1.0 Background

In accordance with Board resolution 01-04-04 and Rule and Regulation 21, the following guidelines shall apply to customer owned generation. These guidelines conform to the technical aspects of the California Public Utility Commission (CPUC) and California Energy Commission's (CEC) Rule 21 Interconnection Rules while supporting prevailing SMUD Tariffs and Rules and Regulations.

2.0 Applicability

These guidelines describe the interconnection, operating and metering requirements for Generating Facilities to be connected to SMUD's Distribution System. Subject to the requirements of these and other applicable guidelines, SMUD will allow the interconnection of Generating Facilities with its Distribution System.

Definitions. Capitalized terms used in these guidelines, and not defined in SMUD's other tariffs shall have the meaning ascribed to such terms in Section 3 of these guidelines. The definitions set forth in Section 3 of these guidelines shall only apply to these guidelines and not to SMUD's other tariffs.

3.0 Definitions

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

Applicant: The entity submitting an Application for Interconnection pursuant to these guidelines.

Application: A SMUD-approved standard form submitted to SMUD for Interconnection of a Generating Facility.

Board: The publicly elected Board of Directors of the Sacramento Municipal Utility District.

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

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

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

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

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

Customer: The entity that receives or is entitled to receive Distribution Service through 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.

Distribution Service: All services required by, or provided to, a Customer pursuant to the approved tariffs of SMUD, with the exception of the Open Access Transmission Tariff (OATT).

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

Emergency: An actual or imminent condition or situation, which jeopardizes the Distribution System Integrity.

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

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

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

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

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

Initial Review: The review by SMUD, following receipt of an Application, to determine the following:

Either:

a) Whether the Generating Facility qualifies for Simplified Interconnection; or

b) Whether the Generating Facility can be made to qualify for Interconnection with a Supplemental Review that determines any potential additional requirements.

In-rush Current: The maximum, instantaneous input current drawn by an electrical device when first turned on as determined by the In-rush Current Test.

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

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

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 the interconnection of a Generating Facility to the Distribution System. Interconnection Facilities may be integrated into a Generating Facility or provided separately. Interconnection Facilities may be connected to either side of the Point of Common Coupling, as appropriate to their purpose and design.

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

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

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

Metering: The measurement of electrical power flow in kW and/or kWh, and, if necessary, kVAR at a point, and its display to SMUD, as required by these guidelines.

Metering Equipment: All equipment, hardware, and software including meter cabinets, conduit, etc. that is necessary for Metering.

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

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

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

Net Generation Metering: Metering of the net electrical power or energy output in kW or kWh, respectively, from a given Generating Facility. This may also be the measurement of the difference between the total electrical energy produced by a Generating Facility and the electrical energy consumed by the auxiliary equipment necessary to operate the Generating Facility. For a Generating Facility with no Host Load and/or no Public Utilities Code Section 218 Load, Metering that is located at the point of Common Coupling. For a Generating Facility with Host Load and/or Section 218 Load, Metering that is located at the Generating Facility bus after the point of auxiliary load(s) and prior to serving Host Load and/or Section 218 Load.

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

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 Applicant's Generating Facility to SMUD.

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

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

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

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

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

Point of Common Coupling (PCC): The transfer point for electricity between the electrical conductors of SMUD and the electrical conductors of the Applicant's Generating Facility.

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

Power Purchase Agreement (PPA): An agreement for the sale of electricity by the Applicant to SMUD.

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.

Prudent Electrical Practices: Those practices, methods, and equipment, as modified 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.

Scheduled Operation Date: The date specified in the Interconnection Agreement when the Generating Facility is, by the Applicant's estimate, expected to begin operation pursuant to these guidelines.

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 generator transaction would not classify a generating entity as an Electric Corporation. These conditions relate to "over-the-fence" sale of electricity from a generator without using the Distribution System.

Simplified Interconnection: Interconnection conforming to the minimum requirements under these rules, as determined by Section 10.

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

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

SMUD: The Sacramento Municipal Utility District (SMUD), under the jurisdiction of the Board, which is charged with providing Electrical Distribution Service to the Customer.

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

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

Supplemental Review: A process wherein SMUD further reviews an Application that fails one or more of the Initial Review Process screens. The

Supplemental Review may result in one of the following: a) Simplified Interconnection; b) approval of Interconnection with additional requirements; or c) cost and schedule for an Interconnection Study.

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

Telemetering: The electrical or electronic transmittal of metering data in real-time to SMUD.

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

Transmission Service Agreement: An agreement between the Applicant and SMUD to transmit Applicant's power across SMUD's system to another utility.

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 SMUD.

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

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

4.0 General Rules, Rights And Obligations

4.1 Authorization required to operate. An Applicant must comply with these guidelines, execute an Interconnection Agreement with SMUD, and receive SMUD's express written permission to operate its Generating Facility in parallel with SMUD's Distribution System. SMUD shall apply these guidelines in a non-discriminatory manner and shall not unreasonably withhold its permission for an Applicant's Generating Facility to operate in parallel with SMUD's Distribution System.

4.2 Separate arrangement required for other services. An Applicant requiring other electric services from SMUD including, but not limited to, Distribution Service during periods of curtailment or interruption of its Generating Facility, must sign separate agreements with SMUD for such services, in accordance with approved tariffs.

4.3 Transmission service not provided with interconnection. Interconnection with SMUD's Distribution System under these guidelines does not provide an Applicant any rights to utilize SMUD's Distribution System for the transmission, distribution, or wheeling of electric power, nor does it limit those rights.

