7: Dielectric Test

Perform the test described in IEC 414 using 2 kV RMS for one minute.

Step 8: Surge Withstand

Perform the surge withstand test described in IEEE C37.90.1.1989 or the surge withstand test described in Section J.3.g.

3) Tests for Inverters and Controllers with Integrated Functions (T)

Inverters and controllers designed to provide reverse or under-power functions shall be tested to certify the intended operation of this function. Two methods are acceptable: (T)

Method 1: If the inverter or controller utilizes external current/voltage measurement to determine the reverse or under-power condition, then the inverter or controller shall be functionally tested by application of appropriate secondary currents and potentials as described in the Discrete Reverse Power Relay Test, Section J.7.a.(1) of this Rule. (T)

Method 2: If external secondary current or voltage signals are not used, then unit-specific tests must be conducted to verify that power cannot be exported across the PCC for a period exceeding two seconds. These may be factory tests, if the measurement and control points are integral to the unit, or they may be performed in the field. (T)

(Continued)



RULE 21—GENERATING FACILITY INTERCONNECTIONS
(Continued)

J. TESTING AND CERTIFICATION CRITERIA (Cont'd.) (T)

7. SUPPLEMENTAL TESTING PROCEDURES (Cont'd.)

b. In-Rush Current Tests Procedures (T)

This test will determine the maximum In-rush Current drawn by the unit.

1) Locked-Rotor Method

Use the test procedure defined in NEMA MG-1 (manufacturer's data is acceptable if available).

2) Start-Up Method (T)

Install and setup the Generating Facility equipment as specified by the manufacturer. Using a calibrated oscilloscope or data acquisition equipment with appropriate speed and accuracy, measure the current draw at the Point of Interconnection as the Generating Facility starts up and parallels with PG&E's Distribution System. Startup shall follow the normal, manufacturer-specified procedure. Sufficient time and current resolution and accuracy shall be used to capture the maximum current draw within five percent. In-rush Current is defined as the maximum current draw from PG&E during the startup process, using a 10-cycle moving average. During the test, the utility source, real or simulated, must be capable of maintaining voltage within +/- 5% of rated at the connection to the unit under test. Repeat this test five times. Report the highest 10-cycle current as the In-rush Current. A graphical representation of the time-current characteristic along with the certified In-rush Current must be included in the test report and made available to PG&E. (T)

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