

INTERCONNECTION AND SAFETY STANDARDS FOR CUSTOMER-OWNED GENERATOR FACILITIES

Introduction

These Interconnection and Safety Standards have been prepared by Public Service Company of New Mexico (PNM) for those customer-owned generating facilities interested in operating in parallel with PNM. The document has been separated into the following areas:

1. IMPORTANT CONSIDERATIONS FOR INTERCONNECTION.
2. GENERAL SAFETY REQUIREMENTS.
3. SPECIFIC INTERCONNECTION REQUIREMENTS.

IMPORTANT CONSIDERATIONS FOR INTERCONNECTION

A customer-owned generator (COG) facility desiring to interconnect with the PNM system will be required to meet certain interconnection and safety standards. PNM will review the COG facility's interconnection design and will make corrective recommendations as necessary. PNM's interconnection and safety standards are designed to assure:

1. The integrity of the PNM system,
2. The quality of service to all PNM customers,
3. The safety of PNM's employees and customers, and
4. The COG facility does not interfere with PNM's primary responsibility of providing safe and reliable electric service to all of its customers.

PNM will endeavor to aid and assist the COG in any reasonable way to insure the COG facility's interconnection design is adequate for connection of the COG to the utility system. This may include consultations with the COG and its engineering representative to coordinate the design, operation, maintenance, and protection of the PNM system interface with that of the COG.

The COG should allow adequate time in the design and construction schedule for design interface meetings with PNM and for material procurement by PNM. This time will vary depending on the COG facility's location, size, design, specific operating and system requirements, and the availability of materials needed to accomplish the interconnection.

All protection equipment associated with the interface, operational procedures, relay settings, and power transfer modes will be reviewed for acceptability by PNM. All interconnection equipment will be inspected and checked by PNM personnel authorized to accept the design and installation of the interconnection protection system.

If it is discovered that any equipment connected to the PNM system is in PNM's judgment problematic or is considered to be unsafe it will be disconnected from the PNM system.

COGs that generate electrical energy for on-site use only and are interlocked or otherwise prevented from feeding energy into the PNM system are special cases and may not be required to meet all of the requirements of this document. However, they are required to show by design and by operation that they cannot feed energy into the PNM system.

The COG design should include provisions to allow for the proper operation of the COG under unusual or

adverse conditions. Conditions that should be considered are:

1. The sudden return of the utility system as a result of normal PNM system breaker operation.
2. Utility system transients (interference with normal utility system power flow, e.g., lightning and switching surges).
- 3.
3. Manual disconnect operation by the utility (under emergency conditions the utility may need to disconnect the COG without prior notice).

GENERAL SAFETY REQUIREMENTS

The COG customer shall separate from the PNM power system in the event of:

1. A fault on the COG's system.
2. A COG contribution to a PNM system emergency.
3. Abnormal frequency or voltage conditions on PNM's system.
4. Any occurrence or condition that will endanger PNM's employees or its customers.
5. A COG problem that would otherwise interfere with PNM's ability to provide safe and reliable electric service to other customers.
6. The sudden loss of the PNM system power.

SPECIFIC INTERCONNECTION REQUIREMENTS

The specific interconnection requirements are the minimum requirements for COGs with a design capacity greater than 10 kVA. For COGs with a design capacity of 10 kVA or less, all of these requirements may not apply. However, each installation, regardless of size, will be evaluated on a case-by-case basis.

All relays, current transformers, potential transformers, breakers, and interconnection power transformers shall be utility grade that meet or exceed the quality of the equipment that would normally be used by PNM in a similar application. The trip energy source for the interconnection breaker must be of a stored energy type (i.e., battery) that will be available under circumstances when the alternating current source is unavailable. The interconnection and all costs associated with the interconnection will comply with all relevant provisions of Rule 570, including Sections 570.6, 570.8 and 570.27.

The COG must ensure that the facility and all equipment connected therewith comply with the National Electrical Code, the National Electrical Safety Code, and/or any applicable local, state, and Federal government requirements, whichever are stricter.

The COG will be required to install at locations approved by PNM, the following:

1. A lockable, visible-open, load break disconnect between the COG and the PNM system that is visibly marked "Customer-Owned Generation Disconnect." This disconnect will be accessible to and lockable by PNM.
2. A fully rated breaker, that is visibly marked "Customer-Owned Generation Breaker," to isolate the COG's generation from the PNM system in the event of a PNM system disturbance.
3. A permanent and weather proof one-line electrical diagram of the COG located at the point of service connection to PNM. A permanent and weather proof map of the COG facility showing the location of all major equipment including the PNM meter point, the Customer-Owned Generation Disconnect, and the Customer-Owned Generation Breaker. Included with or attached to this map will be the names and current telephone numbers of at least two persons that are authorized to provide access to the COG facility and who have authority to make decisions regarding the COG interconnection and operation. This telephone listing shall be updated as needed to maintain its usefulness.
4. A synchronizing or synchro-check relay (for self-excited or self-commutated sources only) to provide for proper synchronization of the COG with the PNM system.
5. A frequency relay to disconnect the COG facility's generation from PNM's system under abnormal frequency conditions.
6. A set of voltage supervised directional overcurrent relays or impedance relays to disconnect the COG facility's generation from PNM in the event of a fault on the PNM system. These are to be three-phase devices or three single-phase devices connected to sense the current in each of the three phases of the power system.
7. A voltage relay (three phase relay for three phase COG) to disconnect the COG facility's generation from PNM's system in the event of an abnormal voltage condition.
8. A COG Generation Breaker lockout or interlock to prevent the COG facility's generation from closing into or energizing any de-energized PNM power system equipment.
9. A directional, instantaneous, overcurrent relay or directional, instantaneous power relay to supervise and control the trip output of the voltage and frequency relays referred to above. These are to be three-phase devices or three single-phase devices connected to sense the current in each of the three phases of the power system. Single-phase COG interconnections will require only one relay to sense the current. However, it must be a directional relay.
10. COGs with a design capacity of 20 kVA or less may be required to have an isolation transformer if other customers are connected to the secondary side of the distribution transformer from which