4.4 Compliance with laws, rules, and tariffs. An Applicant shall ascertain and comply with applicable Board-approved tariffs of SMUD, applicable Federal Energy Regulatory Commission-approved rules, tariffs, and regulations, and any local, state or federal law, statute or regulation which applies to the design, siting, construction, installation, operation, or any other aspect of the Applicant's Generating Facility and Interconnection Facilities.

4.5 Design reviews and inspections. SMUD shall have the right to review the design of an Applicant's Generating Facility and Interconnection Facilities and to inspect an Applicant's Generating and/or Interconnection Facilities prior to the commencement of Parallel Operation with SMUD's Distribution System. The Applicant is responsible for all local building permits and final inspections with the local agency before SMUD performs its final inspection. SMUD may require an Applicant to make modifications as necessary to comply with the requirements of these guidelines. SMUD may require proof that the Applicant's protection system is performing to the level required in these Interconnection Guidelines and the Interconnection Agreement. SMUD's review and authorization for Parallel Operation shall not be construed as confirming or endorsing the Applicant's design or as warranting the Generating and/or Interconnection Facilities' safety, durability or reliability. SMUD shall not, by reason of such review or lack of review, be responsible for the strength, adequacy, or capacity of such equipment.

4.6 Right to access. An Applicant's Generating Facility and Interconnection Facilities shall be reasonably accessible to SMUD personnel as necessary for SMUD to perform its duties and exercise its rights under its tariffs approved by the Board, and any Interconnection Agreement between SMUD and the Applicant.

4.7 Confidentiality of information. SMUD shall treat any information pertaining to Generating and/or Interconnection Facilities provided to SMUD by an Applicant in a confidential manner, unless disclosure is otherwise required by applicable law. SMUD 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 SMUD by the customer through other means.

4.8 Prudent operation and maintenance required. An Applicant shall operate and maintain its Generating Facility and Interconnection Facilities in accordance with Prudent Electrical Practices and shall maintain compliance with these guidelines.

4.9 Curtailment or disconnection. SMUD may limit the operation or disconnect or require the disconnection of an Applicant's Generating Facility from SMUD's Distribution System at any time with or without notice in the event of an Emergency, or to correct Unsafe Operating Conditions. However, SMUD must provide written notice as soon as possible following such disconnection. SMUD may also limit the operation or disconnect or require the disconnection of an Applicant's Generating Facility from SMUD's Distribution System upon the provision of reasonable written notice: 1) to allow for routine maintenance, repairs or modifications to SMUD's Distribution System; 2) upon SMUD's determination that an Applicant's Generating Facility is not in compliance with these guidelines; or, 3) upon termination of the Interconnection Agreement. Upon the Applicant's written request, SMUD shall provide a written explanation of the reason for such curtailment or disconnection.

5.0 Application And Interconnection Process

5.1 Applicant initiates contact with SMUD. SMUD will establish an individual representative as the single point of contact for an Applicant, but may allocate responsibilities among its staff to best coordinate the Interconnection of an Applicant's Generating Facility. Documents and other information relevant to Interconnection are provided on SMUD's website at www.smud.org.

5.2 Applicant completes and files SMUD Application Form 2655 "SMUD Generating Facility Interconnection Application," available on SMUD's website at the following location:

http://www.smud.org/en/community-environment/solar-renewables/Documents/2655.pdf

All Applicants shall be required to complete and file an Application and supply any relevant additional information requested by SMUD. The filing must include the completed Application and a fee for processing the Application and performing the Initial Review to be completed by SMUD pursuant to Section 5.3. The Application 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:

Type of Service provided to Customer Account	Initial Review	Supplemental Review
Net Energy Metering *(per Public Utilities Code Section 2827)*	None	None
All others	$800	$600 (added)

The Applicant may propose and SMUD may negotiate specific costs for processing non-standard applications such as multi-units, multi-sites, or otherwise as conditions warrant. The costs for the Initial Review and the Supplemental Review contained in this Section, as

well as the language provided in Section 5.3, do not apply under these circumstances.

Within ten (10) business days of receiving an Application, SMUD shall normally acknowledge its receipt and state whether the Application has been completed adequately. If deficiencies are noted, the Applicant shall, in a timely manner, correct the deficiencies needed to establish a satisfactory Application. SMUD reserves the right to reject any Application that it considers deficient.

5.3 SMUD performs an Initial Review and develops preliminary cost estimates and interconnection requirements.

A. Upon receipt of a satisfactorily completed Application and any additional information necessary to evaluate the Interconnection of a Generating Facility, SMUD shall perform an Initial Review using the process defined in Section 10. The Initial Review determines if (a) the Generating Facility qualifies for Simplified Interconnection, (b) the Generating Facility can qualify for Interconnection subject to additional requirements, or (c) it will be necessary for SMUD to perform an Interconnection Study to determine the Interconnection Requirements.

B. SMUD shall complete its Initial Review, absent any extraordinary circumstances, within 10 business days, upon determination that the Application is complete and receipt of fee payment, if the Generating Facility qualifies for Simplified Interconnection. If the Initial Review determines that the proposed facility can be interconnected by means of a Simplified Interconnection, SMUD will provide the Applicant with a written description of the requirements for interconnection and a draft Interconnection Agreement pursuant to Section 5.3.E.

C. If the Generating Facility does not qualify for Simplified Interconnection as proposed, SMUD will notify the Applicant and perform a Supplemental Review as described in Section 10. The Supplemental Review will provide 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 30 business days upon determination that the Application is complete and receipt of any additional fees for Supplemental Review. Payment for the Supplemental Review shall be submitted to SMUD within 30 calendar days after the results of the Initial Review are provided to the Applicant.

D. When Required, Applicant and SMUD commit to additional interconnection study steps. When an Initial and Supplemental Reviews reveal that the proposed facility cannot be interconnected to SMUD's Distribution System by means of a Simplified Interconnection, or that significant SMUD Interconnection Facilities or Distribution System improvements must be installed or made to SMUD's Distribution System to accommodate the interconnection of an Applicant's Generating Facility, SMUD and Applicant shall enter into an agreement that provides for SMUD to perform additional studies, facility design, and engineering and to provide detailed cost estimates, to the Applicant at the Applicant's expense. The Interconnection Study Agreement shall set forth SMUD's schedule for completing such work and the estimated costs of such studies and engineering. Upon completion of an Interconnection Study, SMUD shall provide the Applicant with the specific requirements, costs and schedule for interconnecting the Generating Facility to accommodate execution of agreements pursuant to Section 5.3.E.

E. Applicant and SMUD enter into a Generation Interconnection Agreement and, where required, a Financing and Ownership Agreement for Interconnection Facilities or Distribution System Modifications. SMUD shall provide the Applicant with an executable version of the Generating Facility Interconnection Agreement, Net Energy Metering Agreement, Power Purchase Agreement, or Transmission Service Agreement appropriate for the Applicant's Generating Facility and desired mode of

operation. Where the Initial Review or Interconnection Study performed by SMUD has determined that modifications or additions are required to be made to its Distribution System, or that additional metering, monitoring, or protection devices will be necessary to accommodate an Applicant's Generating Facility, SMUD may also provide the Applicant with other interconnection facilities financing and ownership agreements. These agreements shall set forth the Applicant's responsibilities, completion schedules, and estimated costs for the required work.

F. Where Applicable, SMUD installs required interconnection facilities or modifies SMUD's Distribution System. After executing the applicable agreements, SMUD will commence construction/installation of the modifications or metering and monitoring requirements identified in the agreements. The parties will use good faith efforts to meet the schedules and cost estimates.

G. Applicant arranges for and completes commissioning testing of Generating Facility and Interconnection Facilities. The Applicant is responsible for testing new Generating Facilities and associated Interconnection Facilities, according to Section 11 to ensure compliance with the safety and reliability provisions of these guidelines prior to being operated in parallel with SMUD's Distribution System.

H. SMUD authorizes parallel operation or momentary parallel operation. The Applicant's Generating Facility shall be authorized for Parallel Operation or Momentary Parallel Operation, as applicable, with SMUD's Distribution System upon satisfactory compliance with the terms of all applicable agreements and 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 Applicant and SMUD.

I. SMUD Reconciles Costs and Payments. The Applicant may be required to reimburse SMUD for installation of any equipment or facilities required as a result of the installation of a customer-owner generator in parallel with SMUD's system. All extensions of electric distribution lines needed to make connection to Applicant-owned generators will be constructed at Applicant expense. This includes line and service extension costs that are recovered through Rule and Regulation 16 or Rule and Regulation 21, where applicable.

J. Recovery for ongoing Interconnection Facilities Costs. "Interconnection Facilities" means 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 the interconnection of a Generating Facility to the SMUD Distribution System. While the Applicant bears the cost of the interconnection facilities, ultimate ownership will reside with SMUD. Applicant shall be responsible for costs related to ongoing operations and maintenance and eventual replacement of the Interconnection Facilities through one of two options:

1. A monthly charge (Interconnection Facilities Charge). The Interconnection Facilities Charge for recovery of these costs is currently $6.63 per $1,000 of facilities.

2. A one time payment of $1201 per $1,000 of facilities cost.

This Interconnection Facilities Charge is based on the Interconnection Facilities replacement cost new multiplied by SMUD's economic carrying charge for the expected life of the Interconnection Facilities. SMUD will review the Interconnection Facilities Charge calculations periodically as SMUD's costs change. If any portion of the Interconnection Facilities for which Applicant pays a Monthly Interconnection Facilities Charge is, at some future date, utilized by others, the Interconnection Facilities Charge will be reassessed based on

the Applicant's proportionate share of the maximum load on the portion of Interconnection Facilities utilized by such third party.

6.0 Generating Facility Design And Operating Requirements

6.1 General Interconnection and Protection Requirements – SMUD approved equipment and standards apply.

A. Protective Functions Required. The Protective Functions for Generating Facilities operating in parallel with SMUD's Distribution System shall include:

- Over and under voltage trip functions and over and under frequency trip functions;
- A means for disconnecting the Generating Facility from SMUD's Distribution System when a protective function initiates a trip;
- An automatic means 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 of specified settings and is stable for at least 60 seconds;
- A means to prevent the Generating Facility from contributing to the formation of an Unintended Island;
- Momentary Paralleling Generating Facilities. With SMUD's approval, the transfer switch or system used to transfer the Applicant's loads from SMUD's Distribution System to Applicant's Generating Facility may be used in lieu of the Protective Functions required for Parallel Operation.

B. Purpose of Protective Functions. The Protective Functions and requirements of these guidelines are designed to protect SMUD's Distribution System and not the Generating Facility.

An Applicant shall be solely responsible for providing adequate protection for its Generating Facility and Interconnection Facilities. The Applicant's protective equipment shall not impact the operation of other protective devices utilized on the Distribution System in a manner that would affect SMUD's capability of providing reliable service to its customers.

C. 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. Applicant'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 SMUD's Distribution System.

D. Visible Disconnect Required. Applicant shall furnish and install a manual disconnect device that has a Visible Disconnect to isolate the Generating Facility from SMUD's Distribution System. The device must be accessible to SMUD personnel and be capable of being locked in the open position. Generating Facilities with Non-Islanding inverters totaling one (1) kVA or less are exempt from this requirement.