the COG is served. If a COG with a design capacity of 20 kVA or less is the only customer connected to the secondary side of the distribution transformer, the COG may be required to have an isolation transformer when another customer is connected to the secondary side of the distribution transformer. When an isolation transformer is required, the COG will be required to install the isolation transformer at COG's expense. All COGs with a capacity larger than 20 kVA will be required to have an isolation transformer regardless of whether or not other customers are connected to the secondary side of the distribution transformer from which the COG is served. The power connections of these isolation transformers (wye or delta) will be determined by PNM.

An isolating transformer shall not normally be required for single-phase photovoltaic systems rated at 10 kVA or less which are interconnected to the utility grid by means of an inverter that satisfies the safety and performance requirements of state and local building codes, the National Electrical Code, Institute of Electrical and Electronic Engineers Standards and the National Electrical Safety Code. If, due to the particular configuration of the interconnection, PNM determines that an isolating transformer is required, and the customer disputes PNM's determination, PNM shall promptly file an Application with the NMPRC detailing PNM's technical justification for requiring an isolating transformer. The interconnection with the customer shall not be completed pending NMPRC resolution of the Application.

11. COGs sized at 5 MW or larger will be required to interconnect with PNM at the subtransmission voltage level.
12. The maximum total COG capacity that will be allowed to interconnect with any PNM feeder is 60 percent of that feeder's power rating.

Additional PNM Interconnection Requirements

At the COG's expense and as necessary to protect PNM's system, PNM will install as determined on a case-by-case basis:

1. Additional protective relays to disconnect the COG generation or to trip the PNM substation breaker for COG facility system faults.
2. Additional breakers to isolate the COG facility's generation from the PNM system.
3. Any special relays or transfer trip equipment necessary to protect the PNM system from problems that are or may be caused by or are the result of the attachment to the COG. This may include but is not limited to high side potential transformers on the PNM substation transformer and the necessary relays and fault interrupters needed to clear PNM substation transformer or transmission line faults.
4. Special transformers needed for distribution ground fault sensing.
5. Dead-line supervised reclosing at the PNM substation.
6. Any modifications to the PNM system required to accommodate the COG to solve problems that are discovered after the COG is operational.

For COGs with a design capacity greater than 10kVA the COG installation and the electrical protection of the COG must be designed or approved by a Professional Electrical Engineer engaged by the COG, currently licensed in the state of New Mexico. The details of the design, protection, operation and maintenance of the COG facility's equipment are the responsibility of the COG and its licensed Professional Electrical Engineer. PNM will accept the proposed COG interconnection design if it is

adequate for interconnection with PNM's system. PNM's acceptance of the COG interconnection design shall not constitute PNM's agreement with the proposed COG facility's interconnection design relative to its completeness or its effectiveness for the protection of the COG.

Operating Requirements

1. Quality of Power:

The COG is responsible for the quality of the COG power that is transmitted into the PNM system and is responsible for all damage that is caused by or that is a result of the COG facility's operation or the COG facility's connection to the PNM system.

If other PNM customers are influenced or affected by flicker or harmonic distortion caused by the COG, PNM will require the COG to make changes to the facility to correct the problem. If such changes do not correct the problem or if the original problem is severe, PNM will require the COG to disconnect the disrupting machine or equipment from the PNM system until the problem has been resolved.

The maximum allowable voltage flicker (rapid change in voltage) caused by the COG is as shown below:

<u>FREQUENCY OF VOLTAGE FLICKER</u>	<u>PERCENT OF VOLTAGE</u>
1 per hour to 6 per hour	2.5%
7 per hour to 30 per hour	1.5%
31 per hour to 6 per minute	1.0%
7 per minute to 1 per second	0.7%
2 per second to 15 per second	0.5%

The above data is derived from charts and data in the Distribution Data Book by General Electric and from the Westinghouse Transmission and Distribution Book.

The total harmonic distortion of the COG voltage and/or current shall not exceed 5 percent of the fundamental 60 Hz frequency for the square root of the sum of the squares of the harmonics, and 2 percent of the fundamental 60 Hz frequency for any individual harmonic as measured at the customer service connection point.

2. Maintenance:

The COG owner is responsible for the maintenance and upkeep of the interconnection protection equipment. All interconnection protection equipment will be maintained on an annual basis. The COG may contract with PNM for maintenance services if desired.

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