E. 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 applied on a center-tapped neutral 240-volt service must be installed such that no more than 6 kVA of imbalance in capacity exists between the two sides 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. SMUD tariffs currently charge for power factors below .95 lagging.

F. Drawings Required. SMUD, prior to Parallel Operation or Momentary Parallel Operation of the Generating Facility, shall approve the Applicant's protection and control diagrams for the Generating Facility. Generating Facilities equipped with a protection and control scheme previously approved by SMUD for system-wide application or only Certified Equipment may satisfy this requirement by reference to previously approved drawings and diagrams.

G. Generating Facility Conditions Not Identified. In the event these guidelines do not address the interconnection requirements for a particular Generating Facility, SMUD and the Applicant may agree upon other requirements.

6.2 Prevention of Interference. The Applicant shall not operate equipment that superimposes a voltage or current upon SMUD's Distribution System that interferes with SMUD's service to SMUD's 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 SMUD. If the Producer does not take corrective action in a timely manner, or continues to operate the equipment causing interference without restriction or limit, SMUD may, without liability, disconnect the Applicant's equipment from the Distribution System, in accordance with Section 4.9 of these guidelines.

To eliminate undesirable interference caused by operation of the Generating Facility, each Generating Facility shall meet the following criteria:

A. Normal voltage operating range. The voltage operating range limits for Generating Facilities shall be used as a Protective Function that responds to abnormal conditions on SMUD's Distribution System and not as a voltage regulation function.

- 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 SMUD'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 SMUD's circuits whenever the voltage at the point of Common Coupling deviates from the allowable voltage operating range.

- Generating Facilities (Greater than 11 kVA). SMUD may have specific operating voltage ranges for Generating Facilities with Gross Nameplate Ratings greater than 11kVA 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.

- Voltage Disturbances. Whenever the system voltage at the Point of Common Coupling varies from normal (nominally 120 volts) by predetermined amounts as set forth in Table D-1, the Generating Facility's Protective Functions shall cause the generator(s) to become isolated from SMUD's Distribution System.

Table D-1: Voltage Trip Settings

Voltage at Point of Common Coupling (Assuming 120V base)	Maximum Trip Time Allowed (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 11kVA)
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 the Distribution System. Protective Function sensing devices and circuits may remain connected to the Distribution System to allow sensing of electrical conditions for use by the "reconnect" feature. The purpose of the 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 SMUD.

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 519-1992, Institute of Electrical and Electronic Engineers, Piscataway, NJ. April 1992. This requirement is necessary to minimize the adverse voltage effects experienced by other customers on SMUD'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.

C. Frequency. SMUD controls system frequency, and the Generating Facility shall operate in synchronism with the Distribution System. Generating Facilities with a 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 SMUD's Distribution System in a maximum of ten cycles should 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. SMUD may require adjustable operating frequency settings for Generating Facilities with a Gross Nameplate Rating greater than 11 kVA.

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 for the loads at that site.

E. Direct Current Injection. Generating Facilities should not inject Direct Current greater than 0.5% of rated output current into SMUD's Distribution System.

F. Power Factor. Each Generator in a Generating Facility shall be capable of operating at some point within a power factor range of 0.9 leading and 0.9 lagging. Operation outside this range is acceptable provided the reactive power of the Generating Facility is used to meet the reactive power needs of on-site loads or that reactive power is otherwise provided under tariff by SMUD. The Applicant shall notify SMUD if it is using the Generating Facility for power factor correction.

6.3 Control, Protection and Safety Equipment Requirements

A. Technology Specific Requirements

- Three-Phase Synchronous Generators. For three-phase Generators, the circuit breakers shall be three-phase devices with electronic or electromechanical control. The Applicant shall be responsible for properly synchronizing its Generating Facility with the Distribution System by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all

synchronous generators, which have a Short Circuit Contribution Ratio (SCCR) exceeding 0.05. A Generating Facility whose SCCR exceeds 0.05 shall be equipped with Protective Functions suitable for detecting loss of synchronism and rapidly disconnecting the Generating Facility from the Distribution System. Unless otherwise agreed to between the Applicant and SMUD, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the Distribution System. Power system stabilization functions are specifically not required for Generating Facilities under 10 MW Net Nameplate Rating. Synchronization means that at the time of connection, the frequency difference shall be less than 0.2 Hz, the voltage difference shall be less than 10%, and the phase angle difference shall be less than 10 degrees.

- Induction Generators. Induction Generators do not require a synchronizing function. Starting or rapid load fluctuations on induction generators can adversely impact the Distribution System's voltage. Corrective step-switched capacitors or other techniques may be necessary and may cause undesirable ferroresonance. When these counter measures (e.g. additional capacitors) are installed on the Applicant's side of the Point of Common Coupling, SMUD must review these measures. Additional equipment may be required as determined in a Supplemental Review or an Interconnection Study.

- 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 the Distribution System.

B. Supplemental Generating Facility Requirements

- Unintended Islanding for Generating Facilities that fail the Export Screen (Section 10.3.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, or (2) verifying that local loads sufficiently exceed the Net Nameplate Rating of the Generating Facility, or (3) incorporating a transfer trip or an equivalent Protective Function.

- 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 mitigating Unintended Islands 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 the Distribution System in the event of a fault. For a Generating Facility that cannot detect these faults within two seconds, SMUD may require a transfer trip system or equivalent Protective Function. Reclose-blocking of SMUD's affected recloser(s) may also be required by SMUD for Generating Facilities that exceed 15% of the peak load on the Line Section.

7.0 Interconnection Facility Ownership And Financing

7.1 Scope and Ownership of Interconnection Facilities

A. Scope. Parallel Operation of Generating Facilities may require Interconnection Facilities or improvements to be made to SMUD's Distribution System ("Distribution System improvements"). The type, extent and costs of Interconnection Facilities and Distribution System improvements shall be consistent with these guidelines and determined through the Initial Review or Interconnection Study described in Section 5.

B. Ownership. Interconnection Facilities installed on Applicant's side of the Point of Common Coupling may be owned, operated, and maintained by the Producer or SMUD. Interconnection Facilities installed on SMUD's side of the Point of Common Coupling and Distribution System improvements shall be owned, operated, and maintained only by SMUD.

7.2 Responsibility for Costs of Interconnecting a Generating Facility

A. Study and Review Costs. An Applicant shall be responsible for the reasonably incurred costs of the reviews and studies conducted pursuant to Section 5 of these guidelines.

B. Facility Costs. An Applicant shall be responsible for all costs associated with Interconnection Facilities owned by the Applicant. The Applicant shall also be responsible for any costs reasonably incurred by SMUD in providing, operating, or maintaining the Interconnection Facilities and Distribution System improvements required solely for the interconnection of the Applicant's Generating Facility with SMUD's Distribution System, as further specified in Section 5.3.J.

C. Separation of Costs. Should SMUD combine the installation of Interconnection Facilities, or Distribution System improvements required for the interconnection of a Generating Facility with modifications or additions to SMUD's Distribution System to serve other Customers or third parties, SMUD shall not include the costs of such separate or incremental facilities in the amounts billed to the Applicant.

7.3 Installation and Financing of Distribution System Improvements

A. Agreement Required. The Applicant, pursuant to the provisions contained in the Generating Facility Interconnection Agreement, shall pay the costs of Interconnection Facilities and Distribution System improvements. Where the type and extent

of the Interconnection Facilities or Distribution System improvements warrant additional detail, Applicant and SMUD shall form a separate agreement to more fully describe and allocate the parties' responsibilities for installing, owning, operating, maintaining the Interconnection Facilities and Distribution System improvements.

B. Attachments and Modifications to Distribution System. Except as provided for in Section 7.3.C of these guidelines, Interconnection Facilities connected to SMUD's side of the Point of Common Coupling and Distribution System improvements shall be provided, installed, owned and maintained by SMUD at Applicant's expense.

C. Third-Party Installations. Subject to the approval of SMUD, an Applicant may, at its option, employ a qualified contractor to provide and install Interconnection Facilities or Distribution System improvements on SMUD's side of the Point of Common Coupling to be owned and operated by SMUD. Such Interconnection Facilities and Distribution System improvements shall be installed in accordance with SMUD's design and specifications. Upon final inspection and acceptance by SMUD, the Applicant shall transfer ownership of such Applicant installed Interconnection Facilities or Distribution System improvements to SMUD and such facilities shall thereafter be owned and maintained by SMUD at Applicant's expense. The Producer shall pay SMUD's reasonable cost of design, administration, and monitoring of the installation for such facilities to ensure compliance with SMUD's requirements. Applicant shall also be responsible for all costs, including any income tax liability, associated with the transfer of Applicant installed Interconnection Facilities and Distribution System improvements to SMUD.

D. Reservation of Unused Facilities. When an Applicant wishes to reserve SMUD-owned Interconnection Facilities or Distribution System improvements installed and operated for the Applicant at the Applicant's expense, but idled by a change in the

operation of the Applicant's Generating Facility or otherwise, Applicant may elect to abandon or reserve such facilities consistent with the terms of its agreement with SMUD. If Applicant elects to reserve idle Interconnection Facilities or Distribution System improvements, SMUD shall be entitled to continue to charge Applicant for the costs related to the ongoing operation and maintenance of such Facilities.

E. Refund of Salvage Value. When an Applicant elects to abandon the Interconnection Facilities or Distribution System improvements for which it has either advanced the installed costs or constructed and transferred to SMUD, the Applicant shall, pay for all costs of removal and receive from SMUD a credit for the net salvage value of the Interconnection Facilities or Distribution System improvements.

8.0 Metering, Monitoring And Telemetry

8.1 General Requirements. All Generating Facilities shall be metered in accordance with this Section and shall meet all applicable standards of SMUD contained in SMUD's applicable tariffs and published in SMUD's manuals dealing with metering specifications. The requirements in this Section do not apply to metering of Generating Facilities operating under SMUD's net energy metering tariff pursuant to California Public Utilities Code Section 2827.

8.2 Metering by non-SMUD Parties. The ownership, installation, operation, reading, and testing of metering for Generating Facilities shall be by SMUD except to the extent that SMUD has determined that all these functions, or any of them, may be performed by a non-SMUD entity as authorized by the Board.

8.3 Net Generation Metering. For purposes of monitoring Generating Facility operation for determination of standby charges and applicable non-bypassable charges as defined in SMUD's tariffs, and for Distribution System planning and operations, consistent with Section 3.4 of these Rules, SMUD shall have the right to specify the type, and require the installation of, Net Generation Metering. SMUD shall require the provision of generator output data to the extent reasonably necessary to provide information for the utility to administer its tariffs or to operate and plan its system. SMUD shall

only require Net Generation Metering to the extent that less intrusive and/or more cost effective options for providing the necessary generator output data are not available. In exercising its discretion to require Net Generation Metering, SMUD shall consider all relevant factors, including but not limited to:

A. Data requirements in proportion to need for information;

B. Customer election to install equipment that adequately addresses SMUD's operational requirements;

C. Accuracy and type of required metering consistent with purposes of collecting data;

D. Cost of metering relative to the need for and accuracy of the data;

E. The project's size relative to the cost of the metering/monitoring;

F. Other means of obtaining the data (e.g. generator logs, proxy data etc.);

G. Requirements under any power purchase agreement with the customer.

H. Requirements under any Transmission Service Agreement with the Applicant.

8.4 Point of Common Coupling Metering. For purposes of assessing SMUD 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 SMUD to install multi-metering equipment to separately record power deliveries to the Distribution System and retail purchases from SMUD. Such Point of Common Coupling Metering shall be designed to prevent reverse registration.

8.5 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 Applicant's (and Customer's) expense. If the Generating Facility is interconnected to a portion of SMUD's Distribution System operating at a voltage below 10kV, then Telemetering equipment may be required on Generating Facilities 250 kW or greater.

8.6 Location. Where SMUD-owned metering equipment is located on the Applicant's (or Customer's) premises, the Applicant (and Customer) shall provide, at no expense to SMUD, a suitable location for all such metering equipment.

8.7 Costs of metering. The Applicant (and Customer) will bear all costs of the metering required by Rule 21, including the incremental costs of operating and maintaining the metering equipment.

9.0 Dispute Resolution Process

The following procedures will apply for disputes arising from these guidelines:

9.1 SMUD shall have jurisdiction to interpret, add, delete or modify any provision of these guidelines or of any agreements entered into between SMUD and the Applicant to implement these guidelines and to resolve disputes regarding SMUD's performance of its obligations under its tariffs, the applicable agreements, and requirements related to the interconnection of the Applicant's Generating or Interconnection Facilities pursuant to these guidelines.

9.2 Any dispute arising between SMUD and the Applicant (individually "Party" and collectively "the Parties") regarding SMUD's performance of its obligations under its tariffs, the applicable agreements, and requirements related to the interconnection of Applicant's Generating or Interconnection Facilities pursuant to these guidelines shall be resolved according to the following procedures.

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 9.2. The dispute letter shall be served on the other Party within thirty (30) days of the date the aggrieved Party either knew or should reasonably have known of the acts, active or passive, giving rise to the dispute. Within 30 calendar days of the date the dispute letter is served, the Applicant's authorized representative and the responsible SMUD Manager shall meet and confer to try to resolve the dispute.

9.3 If the Parties do not resolve their dispute within 45 calendar days after the date the dispute letter was served, the Applicant's authorized representative may appeal to the SMUD Board of Directors. The decision of the Board of Directors or its delegate shall be final agency action as that term is defined by California Code of Civil Procedure Section 1094.5.

9.4 Pending resolution of any dispute under this section, the Parties shall proceed diligently with the performance of their respective obligations under these guidelines and the applicable agreements, unless the applicable agreements have been terminated.

10.0 Initial Review Process for Applications to Interconnect a Generating Facility

10.1 Introduction. This Initial Review Process was developed to create a path for selection and rapid approval for the Interconnection of those Generating Facilities that do not require an Interconnection Study. The Initial Review process includes a screening to determine if a supplemental review is required.

10.2 Purpose. The Initial Review determines:

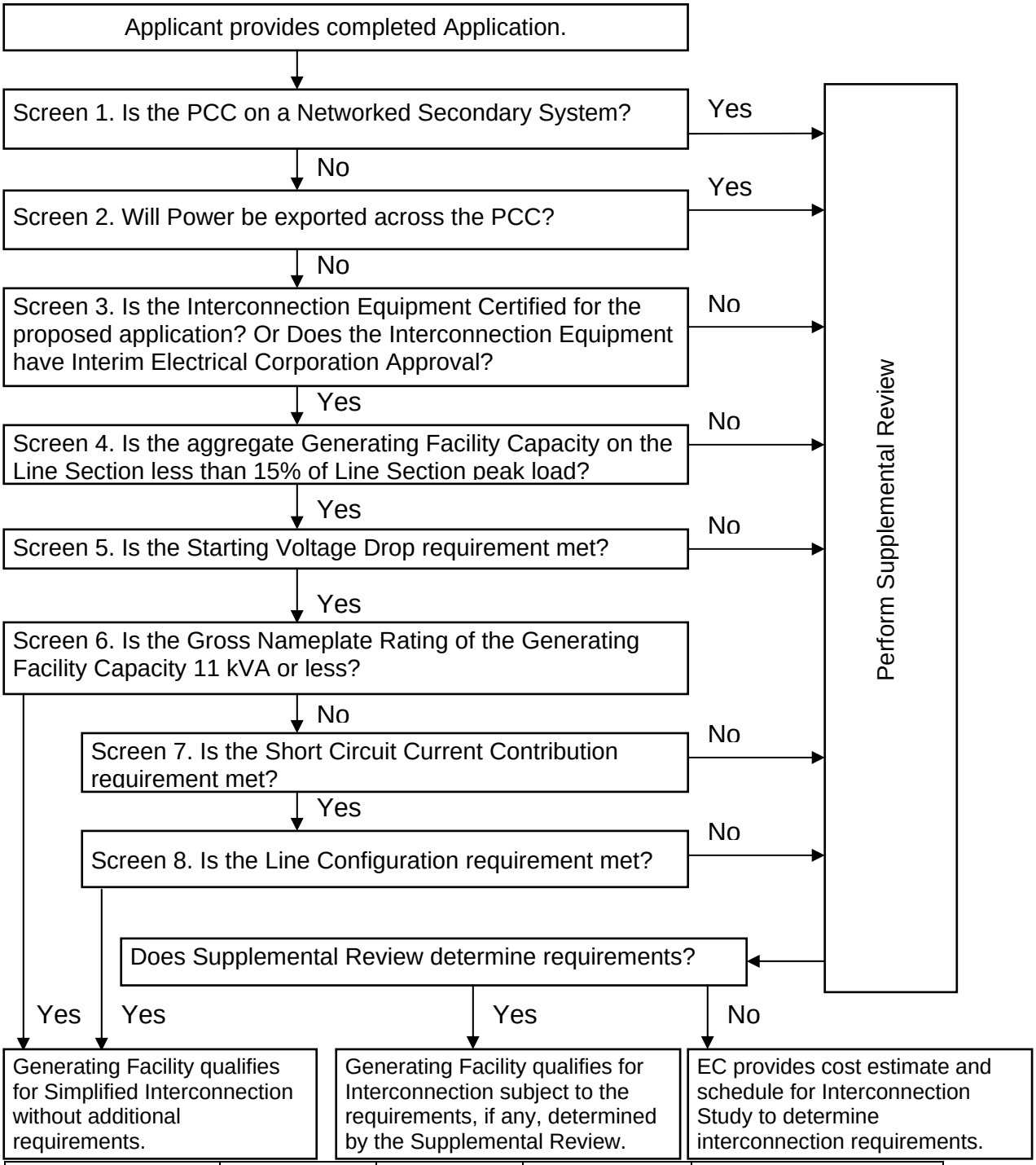
A. If a Generating Facility qualifies for Simplified Interconnection;

B. If a Generating Facility can be made to qualify for Interconnection with a Supplemental Review determining any potential additional requirements, or

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 Initial Review means only that further review, and/or studies, are required before the Generating Facility can be approved for interconnection with SMUD Distribution System. It does not mean that the Generating Facility cannot be interconnected.

Initial Review Process Flow Chart



10.3. Initial Review Screening Process Details

A. Screen 1: Is the PCC on a networked secondary system?

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

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: To insure power is never exported, a reverse power Protective Function must be implemented at the PCC. Default setting shall be 0.1% (export) of transformer rating, with a maximum 2.0 second time delay.

Option 2: To insure at least a minimum import of power, an under-power Protective Function must implemented at the PCC. Default setting shall be 5% (import) of the Generating Facility Gross Nameplate Rating, with maximum 2.0 second time delay.

Option 3: To limit the incidental export of power, all of the following conditions must be met:

The aggregate capacity of the Generating Facility must be no more than 25% of the nominal ampere rating of the Customer's Service Equipment;

The total aggregate Generating Facility capacity must be no more than 50% of the service transformer rating. (This capacity requirement does not apply to Customers taking primary service without an intervening transformer);

The Generating Facility must be certified as Non-Islanding.

Option 4: To insure that the relative size (capacity) of the Generating Facility compared to facility load results in no export of power without the use of additional devices, the Generating Facility capacity must be no greater than 50% of the Customer's verifiable minimum load over the last 12 months.

Significance:(1) If it can be assured that the Generating Facility will not export power, SMUD's Distribution System does not need to be studied for load-carrying capability or Generating Facility power flow effects on SMUD voltage regulators as the Generating Facility will simply be reducing Customer's load on SMUD's Distribution System. (2) Permits use of reverse-power relaying at the PCC as positive anti-islanding protection.

C. Screen 3: Is the Interconnection Equipment Certified for the Application or does the Interconnection Equipment have Interim SMUD Approval?

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

Significance: If the Generating Facility has been Certified or previously approved by SMUD, SMUD does not need to repeat its review and/or test

of the Generating Facility's Protective Functions scheme. Site Commissioning Testing may still be required to insure that the system is connected properly and that the protective functions are working properly.

Certification indicates the following criteria have been tested and verified:

- Basic protective function requirements.
- Harmonic distortion limits.
- Synchronizing requirements.
- Power factor regulation requirements.
- Non-islanding requirements.
- If used, reverse power function requirement.
- If used, under-power function requirement.

D. Screen 4: Is the aggregate Generating Facility capacity on the Line Section less than 15% of Line Section Peak Load?

- If Yes, continue to next screen.
- If No, Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review to determine cumulative impact on Line Section.

Significance: Low penetration of Generating Facility installations will have a minimal impact on Distribution System and load operation and power restoration.

The operating requirements for a high penetration of Generating Facilities may be different since the impact on SMUD's Distribution System operation will no longer be minimal, therefore requiring additional study or controls.

E. Screen 5: Is the Starting Voltage Drop Within Acceptable Limits?

- 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

NOTICE: This screen only applies to Generating Facilities that start by motoring the Generator.

SMUD has two options in determining whether Starting Voltage Drop could be a problem; which option to use is at SMUD's discretion.

Option 1: SMUD may determine that the Generating Facility's starting Inrush Current is equal to or less than the continuous ampere rating of the Customer's service equipment.

Option 2: SMUD may determine the impedances of service distribution transformer (if present) and secondary conductors to Customer's service equipment and perform a voltage drop calculation. Alternatively, SMUD may use tables or nomographs to determine the voltage drop. Voltage drops caused by starting a Generating Unit as a motor must be less than 2.5% for primary interconnection and 5% for secondary interconnection.

Significance:(1) This screen addresses potential voltage fluctuation problems for generators that start by motoring. (2) When starting, a Generating Facility should have minimal impact on the service voltage to other SMUD customers. (3) Passing this screen does not relieve the Producer from ensuring that its Generating Facility complies with the flicker requirements detailed in Section 6.2.

F. Screen 6: Is the Gross Nameplate Rating of the Generating Facility 11 kVA or less?

- If yes, the Generating Facility qualifies for Simplified Interconnection. Skip remaining screens.

- If No, continue to next screen.

Significance: The Generating Facility has minimal impact on fault current levels and any potential line overvoltages from loss of system neutral grounding.

G. Screen 7: Is the Short Circuit Current Contribution Within Acceptable Limits?

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

Short Circuit Current Contribution Screen:

The Short Circuit Current Contribution Screen consists of two criteria; both of which must be met when applicable:

- At primary side (high side) of the Dedicated Distribution Transformer, the sum of the Short Circuit Contribution Ratios (SCCR) of all Generating Facilities on the Distribution System circuit may not exceed 0.1.
- At secondary (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.

Significance:

No significant Generating Facility impact on:

(1) Distribution System's short circuit duty

(2) Distribution System fault detection sensitivity

(3) Distribution System relay coordination

(4) Distribution System fuse-saving schemes

If the Generating Facility passes this screen it can be expected that it will have no significant impact on SMUD's Distribution System's short circuit duty, fault detection sensitivity, relay coordination or fuse-saving schemes.

H. Screen 8: Is the Line Configuration acceptable for Simplified Interconnection?

- If No, then the Generating Facility does not qualify for Simplified Interconnection. Perform Supplemental Review.
- If Yes, the Generating Facility qualifies for Simplified Interconnection.

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.

Primary Distribution Line Type	Type of Interconnection to Primary Distribution Line	Result/Criteria
Three-phase, three wire	Any	Pass screen
Three-phase, four wire	Single-phase, line-to-neutral	Pass screen
Three-phase, four wire (For any line that has such a section OR mixed 3 wire & 4 wire)	All others	To pass, aggregate Generating Facility Capacity must be less than or equal to 10% of Line Section Peak Load.

Significance: If the primary distribution circuit serving the Generating Facility is of a three-wire type, or if the Generating Facility's Interconnection transformer is single-phase and connected in a line-to-neutral configuration, then there is no concern about overvoltages to SMUD's, or other Customer's equipment caused by loss of system neutral grounding during the operating time of anti-islanding protection.

11.0 Testing and Certification Criteria

11.1. Introduction

This Section describes the test procedures and requirements for equipment used for the Interconnection of a Generating Facility to

SMUD's Distribution System. Included are Certification Criteria, Production Testing, Commissioning Testing, and Periodic Testing. The procedures listed rely heavily on those described in applicable Underwriters Laboratory (UL), Institute of Electrical and Electronic Engineers (IEEE), and International Electrotechnical Commission (IEC) documents—most notably UL 1741 and IEEE 1547

The tests described here, together with the technical requirements in Section 6 of these guidelines, are intended to provide assurance that the Generating Facility's equipment will not adversely affect SMUD's Distribution System and that a Generating Facility will cease providing power to SMUD's Distribution System under abnormal conditions. The tests were developed assuming a low level of Generating Facility penetration.

11.2. Certification Criteria

The use of Certified Equipment is a requirement for interconnection.

Equipment tested and approved (e.g. listed) by a NRTL as having met the requirements of UL 1741 and IEEE 1547 is considered to be Certified Equipment for purposes of Interconnection with SMUD's Distribution System. Certification may apply to either a pre-packaged system or an assembly of components that address the necessary functions.

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:

- Effective date of certification or applicable serial number (range or first in series), other proof that certification is current
- Equipment model number (s)
- Software version, if applicable
- Test procedures specified (including date or revision number)
- Laboratory accreditation (by whom and to what standard)

B. Technical (As appropriate):

- Device rating (kW, kVA, V, A, etc.)
- Maximum available fault current, A
- In-rush current, A
- Trip points, if factory set (trip value and timing)
- Trip point and timing ranges for adjustable settings
- Nominal power factor or range if adjustable
- If the device/system is certified for non-export and the method used (reverse power or under power)
- 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.

11.3. 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 SMUD's Distribution System. This testing

may be performed in the factory or as part of a Commissioning Test (Section 11.4).

11.4. Commissioning Testing

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 these guidelines.

SMUD 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.

Functions to be tested during commissioning may consist of the following:

- Over- and under-voltage
- Over- and under-frequency
- Anti-Islanding (if applicable)
- Non-Export (if applicable)
- Inability to energize dead line
- Time delay 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

Other checks and tests that may need to be performed include:

- Verifying final protective settings
- Trip test
- In-service test

A. Simplified Interconnection

Generating Facilities qualifying for Simplified Interconnection are judged to have little or no potential impact on SMUD's Distribution System. For such Generating Facilities, it is necessary to perform only the following tests:

Protection settings that have been changed after factory testing will require field verification. Tests will be performed using injected secondary 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.

Non-Islanding function, if included, will be checked by opening 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.

Non-Export function, if included, 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-export criteria (i.e., reverse power or under power) are met.

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

B. Verification of Settings

If the testing is part of the commissioning process, then, at the completion of such testing, the EP shall confirm all devices are set to SMUD-approved settings. This step shall be documented in the Commissioning Test Certification.

C. Trip test

Interconnection protective devices (e.g. reverse power relay) that have not previously been tested as part of the interconnection system 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 devices or between interrupting devices shall be similarly tested unless they are part of a system that has been tested and approved during manufacture.

D. In-service test

Interconnection protective devices that have not previously been tested as part of the interconnection system 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 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 indicate 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.

11.5 Periodic Testing

The Producer shall perform periodic Testing of Interconnection-related Protective Functions as specified by the manufacturer, or at least every four years. All periodic tests prescribed by the manufacturer shall be performed. The EP Producer shall maintain periodic test reports or a log for inspection by SMUD. Periodic Testing conforming to SMUD test intervals for the particular line section may be specified by SMUD 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.